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## **The effects of early home literacy environments on fourth-grade literacy achievement: an international comparison**

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**Abstract:** It is well known that the home environment is a major factor in a child's literacy development. Exactly how different home-environmental factors play out across different national contexts is not as well understood. Using data from the 2011 Progress in International Reading and Literacy Study (PIRLS), we tested for structural invariance in the relationship between early childhood home literacy practices and later fourth-grade achievement among students across 52 countries or regions within countries (N = 106,297–109,582), while controlling for background characteristics. Findings indicate that the effect of many aspects of the home environment prior to school age, including adult-child interactions and parental values and beliefs about reading, may interact with national factors, particularly factors relating to government-subsidised preschool programmes. Implications include that any

early home reading intervention efforts should include thoughtful consideration of the national policies and funding for preschool learning.

**Keywords:** PIRLS; literacy; home environment; education; fourth-grade reading comprehension; international tests; national invariance; structural invariance; quantitative research; survey research; regression analysis.

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## 1 Introduction

The link between young children's development as readers and their home environments is well documented. Many studies (conducted primarily in North America) have highlighted the importance of story telling, interactive book reading, availability of print materials in the home, and adult modelling of literate behaviour (e.g., Alexander et al., 1997; Beals, 2001; Dauber et al., 1996; Hart and Risley, 1995; Li and Rao, 2000; Lonigan, 2004; Miller and Moore, 1989; Pallas et al., 1987; Paratore et al., 2010; Phillips

and Lonigan, 2005; Weizman and Snow, 2001; Whitehurst and Lonigan, 1998). While some researchers have reported similar findings across countries (e.g., Aram, 2010; Aram and Aviram, 2009; Aram and Levin, 2001; Kalia and Reese, 2009; Manolitsis et al., 2009; Street, 1984), others have found that culture-specific beliefs and practices may have a mediating effect on language and literacy development (e.g., Chao, 2001; Heath, 1982; Reese and Gallimore, 2000; Strasser and Lissi, 2009; Yamamoto and Holloway, 2010; Bradley and Corwyn, 2005). Thus, the role of national differences in practices related to literacy development remains unclear. Further, the majority of studies on home language and literacy practices are qualitative and/or relatively small scale in nature, from which it is difficult to make cross-national generalisations and comparisons.

In this study, we used data from the 2011 Progress in International Reading Literacy Study (referred from here on as PIRLS; International Association for the Evaluation of Educational Achievement; IEA, 2013) in order to explore the effects of early home-environmental characteristics on within- and between-country differences in literacy development, and contribute cross-national findings to current understandings about home practices and literacy development. Specifically, the effect of home-environmental variables on reading comprehension is tested for invariance across the 52 countries who participated in the PIRLS 2011 study (see Table 2 for the complete list of countries).

### *1.1 Early home literacy practices in North America*

#### *1.1.1 Print-related practices*

Parent-child interactions (e.g., talk, shared reading), adult modelling of literacy behaviours, parental attitudes about literacy practices, and available resources (e.g., number of books in the home) have been found to be significantly associated with literacy skills of children (e.g., Baker et al., 1997; Beals et al., 1994; Collins and Michaels, 1980; Dickinson and Tabors, 2001; Hart and Risley, 1995; Lonigan, 2004; Heath, 1982; Huttenlocher et al., 2002; Miller and Moore, 1989; Phillips and Lonigan, 2005; Scarborough and Dobrich, 1994; Weizman and Snow, 2001; Whitehurst and Lonigan, 1998). For example, when Payne et al. (1994) studied the language ability of young American children and their caregivers, they found that a composite home-literacy measure (composed of the following: the frequency and duration of talk; frequency of shared book reading; reports of child's independent exploration of text; visits to the library; the time the caregiver spent reading alone; the number of books in the home) was strongly associated with child language skills (word knowledge, story telling, etc.). Similarly, Sénéchal and LeFevre (2002) found in their longitudinal study that Canadian children's early exposure to books in the home was related to the development of their listening comprehension and vocabulary skills, and that these language skills were associated with children's third-grade reading achievement.

