

Children's early home learning environment and learning outcomes in the early years of school

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4.1 Introduction

A large body of research has shown that the quality of the home learning environment during a child's first three years of life is associated not only with cognitive development at age 4–5 years but also with educational achievement at school and beyond. A poor home learning environment, for example, has been shown to be associated, in the short term, with poorer language development, deficits in school readiness and impaired cognitive development by the age of 3 (Evans et al., 2010; Trentacosta et al., 2008; Vernon-Feagans, Garrett-Peters, Willoughby, & Mills-Koonce, 2012). In the long term, it is associated with poor academic achievement at school and lower levels of education, employment and earnings in adulthood (Pungello, Iruka, Dotterer, Mills-Koonce, & Reznick, 2009; Pungello et al., 2010). Different features of the home learning environment have been found to have different influences on early cognitive development (Gest, Freeman, Domitrovich, & Welsh, 2004; Hartas, 2012; Melhuish et al., 2008). Therefore, to develop effective interventions, researchers have focused on identifying the features of a stimulating home learning environment and the individual contribution of those features to children's cognitive development and learning outcomes (Baker & Iruka, 2013).

Many studies have examined the relationship between different types of home activities (as a proxy for the home learning environment) and children's cognitive development (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). An activity such as parent–child play during daily routines promotes the expression of warm feelings and shared understanding, which are important for the development of communication abilities in early childhood. For example, in a study of 132 low-income families in the United States, Camp, Cunningham, and Berman (2010) showed that child–parent verbal interactions when children were between 10 and 18 months old were significantly related to the children's expressive vocabulary at the age of 18–30 months. The importance of home learning experiences to children's numeracy development has also been demonstrated in previous studies. In a study of 2,857 children from 141 preschool centres in the United Kingdom, Melhuish et al. (2008) found that home learning activities have a strong association with children's numeracy skills at school entry. In another study from Canada, children's mathematical skills in kindergarten and Grades 1 and 2 were shown to be correlated with the frequency in which they were involved in home activities such as cooking, and playing board and card games (LeFevre et al., 2009).

It has been widely recognised that reading to children helps the development of children's positive attitudes towards reading and their capacity to assimilate formal language (Hartas, 2012; LeFevre, Polyzoi, Skwarchuk, Fast, & Sowinski, 2010). Gest et al. (2004) found that parental involvement in reading activities with their child during kindergarten has important influences not only on children's reading competency and vocabulary comprehension, but also on expressive language skills among children aged 5 years. Frequent reading to children has been found to uniquely predict expressive language ability among 18-month-olds (Westerlund & Lagerberg, 2008). Children's home literacy practices, such as reading with parents, also predicted growth in English receptive vocabulary from kindergarten to Grade 1 among 110 English-speaking children schooled in French (Sénéchal & LeFevre, 2014).

The availability of learning materials in the home has also been found to be an important predictor of children's early cognitive development. For example, Tomopoulos et al. (2006) reported that the number of books provided to children at 18 months of age is significantly related to their cognitive development and receptive language at 21 months. Using data from *Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC)*, Mullan and Daraganova (2012) found that, compared to children who lived in households with 30 or fewer children's books, those who lived in households with more than 30 books at the age of 4–5 years were more likely to enjoy reading at age 10–11 years.

However, research on the home learning environment has mainly been focused on children's experiences inside the house. The importance of children's involvement in activities with their parents or family members outside the house (e.g., visiting a library or museum) has not been extensively studied. Enrichment experiences have been found to be an important aspect of the home learning environment that uniquely promotes children's literacy and social outcomes at the age of 5 (Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005). Enrichment experiences are academically significant because they positively influence children's interest in learning and information processing. Activities such as visiting a museum or a zoo, for example, promote children's critical thinking and analytical skills (Marty et al., 2013).

Although the association between the home learning environment and child development has been clearly established, most existing studies have only assessed the home learning environment among kindergarten or early primary school children (Baker & Iruka, 2013; Hartas, 2012; Hood, Conlon, & Andrews, 2008; Martini & Sénéchal, 2012; Mullan & Daraganova, 2012). It is early childhood, however, that is the most important period for child development. A number of studies have documented that brain development is particularly sensitive to early experiences, and children's social and cognitive skills are acquired most effectively during early childhood (e.g., Knudsen, Heckman, Cameron, & Shonkoff, 2006; Kuhl, 2004). Thus, it is important to examine early home learning experiences in the first three years of life, when, for most children, the home still exerts the predominant influence on child language and cognitive development.