In a meta-analysis of 146 studies related to literacy practices of primary school students, Mol (2010) found moderate support for the hypotheses that literacy development begins prior to schooling and that exposure to print prior to school has a significant impact on academic success. She also found interactive reading to be positively associated with literacy development (particularly on oral language, print knowledge, and vocabulary development) for two- to six-year-old children. However, methodological differences between studies prevented Mol from investigating the relative

effects of potentially culture-specific features of interactive reading (e.g., duration and quality of talk).

### *1.1.2 Oral practices*

The quality and amount of talk between caregivers and young children has been found to have a significant effect on language use and literacy development (Beals, 2001; Beals et al., 1994; Collins and Michaels, 1980; Davidson and Snow, 1995; DeTemple and Beals, 1991; Dickinson and Tabors, 2001; Dunn and Dunn, 1981; Hart and Risley, 1995; Hoff and Naigles, 2002; Huttenlocher et al., 2002; Dickinson and Tabors, 2001; Weizman and Snow, 2001), and may be related to within-culture differences in language tradition (e.g., Collins and Micheals, 1980; Heath, 1982). For example, Weizman and Snow (2001) found that the number of words in adult talk in adult-child dyads was positively associated with child vocabulary production and that the most sophisticated levels of talk (in terms of the vocabulary used) occurred during shared book reading, which has also been found to be a significant predictor of reading performance (e.g., Hart and Risley, 1995; Sénéchal and LeFevre, 2002). Collins and Michaels (1980) found that children who produce a narrative style (reflected by lexical, syntactic and rhythmic qualities of oral tellings) that resembles the standard narrative practices within the school context have fewer struggles during instruction. Thus, oral language practices vary across countries and may have a mediating effect on academic performance.

## *1.2 Early home literacy practices beyond North America*

Home-based shared literacy practices have been found to be positively associated with school literacy performance beyond North America as well (e.g., Kalia and Reese, 2009; Strasser and Lissi, 2009; Street, 1984). For example, Kalia and Reese (2009) found that parent-child book-reading practices in India predicted children's vocabulary and print-related skills and Strasser and Lissi (2009) found Chilean mothers' literacy skills significantly predicted children's emergent writing and phonological-awareness ability. Comparing Greek and Canadian children, Manolitsis et al. (2009) also found that teaching letter names and sounds at home was associated with better letter knowledge in both languages. Street's (1984) ethnographic study of literacy practices in Iran revealed the importance of a child's community in the development of valued literacy skills. These studies together suggest that, across countries, rich home and community language and literacy experiences support children's literacy skills. What remains unclear, however, is whether effects of particular home literacy practices on school literacy performance differ across countries.

In addition to the fact that culture-specific beliefs and attitudes have been found to affect parenting practices and characteristics of the home environment (Bradley et al., 2001), such culture-specific practices have been documented to affect school literacy performance. For example, Heath (1982) described the impact of three community-based language traditions and their influences on child literacy development. Chao (2001) found that cultural differences in parenting styles were associated with differences in school performance among European American and first- and second-generation Chinese American adolescents.

Although these studies underscore cultural differences in values and practices, they do not in themselves establish whether the relationship between home-environmental

factors and literacy achievement is itself mediated by cultural factors. It is possible that early parent-child literacy practices are equally valuable for the promotion of children's literacy skills, though countries differ with respect to which practices and attitudes are valued. Conversely, the effects of home-environmental factors on literacy development may themselves be mediated by cultural context. In this study, we investigated how culture (as represented by nationality) and attributes of the home environment interact to affect literacy performance using the 2006 PIRLS dataset for Iran, Norway, South Africa, and Taiwan.

Large-scale international studies such as the PIRLS provide rich data sources to examine between-nation variance in the effects of a variety of literacy practices on reading achievement. Because all countries examined are to some extent internally heterogeneous, effects at the national level represent an only a main effect of the conditions found in that country.

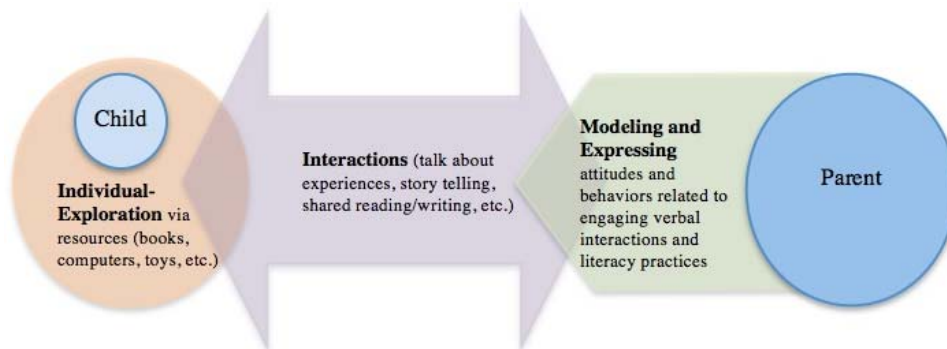
### 1.3 Organising framework

Our approach for selecting and managing the numerous potential variables from the 2011 PIRLS home literacy surveys and attitude scales is founded on established theories within the field of early literacy development (Caldwell and Bradley, 2003; Teale and Sulzby, 1986). Teale and Sulzby (1986) suggest the home environment can be divided into three general categories related to literacy development:

- a adult-child interactions, which include shared reading and writing
- b the child's independent exploration of text and other cultural tools (toys, games, etc.)
- c the child's observations of adults modelling literate behaviours.

Similarly, Caldwell and Bradley (2003) suggest that the home-literacy environment includes the degree of language, literacy, and academic stimulation and support, learning materials, and adult modelling of literate behaviours. The theoretical framework that helps to inform our decisions about which home survey variables to include in this study stems from these two perspectives, as characterised in Figure 1.

**Figure 1** A proposed interpretation of the home environment model (see online version for colours)



Children develop literacy skills individually and through interactions with others. Literacy-related resources such as books and computer games provide children with tools during times of self-exploration. Caregivers may offer guidance while their young children attempt to read aloud and retell familiar picture books, learn to read new words, and attempt to write letters and words. Caregivers also model these behaviours (perhaps unintentionally) when they read and write in the presence of their children.

With this home environment framework in mind, we selected a portion of the 2011 PIRLS dataset to investigate the relationship between specific environmental factors and literacy achievement in the participating countries. This study is unique in that most research on home practices and literacy development is qualitative in nature. The PIRLS allows for a single, large-scale investigation of a host of home-environmental variables, including adult-child oral and print-related interactions (e.g., visiting a library), opportunities for the child's independent exploration of print (especially, the number of books in the home), and parental beliefs and practices (e.g., how much the caregiver reads and enjoys reading), while accounting for within-country differences in socio-economic status (SES). SES has been associated with differences in home resources, values and beliefs about reading, books, and the quality and quantity of literacy interactions in the home (Bradley et al. 2001), and thus may itself account for a significant amount of the explanatory power of home environment variables on literacy development. The predictive power of home practices has not been studied on an international scale.

We hypothesised that most of the home-environment variables included in this study would play important roles in literacy achievement regardless of country. However, country-specific differences may have a mediating effect on home literacy practices, which in turn may affect literacy achievement. In Norway, for example, children rarely engage in reading instruction before school entry (e.g., Elbro, 2006; Elbro et al., 1998; Samuelsson et al., 2007); thus, it may be that other practices such as verbal interaction and modelling play a greater role in later school achievement. Further, country-specific policies may play a role in literacy-related home experiences. For example, policies that require a relatively substantial portion of public funds to support early childhood literacy practices may have a mediating effect on home-related literacy experiences.

Our primary research question is as follows: to what extent do the effects of adult-child print- and language-focused interactions, the availability of home literacy-related resources, and the literacy-related behaviours and attitudes of caregivers on child literacy development vary between (or, conversely, to what extent are they invariant across) countries?

## **2 Method**

### *2.1 Sample and data*

The data analysed in this study were collected during the 2011 cycle of the International Association for the Evaluation of Educational Achievement's Progress in International Reading Literacy Study (PIRLS; IEA, 2013). The PIRLS, which is conducted every five years, is designed to measure trends in fourth-grade children's reading comprehension ability and gather information about policies and practices relevant to literacy development.