The few studies that have examined the home learning environment during the first three years of life have primarily focused on the relationship between the early home learning environment and preschool academic skills and early cognitive development (Azak, 2012; Camp et al., 2010; Rodriguez et al., 2009; Westerlund & Lagerberg, 2008). The mechanism by which the early home learning environment influences longer term cognitive outcomes is not well understood. Children's preschool academic readiness has been found to significantly predict their outcomes in later school years (Duncan et al., 2007), and it is possible that the home learning environment in early childhood may influence children's later school performance via early cognitive development. For example, Manolitsis, Georgiou, and Tziraki (2013) showed that the home literacy environment of 5-year-old children significantly predicted phonological awareness and, in turn, influenced reading ability at the end of Grade 1. In addition, maths-related activities at home at the age of 5 have been found to influence children's early numeracy skills (LeFevre et al., 2009), which are important for the acquisition of mathematics in school (Jordan, Kaplan, Locuniak, & Ramineni, 2007).

A better understanding of the influence of the early home learning environment on children's later school outcomes has important implications for theories of learning as well as educational policies and interventions. A large body of research suggests that a number of social and family factors have strong influences on parents' ability to provide a rich home learning environment for their young children. Family income, for example, was found to affect parents' ability to provide learning materials and engage in different outdoor activities (Tandon et al., 2012). Compared to coupled mothers, single mothers are less likely to interact with their children in a stimulating and nurturing manner (Rosenkrantz Aronson & Huston, 2004). In addition, children from non-English speaking families face challenges in developing their literacy skills in English in the early years. Researchers found that parents' literacy-related behaviours in a language other than English do not benefit preschoolers' English oral language and phonological awareness skills (Farver, Xu, Lonigan, & Eppe, 2013). Previous studies also found significant associations between neighbourhood characteristics and children's vocabulary and reading abilities (Dupere, Leventhal, Crosnoe, & Dion, 2010). While families' socio-economic status is often difficult to change, understanding how the home learning environment influences children's learning outcomes across different social groups may have implications for policy-makers, as this understanding can inform the design of early education programs to support families with different needs.

Using data collected in LSAC and children's Year 3 National Assessment Program—Literacy and Numeracy (NAPLAN) results, this chapter provides a first glimpse into the nature of the link between specific aspects of the early home learning environment and children's learning outcomes. In addition, it examines whether the relationship between the early home learning environment and children's learning outcomes in primary school varies by child gender, family socio-economic position, language spoken at home, and family type. Finally, to further investigate the mechanism by which the early home learning environment influences children's learning outcomes, this chapter analyses the pathways by which the early home learning environment influences later learning outcomes through early cognitive development.

In particular, the analysis addresses three main research questions:

- Is there an association between children's early home learning environment and their learning outcomes in Year 3?
- Does the influence of the early home learning environment on children's learning outcomes in Year 3 vary by gender, socio-economic status, language spoken at home and family type?
- Does the early home learning environment influence children's learning outcomes in Year 3 via their cognitive development at age 4–5 years?

4.2 Sample and measures

This section provides a brief description of the sample and measures used to assess the home learning environment, and children's cognitive development and learning outcomes.

Sample

The sample used for the analysis in this chapter was drawn from the Baby (B) cohort of the LSAC children. The data from Wave 2, when children were aged 2–3 years old, were used to assess their early home learning environment. Children's language ability and school readiness, which were assessed at Wave 3 when they were aged 4–5 years old, were used as early indicators of cognitive development. Later learning outcomes were measured using the children's Year 3 NAPLAN scores, which were linked to the Wave 5 data, when children were 8–9 years old. Therefore, the sample used in this chapter consists of B cohort children who have data available at both Waves 2 and 3, as well as completed NAPLAN assessment in Year 3—an overall total of 3,856 children.