The subset of data analysed in the present study contains reading comprehension scores and background information from caregiver surveys. The sample includes complete observations for participating students in 52 of the countries that participated in the 2011 PIRLS. The number of participating students varied slightly depending on the model ( $N = 106,297\text{--}109,582$ ). It should be noted that although England and the USA are noted to be participants in 2011 PIRLS, neither country administered the home practices survey and they are thus excluded from this study (IEA, 2013). Students were sampled via a cluster-randomised procedure in which schools were randomly sampled from each country, and students were then randomly sampled from each sampled school. Similarly, critical demographic variables are missing from Austria, Germany and Alberta, Canada, and thus these countries are also excluded from this study. As is described in more detail in official IEA documentation, TIMSS and PIRLS employ a two-stage sampling procedure to ensure representative and sufficiently large samples of students, schools, teachers, and classrooms within each participating country. The sampling procedures were developed to maximise representation of targeted populations (i.e., general education, fourth grade or school-age equivalent) by ensuring that at least 95% of schools with the targeted population had an equal probability of being selected to participate in the study, excluding students with disabilities or special needs.

## 2.2 Measures

The primary measures used in the present study were the *PIRLS Reading Comprehension* measure and four caregiver survey composite measures: a measure of the *quality of caregiver-child print-focused interactions* of the *quality of caregiver-child spoken-language-focused interactions*, of *caregiver attitudes about literacy*, and of *caregiver modelling of literacy-focused behaviours*. Additionally, demographic information was used, along with a measure of the availability of print-related resources in the home.

### 2.2.1 Reading comprehension

The reading comprehension assessment included a variety of item types (e.g., fictional short stories, biographies, scientific, and procedural texts). Items targeted basic skills (e.g., direct recall and inference making) as well as more complex skills (e.g., interpreting, integrating, and evaluating texts). Efforts were made by a PIRLS international evaluation panel to ensure that the items were comparable across languages, culturally unbiased, and appropriate in terms of fourth-grade students' interests and reading levels (IEA, 2013).

### 2.2.2 Caregiver survey responses

Caregivers of student participants responded to a variety of questions regarding their experiences, available resources, and attitudes related to literacy. Teale and Sulzby's (1986) framework provided a starting point for the selection and organisation of caregiver survey items relevant to the hypotheses addressed in this study; specifically, these items were grouped into three main conceptual categories: quality of adult-child interaction, availability of home resources, and caregiver literacy-related attitudes and behaviours. The first category was further split into quality of print-focused adult-child interaction

and quality of spoken-language-focused adult-child interaction, and the last category was split into caregiver modelling of literacy behaviours, and parental attitudes about literacy. In this study, books in the home were used to reflect the availability of home literacy-related resources. Each variable is described in turn.

- *Quality of caregiver-child print-focused interactions.* Caregivers were asked, “before your child began <ISCED Level 1>, how often did you or someone else in your home do the following activities with him or her?” Response options were *often* (coded ‘3’), *sometimes* (coded ‘2’), and *never or almost never* (coded ‘1’), and the activities selected for inclusion in this scale were ‘read books’, ‘play with alphabet toys’, ‘talk about what you had read’, ‘write letters or words’, ‘read aloud signs and labels’, and ‘visit a library’. Scale values were obtained by taking the first principal component of the six item responses. The reliability of the scale was estimated at  $\alpha = .90$ .
- *Quality of caregiver-child spoken-language-focused interactions.* Responding to the same general prompt, caregivers also rated the activities ‘tell stories’, ‘sing songs’, ‘talk about things you had done’, and ‘play word games’. Scale values were obtained by taking the first principal component of the four item responses. The reliability of the scale was estimated at  $\alpha = .75$ .
- *Caregiver attitudes about literacy.* Caregivers were prompted to “please indicate how much you agree with each of the following statements about reading”, with response options *agree a lot* (coded ‘4’), *agree a little* (coded ‘3’), *disagree a little* (coded ‘2’), and *disagree a lot* (coded ‘1’). The items selected were “I read only if I have to”, “I like talking about books with other people”, “I like to spend my spare time reading”, “I read only if I need information”, and “reading is an important activity in my home”. Scale values were obtained by taking the first principal component of the five item responses. The reliability of the scale was estimated at  $\alpha = .62$ .
- *Caregiver modelling of literacy-focused behaviours.* Caregivers were asked, “in a typical week, how much time do you usually spend reading for yourself at home, including books, magazines, newspapers, and materials for work?” Response options were *or more than 10 hours* (coded ‘4’), *6–10 hours a week* (coded ‘3’), *1–5 hours a week* (coded ‘2’) and *less than one hour a week* (coded ‘1’). Caregivers were also asked “when you are at home, how often do you read for your own enjoyment?” Response options were *every day or almost every day* (coded ‘4’), *once or twice a week* (coded ‘3’), *once or twice a month* (coded ‘2’), and *never or almost never* (coded ‘1’). Caregivers were finally asked to what extent they agree with the following statement: *I enjoy reading*. Response options were *agree a lot* (coded ‘4’), *agree a little* (coded ‘3’), *disagree a little* (coded ‘2’), and *disagree a lot* (coded ‘1’). Scale values were obtained by taking the first principal component of the three item responses. The reliability of the scale was estimated at  $\alpha = .58$ .
- *Demographic information.* Age was computed by examining the difference between the student’s birth date and the date of test administration. Gender was reported by the student. A caregiver education variable was created by taking the highest level of education attained by either of the child’s primary caregivers, as reported by the caregiver, and coding it according to the International Standard Classification Level