Measures of the home learning environment

Bradley and Caldwell (1995) defined a stimulating home learning environment as one that provides educational interactions and activities (such as playing games, singing songs, shared reading, and visiting museums, libraries and playgrounds), as well as making learning materials available at home. This definition has been widely accepted and applied in recent studies (e.g., Anders et al., 2012; Son & Morrison, 2010). Following Bradley and Caldwell's (1995) concept, we identified four broad dimensions of the home learning environment:

- home activities;
- reading to the child;
- number of books at home; and
- out-of-home activities.

The advantage of using this definition is that the home learning environment is defined not only by inside-home activities but also by out-of-home activities. The information about the children's home learning environment, as defined above, was collected from parents at Wave 2. The measures of the home learning environment are described in detail below.

Home activities index

The home activities index (HAI) originally consisted of seven items. For the purposes of this chapter, we removed the last item, "reading to child", and included it as an independent measure (see below). The six remaining items were used to assess the frequency of shared parent-child activities in the home. Examples include teaching the child a song, playing games, and doing arts

and crafts. Primary carers (usually the child's mother) reported on the number of days they or an adult in their family had done these activities with their children in the previous week, with possible responses consisting of 0 = none, 1 = 1–2 days, 2 = 3–5 days and 3 = every day (6–7 days). Average scores were calculated and dichotomised to indicate the levels of home activities:

- high HAI (equal to or above the 50th percentile of average scores of HAI); or
- low HAI (below the 50th percentile of average scores of HAI).

Reading to child

The “reading to child” item was originally from the home activities index. This item was used to assess how often the primary carer or a family member read to the child during the previous week. Respondents indicated the frequency of this activity using a four-point scale (not at all, 1–2 days, 3–5 days, or every day (6–7 days)). Given more than 6 out of 10 parents (62%) read to their child every day at Wave 2 (2–3 years), this variable was dichotomised to allow comparisons between parents who read to their child:

- almost every day (6–7 days); or
- less frequently (0–5 days).

Number of children's books

The primary carers reported the presence of children's books available in the home (0 = none; 1 = 1–10 books; 2 = 11–20 books; 3 = 21–30 books; 4 = more than 30 books). In the current sample, more than half of the families had more than 30 books for their child (71%). Additionally, having more than 30 books at home has been found to be an important indicator of child literacy practice at home (Mullan & Daraganova, 2012). Therefore, this variable was dichotomised into:

- 0–30 books at home; or
- more than 30 books at home.

Out-of-home activities

Children's out-of-home activities were used to assess their involvement in experiences or activities outside the home (e.g., visiting a library or zoo, going on picnics, or attending sporting events). The primary carers reported on 10 different types of activities that the child may have experienced during the previous month. At Wave 2, about 42% of children had been involved in three or more different out-of-home activities with their parents or other family members during the previous month. Responses (0 = no; 1 = yes) were totalled and dichotomised:

- 0–2 activities outside the home per month; or
- 3 or more activities outside the home per month.

Measures of early cognitive development

To assess children's early cognitive development (at age 4–5 years), the following measures were selected at Wave 3: (a) Peabody Picture Vocabulary Test, 3rd edition (PPVT-III); and (b) the School Readiness Score (Who Am I?).

PPVT-III

The PPVT-III is a test to assess children's receptive vocabulary abilities. It is used as a screening test of verbal skills in children and adults ranging in age from 2 through 90+ years. The PPVT-III is useful in testing preschool children and is fair to persons with written-language problems and disabilities (Dunn & Dunn, 1997).

Who Am I?

The Who Am I? test was used to assess the cognitive processes that underlie the learning of early literacy and numeracy skills (De Lemos, 2002). Children were asked to write their names, copy shapes and write words and numbers. This test is considered to be a good indicator of school readiness (see details in Chapter 1).

Measures of learning outcomes

Children's reading and numeracy performance in middle primary school was measured using their NAPLAN scores. NAPLAN is an annual testing program administered to all Australian students in Years 3, 5, 7 and 9 in reading, writing, spelling, grammar, punctuation and numeracy (see details in Chapter 1), with scores that range from 0 to 1000 (Australian Curriculum Assessment and Reporting Authority, 2008). To provide a general picture of the school performance of children aged 8–9 years old, we used the results from the Year 3 NAPLAN tests of reading and numeracy.

One way to think about the magnitude of the differences in NAPLAN scores between children who had a higher quality home learning environment and those who had a lower quality home learning environment is to use the difference in the score required to meet the National Minimum Standard (NMS) at Year 3 and Year 5. Students at the NMS have typically demonstrated the basic elements of literacy and numeracy to participate at their year level. The NMS at Years 3, 5, 7 and 9 represents increasingly challenging skills and understandings as students move through the years of schooling. In Year 3, the NMS is 270 points, and the score required to meet the NMS for Year 5 is 374 points. The difference over two years is 104 points. Therefore, the annual gain in NAPLAN scores required to maintain a score at the NMS is 52 points. This can be considered to be the equivalent of one year of schooling at the Year 3 level (Warren & Haisken-DeNew, 2013). On average, Australian students attend school for about 40 weeks per year (excluding school holidays). This means each NAPLAN point can be considered as equivalent to approximately one week of schooling in Year 3 (52 points/40 weeks = 1.3 points per week).

Measure of cognitive ability

To examine the association between children's home learning environment and their learning outcomes, it is important to consider children's innate intelligence. Children's cognitive ability was measured using the Matrix Reasoning Test at Wave 5, when children were on average 8 years and 11 months. The Matrix Reasoning Test is part of the Wechsler Intelligence Scale for Children, 4th edition (WISC-IV), and measures non-verbal intelligence (Wechsler, 2003). A higher score represents a better outcome. Children's matrix reasoning scores were included as a control variable in the analyses to adjust for the inherited component of children's IQ.

Measures of socio-demographic characteristics

This chapter uses socio-demographic information collected at Wave 2, when children were 2–3 years old. As outlined in the introduction, this chapter examines the relationship between the early home learning environment and children's academic development, using different sub-population groups. This includes child gender, family socio-economic position (SEP; bottom 25%, middle 50% and top 25% of the distribution), mother's language spoken at home (English-speaking vs non-English speaking),¹ family type (single-parent vs two-parent primary households), region of residence (metropolitan vs regional) and neighbourhood disadvantage (bottom 25% vs top 75% of the Socio-Economic Indexes for Areas [SEIFA] distribution).² A detailed description of these measures can be found in Chapter 1.

These socio-demographic factors were chosen as they were reported to influence parents' capacities for providing a rich home learning environment (Hartas, 2011; Miser & Hupp, 2012; Sarsour et al., 2010). Maternal education is another important factor of children's academic achievement. However, this factor was omitted, as parents' level of education was used to derive the measure of family socio-economic position that was included in the analysis.

¹ Mother's language spoken at home refers to the language Parent 1 speaks at home. The vast majority of Parent 1s were mothers (98%), although a small proportion were fathers (2%) or other adults who were identified as the primary carer of the study child (0.1%). LSAC is not representative of children from culturally and linguistically diverse (CALD) backgrounds.

² Neighbourhood disadvantage was measured using the SEIFA Index of Relative Socio-Economic Disadvantage, with lower scores representing the most disadvantaged neighbourhoods.

4.3 Early home learning environment in Australia

Before addressing the research questions outlined in the introduction, this section provides a description of different aspects of the home learning environment among Australian families across different social groups, when children were 2–3 years of age. Table 4.1 provides a summary of a set of chi-square tests of independence, focusing on associations between different measures of the home learning environment and family and social factors.