of Education. A variable estimating the number of relevant books accessible to the student was created by taking the average of the caregiver's estimates of the total number of books in the home and the number of children's books in the home, and the student's estimate of the number of children's books in the home.

### 2.3 Analyses

In four successive models, plausible values of reading comprehension were regressed on each of the four scale variables described previously [quality of caregiver-child print-focused interactions ('print'), quality of caregiver-child spoken-language-focused interactions ('oral'), caregiver attitudes about literacy ('attitudes'), and caregiver modelling of literacy-focused behaviours ('modelling')], with age, gender, parent's education, and fixed country effects (i.e., dummy variables for every country save one) as control variables.

The PIRLS database includes five plausible values of student reading comprehension for each student. The procedure of using plausible values, initially developed for the analysis of National Assessment of Educational Progress (NAEP) data and now common to large-scale assessments including the *Programme for International Student Assessment* (PISA) and the *Trends in International Mathematics and Science Study* (TIMSS), facilitates the unbiased estimation of structural parameters (compared to the use of direct ability estimates or raw scale scores, in which population variance is either under- or over-estimated depending on the estimation method (Rubin, 1987; Schafer, 1997)). In the present study, the five plausible values were modelled as five conditionally independent observations for each student; that is, plausible values were treated as nested within students. Additionally, students sampled from the same school are unlikely to be conditionally independent, as is assumed in typical parametric statistical models; the cluster-randomised sampling procedure described previously suggests instead that students should be modelled as clustered within schools. Thus, three-level hierarchical models were used, with a random intercept at both the student and the school level as such:

$$y_{ijk} = \beta_1 + \beta_2 \text{scale}_{jk} + \beta_3 \text{gender}_{jk} + \beta_4 \text{education}_{jk} + \beta_{5\dots55} \text{country}_k \\ + \zeta_{jk}^{(2)} + \zeta_k^{(3)} + \varepsilon_{ijk}$$

where 'scale' refers to one of the four scores from the home-environment scales, depending on the model.

It should be noted that while the use of plausible values models the measurement error in the reading comprehension scale, thus disattenuating regression estimates from this error, the error in the home-environment scales is not modelled (i.e., the first principal component was used as an observed score). It is thus possible that the regression coefficients reported in this study are downwardly biased (i.e., too conservative).

Following the estimation of these four models, an additional four models were fit, in which the scale score was allowed to interact with the country dummy variables (yielding an additional 51 interaction coefficients). These parameters tested (in)variance in structural parameters across countries: that is, if the interaction effects were non-significant or of trivial magnitude, it could be said that the association between the

home-environment scale in question and reading comprehension was invariant across countries.

All models were estimated using MPlus version 6.0 (Muthén and Muthén, 1998–2010) and Stata (StataCorp, 2011).