Table 4.1: Home learning environment across socio-demographic groups

Socio-demographic characteristics	Home activities index		Reading to child		No. of children's books		Out-of-home activities	
	Low (%)	High (%)	0–5 days (%)	6–7 days (%)	0–30 (%)	> 30 (%)	0–2 (%)	3+ (%)
Child gender								
Boys	52.2	47.8	41.7	58.3	29.2	70.9	59.6	40.4
Girls	51.1	48.9	38.9	61.1	29.6	70.5	60.0	40.0
Socio-economic position								
Low SEP	56.9 ***	43.1 ***	56.6 ***	43.4 ***	44.1 ***	55.9 ***	74.5 ***	25.5 ***
Middle SEP	51.1 ***	48.9 ***	39.2 ***	60.9 ***	26.3 ***	73.7 ***	58.2 ***	41.8 ***
High SEP	45.9 ***	54.1 ***	21.7 ***	78.3 ***	16.8 ***	83.2 ***	44.2 ***	55.9 ***
Mother's language spoken at home								
English	50.3 **	49.7 **	36.9 ***	63.1 ***	23.8 ***	76.2 ***	58.5 **	41.5 **
Non-English	58.3 **	41.7 **	57.4 ***	42.6 ***	56.7 ***	43.3 ***	66.6 **	33.4 **
Family type								
Two-parent	51.6	48.4	39.2 **	60.8 **	28.5 *	71.5 *	59.2	40.8
Single-parent	50.9	49.1	48.9 **	51.1 **	35.6 *	64.4 *	65.0	35.0
Region of residence								
Metropolitan	52.8	47.2	40.2	59.8	30.0	70.0	59.2	40.8
Regional	49.1	50.9	40.8	59.2	27.7	72.3	61.1	38.9
Neighbourhood disadvantage								
Disadvantaged	52.8	47.2	53.7 ***	46.3 ***	43.4 ***	56.7 ***	67.1 ***	32.9 ***
Non-disadvantaged	51.3	48.7	36.4 ***	63.6 ***	25.2 ***	74.8 ***	57.7 ***	42.3 ***
Total	51.7	48.3	40.4	59.6	29.4	70.7	59.8	40.2
No. of observations	1,918	1,938	1,384	2,472	960	2,896	2,156	1,700

Notes: $n = 3,856$. The percentages in each row set sum to 100% but may not total exactly 100.0% due to rounding. Statistical significances from χ^2 tests were noted: * $p < .05$; ** $p < .01$; *** $p < .001$.

Source: Parent 1 response, B cohort, Wave 2

Home activities index

Shared home activities between parents and their children were similar across gender, family type, region of residence and neighbourhood disadvantage. Significant differences were observed only by family's socio-economic position and mother's language spoken at home. Children in low SEP families engaged in at-home activities with their parents less frequently than the other groups, with 43% of low SEP families having a high score on the HAI, compared to 49% of middle SEP families and 54% of high SEP families. Mothers who spoke a language other than English at home also tended to have less frequent shared activities with their child than mothers who spoke English at home (42% and 50% respectively).

Reading to child

Overall, about 60% of parents read to their child at least six days a week, and parents were generally actively engaged in reading to their child, regardless of the child's gender or region of residence. The proportion of parents who read to their child at least six days a week was significantly higher

among two-parent households than single-parent households. Parents from high SEP families were also more likely to read to their children daily (78%), compared to parents from middle or low SEP families (61% and 43%, respectively). Similarly, children from less disadvantaged neighbourhoods were more likely to be read to at least six days a week (64%) compared to children from more disadvantaged neighbourhoods (46%). In addition, children of English-speaking mothers were more likely to be read to at least six days a week (63%) than were children of non-English speaking mothers (43%).

Number of children's books

As Table 4.1 shows, for the current sample, a large majority of children (71%) had more than 30 children's books at home. The distribution was very similar between boys and girls, with parents generally providing a good amount of reading materials for their child at the age of 2–3 years, irrespective of the child's gender. Across socio-economic groups, there were notable differences in the number of children's books in the home. Just over half of parents (56%) in low SEP families had more than 30 books for their children, whereas there were significantly higher proportions of children with more than 30 children's books at home in high SEP families (83%). Compared to children with mothers from an English-speaking background (76%), the proportion of children who had access to more than 30 children's books was lower among those whose mother was from a non-English speaking background (43%). A significant difference was also observed among families from different neighbourhoods. About 57% of children from families living in a disadvantaged neighbourhood had more than 30 books at home, compared to 75% of children from families living in less disadvantaged neighbourhoods. In addition, the proportion of children who had access to more than 30 books was higher among children in two-parent households (72%) compared to children in lone-parent households (64%). There were no significant differences in the number of books between children who lived in metropolitan and regional areas.