### 3 Results

Table 1 displays the main effects of the four home environment variables on reading comprehension. Each of the four scales was standardised to have a mean of 0 and standard deviation of 1, and the standard deviation of PIRLS reading comprehension scores is 100. As can be seen, effects were positive and statistically significant for all four scales, and were slightly larger for the print and oral scales than the attitude and modelling scales.

**Table 1** Main effect of home environmental scales on reading comprehension

	<i>Print</i>	<i>Oral</i>	<i>Attitude</i>	<i>Modelling</i>
Main effect (standard error)	7.877 (.149)	7.533 (.172)	5.954 (.130)	4.581 (.138)

**Table 2** Country-specific effects of home environmental scales on reading comprehension

	<i>Print</i>	<i>Oral</i>	<i>Attitude</i>	<i>Modelling</i>
Azerbaijan	–0.799	–1.579	1.344	–0.657
Netherlands	0.875	2.030	–0.279	–0.339
Czech Republic	3.005	3.895	2.951	4.157
Morocco	3.623	6.787	5.892	2.510
Hong Kong	3.966	0.718	0.372	2.011
Columbia	4.014	4.814	3.231	5.379
Indonesia	4.185	4.050	1.955	3.291
Andalusia, Spain	4.478	5.693	1.046	1.052
Iran	4.689	6.429	2.028	3.289
Denmark	4.712	5.209	2.266	3.637
Portugal	5.012	4.257	3.517	1.918
the French part of Belgium	5.135	5.129	3.735	3.754
Honduras	5.390	7.160	2.363	3.996
Chinese Taipei	5.474	6.442	3.019	2.793
Hungary	5.496	9.052	3.759	6.867
Slovak Republic	5.917	7.282	4.601	5.478
Slovenia	6.114	9.222	7.833	6.375
Spain	6.133	7.235	1.288	1.749
Italy	6.452	6.458	3.350	2.574

Notes: The order of the appearance of countries in this table is determined by their estimated value of the first coefficient (i.e., the effect of print-focused interactions). Standard errors range from 2.2–3.0. All coefficients except those in italics are significantly different from zero ( $p < .01$ ).

**Table 2** Country-specific effects of home environmental scales on reading comprehension (continued)

	<i>Print</i>	<i>Oral</i>	<i>Attitude</i>	<i>Modelling</i>
Saudi Arabia	6.547	6.930	4.398	4.322
Finland	6.551	5.776	2.758	4.219
France	6.582	7.517	3.104	3.806
Norway	7.276	9.380	3.922	5.823
Ontario, Canada	7.418	7.906	4.366	4.067
Georgia	7.455	6.763	7.462	7.701
Croatia	7.675	5.649	2.030	3.381
Lithuania	7.683	3.831	2.103	3.592
Singapore	7.768	8.295	2.623	5.989
Quebec, Canada	7.779	7.933	2.858	3.128
Canada	8.226	7.965	3.890	4.321
Israel	8.693	16.49	6.706	6.170
Morocco	8.703	8.813	6.625	7.483
Qatar	8.763	10.95	7.450	8.712
Australia	9.089	8.603	4.721	6.144
Russian Federation	9.188	8.365	5.693	6.576
Northern Ireland	9.233	9.090	0.256	1.491
Abu Dhabi, UAE	10.023	9.749	3.877	5.287
Ireland	10.409	11.636	4.687	4.781
Kuwait	10.649	11.513	7.453	7.282
Sweden	10.824	9.275	5.585	6.531
Bulgaria	10.978	10.867	5.805	7.395
Malta	11.135	10.288	2.022	-1.152
Oman	11.252	13.506	9.096	8.392
Malta	11.898	12.706	3.149	2.770
Poland	12.256	6.189	3.691	5.277
Romania	12.508	16.524	9.344	11.515
United Arab Emirates	14.371	15.292	9.420	9.718
New Zealand	14.639	12.481	8.176	6.897
Botswana	14.998	11.510	10.522	11.503
Trinidad and Tobago	16.963	16.736	4.686	6.018
Dubai, UAE	19.212	20.868	14.319	14.378
South Africa	20.335	24.749	9.107	11.543

Notes: The order of the appearance of countries in this table is determined by their estimated value of the first coefficient (i.e., the effect of print-focused interactions). Standard errors range from 2.2–3.0. All coefficients except those in italics are significantly different from zero ( $p < .01$ ).