Out-of-home activities

Overall, around 40% of children had three or more activities outside home with their families during the month prior to the interview. The number of out-of-home activities was higher among children in high SEP (56%) and middle SEP (42%) families than among children in low SEP families (26%); and was also higher among two-parent households (41%) than single-parent households (35%). Similarly, a lower proportion of children who lived in disadvantaged neighbourhoods (33%) experienced three or more activities outside of their homes than other children (42%). However, there were no significant differences in out-of-home activities according to the child's gender or the family's region of residence.

Summary

Overall, most families frequently engaged their children in reading and learning-related experiences and activities, although different patterns were observed across various social groups. Families living in disadvantaged neighbourhoods, with mothers speaking a language other than English at home, and in low SEP households were relatively limited in the frequency of learning experiences they provided to their children.

4.4 Is there an association between the early home learning environment and Year 3 learning outcomes?

In this section, we address the first research question by comparing children's learning outcomes in Year 3 according to the quality of their early home learning environment when they were 2–3 years old. The results are presented in Tables 4.3 to 4.7. The average NAPLAN scores for reading and numeracy are reported across different levels of various aspects of the home learning environment (e.g., low vs high home activities index). The difference in the average NAPLAN scores by the early home learning environment, after controlling for various characteristics of the child and their household, is also reported (under "Adjusted difference").

Previous research suggests that there are significant differences in children's home learning experiences and cognitive outcomes according to the child's gender (Matthews, Kizzie, Rowley, & Cortina, 2010), the family's socio-economic status (Hartas, 2012), maternal language spoken at home (Farver et al., 2013; LeFevre et al., 2010), parents' marital status (Rosenkrantz Aronson & Huston, 2004), region of residence (Baxter, Gray, & Hayes, 2011) and neighbourhood disadvantage (Dupere et al., 2010; Edwards, 2005).

As can be seen in Table 4.2, children from families of a low socio-economic status, a lone-parent and living in regional areas or disadvantaged neighbourhoods had lower NAPLAN scores, on average, than others. Although boys had lower reading scores than girls, their numeracy performances were higher. In addition, average numeracy scores were higher among children whose mother spoke a language other than English at home, compared to children whose mother spoke English at home. However, there was no significant difference observed in children's average reading scores according to their mother's language.

	Reading scores	<i>p</i>	Numeracy scores	<i>p</i>
Child gender				
Boys	422.1	***	408.6	***
Girls	435.3		398.7	
Socio-economic position				
Low SEP	391.2		372.6	
Middle SEP	427.3	***	401.8	***
High SEP	478.6		446.6	
Mother's language spoken at home				
English	427.8	ns	401.8	*
Non-English	432.6		413.7	
Family type				
Two-parent	432.6	***	406.7	***
Single-parent	395.1		378.1	
Region of residence				
Metropolitan	435.3	***	410.5	***
Regional	411.0		388.7	
Neighbourhood disadvantage				
Disadvantaged	399.3	***	384.0	***
Non-disadvantaged	437.0		409.3	
Total	428.6		403.7	
No. of observations	3,141		3,138	

Notes: Statistical significances from regression tests were noted: * $p < .05$; ** $p < .01$; *** $p < .001$; ns = not significant.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

Multivariate regression was performed to test whether children who were living in a more stimulating home learning environment at the age of 2–3 tend to have higher NAPLAN scores in Year 3, adjusting for the child's gender, family type, mother's language spoken at home, family's socio-economic position, region of residence, and neighbourhood disadvantage status.³ In addition to the NAPLAN score comparisons, the magnitude of differences in NAPLAN scores was also described in terms of the length of schooling in weeks (1.3 points per school week in Year 3).

Home activities index

Children's reading and numeracy performance in Year 3 was significantly related to differences in the frequency of home activities when they were 2–3 years old. As shown in Table 4.3 (on page 71), children whose parents engaged less often in home activities with them achieved lower

³ The adjusted difference represents the difference in average NAPLAN scores that remains after controlling for family and social characteristics using the ordinary least squares (OLS) method.

NAPLAN reading scores on average (419.7 points) compared to those whose parents frequently engaged in home activities (438.3 points). This difference remained significant even after adjusting for socio-demographic factors and was equivalent to almost 12 weeks of schooling (15.6 points).