Table 2 displays results from the second set of models, in which the scale scores were allowed to interact with the dummy variables for each country. The coefficients in Table 2 are the total effect for each country. As can be seen, there is considerable variance in the magnitude of the effects for each country; this variance was larger for the effects of the print ( $sd$  of coefficients = 4.0) and oral ( $sd$  = 4.5) scales than the attitude ( $sd$  = 3.0) and modelling ( $sd$  = 3.0) scales.

#### 4 Discussion

One limitation of this study is that the PIRLS surveys are self-report measures, and are thus subject to any of the usual concerns about self-report data. In particular, social desirability may play a role in affecting parents' item response patterns. Additionally, the questions about early home practices were asked when the student was in fourth grade, and caregivers might have difficulty accurately remembering the types of activities that took place in the home prior to the child's entry into formal schooling. These issues are balanced by the fact that standardised large-scale educational surveys such as the PIRLS permit cross-national investigations of the structural invariance of home environmental predictors of literacy achievement at a scale inaccessible to most individual researchers.

The results from this study support the hypothesis that

- a home-environmental variables including quality of caregiver-child print-focused interactions, quality of caregiver-child spoken-language-focused interactions, caregiver attitudes about literacy, and caregiver modelling of literacy-focused behaviours are positively associated with reading comprehension across all countries
- b the influences of these home-environmental variables may be mediated by factors that vary at the national level.

In part, the differences in effects across countries may be explainable by the availability of preschool education. In a follow-up, exploratory analysis, we consulted public databases of the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2012), the Organization for the Economic Co-operation and Development (OECD, 2013), and the United Nations Children's Fund (UNICEF, 2013) as well as publicly available, country-specific policy documents related to early childhood education (ECE), to determine which countries had publicly funded preschool services for their citizens (regardless of income level) for children under the age of four years old. We set an inclusion criteria that the preschool must have been available for at least the past six years, given that the fourth-grade participants in the 2011 PIRLS were on average about eight years of age and preschool is available to children as young as two years of age. Then, we compared the magnitude of the country-specific coefficients displayed in Table 2 for countries that did and did not have such preschool available.

This analysis revealed that, for all four home-environment variables, countries with publicly funded preschool had *smaller* coefficients, while those without such services had *larger* coefficients (i.e., stronger relationships between the home-environmental factors and reading comprehension). For the print scale, countries with publicly funded preschool had an average coefficient of 5.48, while those without had an average coefficient of 10.76 ( $t = 5.66, p < .01$ ); for the oral scale, countries with publicly funded preschool had an average coefficient of 5.78, while those without had an average

coefficient of 11.24 ( $t = 4.92, p < .01$ ); for the attitude scale, countries with publicly funded preschool had an average coefficient of 2.80, while those without had an average coefficient of 5.93 ( $t = 4.36, p < .01$ ); for the modelling scale; countries with publicly funded preschool had an average coefficient of 3.54, while those without had an average coefficient of 6.46 ( $t = 3.66, p < .01$ ).

These findings suggest that, while early print-related and oral interactions between preschool-aged children and adults are universally valuable, the availability of preschool somewhat mitigates the importance of interactions with the primary caregiver. This hypothesis could be further tested in future cycles of PIRLS, insofar as polices have been recently implemented in some countries, such as Bulgaria and Israel, and if this hypothesis is correct, the coefficients for these countries would be expected to decline over the next few years.

One possible implication of these findings is that the availability of publicly funded preschool could serve as a mitigating factor against the deleterious effects of being in a family in which the primary caregivers spend lower amounts of time interacting with their children (such as might occur, for example, if all primary caregivers have heavy work obligations).

An implication from this study is that early home literacy practices matter more for later school achievement in the absence of publicly funded preschool services. Future studies could investigate more deeply the effects of national preschool funding on later school literacy achievement. Further research into cross-national differences in home practices may shed light on how specific national ECE policies affect literacy achievement, and as we advance into the digital age, it would be informative to explore the extent to which such factors interact with the form of print (i.e., the book versus the computer tablet). In the meantime, a general (albeit obvious) rule of thumb would be for home caregivers to engage young children with reading and telling stories.

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