Similarly, children with low levels of home activities on average had lower NAPLAN numeracy scores (399.2 points) than those with high levels of home activities (408.6 points). The difference in the scores was significant, even after accounting for socio-demographic factors, and equivalent to approximately six weeks of schooling in Year 3 (7.3 points).

NAPLAN scores	HAI scores (non-adjusted)		Adjusted difference
	Low (n = 1,918)	High (n = 1,938)	
Reading scores (mean = 428.9; SD = 91.5)	419.7	438.3	15.6 ***
Numeracy scores (mean = 403.9; SD = 74.7)	399.2	408.6	7.3 **

Note: The adjusted difference represents the difference that remains in average NAPLAN scores between more or less stimulating home learning environments after controlling for socio-demographic factors. *** $p < .001$; ** $p < .01$; * $p < .05$.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

Reading to child

As Table 4.4 shows, more frequent reading to children in the early years was related to higher reading performance of children at Year 3. Children whose parents read to them every day when they were 2–3 years old had Year 3 NAPLAN reading scores approximately 40 points greater (444.2 points), on average, than children whose parents read to them less frequently (404.3 points). After adjusting for other factors, this difference remained statistically significant and was equivalent to 20 weeks of schooling in Year 3.

Similarly, the frequency with which parents read to their children was associated with children's Year 3 numeracy skills. Children whose parents read to them every day achieved significantly higher NAPLAN scores (413.7 points) compared to other children (388.1 points). The adjusted difference remained significant and was equivalent to approximately 12 weeks of schooling in Year 3 after accounting for socio-demographic factors.

NAPLAN scores	Reading to child (non-adjusted)		Adjusted difference
	0–5 days (n = 1,384)	6–7 days (n = 2,472)	
Reading scores (mean = 428.9; SD = 91.5)	404.3	444.2	26.3***
Numeracy scores (mean = 403.9; SD = 74.7)	388.1	413.7	15.4***

Note: The adjusted difference represents the difference in average NAPLAN scores between more or less stimulating home learning environments that remains after controlling for socio-demographic factors. *** $p < .001$; ** $p < .01$; * $p < .05$.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

Number of children's books

Having more than 30 children's books at home at 2–3 years was positively related to higher NAPLAN scores in reading and numeracy in Year 3 (Table 4.5 on page 72). Compared to children who had 30 or fewer books at home when they were 2–3 years old, children who had more than 30 books had, on average, higher Year 3 NAPLAN reading scores (404.5 and 438.1 points respectively). The difference remained significant and was equivalent to more than four months of schooling even after adjusting for socio-demographic factors.

Similarly, children who had more than 30 books at home when they were 2–3 years old outperformed children who had 30 or fewer books by 25.9 points on their Year 3 NAPLAN numeracy scores (410.9 and 385.0 points respectively). After adjusting for a number of socio-demographic factors, this difference (18.2 points) was still statistically significant and equivalent to 14 weeks more of schooling.

Table 4.5: Children’s reading and numeracy NAPLAN scores, by number of children’s books

NAPLAN scores	No. of children’s books (non-adjusted)		Adjusted difference
	0–30 (n = 960)	> 30 (n = 2,896)	
Reading scores (mean = 428.9; SD = 91.5)	404.5	438.1	22.4 ***
Numeracy scores (mean = 403.9; SD = 74.7)	385.0	410.9	18.2 ***

Note: The adjusted difference represents the difference in average NAPLAN scores between more or less stimulating home learning environments that remains after controlling for socio-demographic factors. *** $p < .001$; ** $p < .01$; * $p < .05$.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

Out-of-home activities

There was a significant difference in average Year 3 NAPLAN scores between children who engaged in higher and lower levels of activities outside the home at 2–3 years (Table 4.6). Children who were engaged in more than two out-of-home activities in the month before the interview at age 2–3 years tended to achieve better NAPLAN scores on reading (444.3 points) than children who had fewer out-of-home activities (417.7 points). This difference was significant and equivalent to approximately 11 weeks of schooling in Year 3 after considering family and social factors.

Having more than two out-of-home activities in the month prior to the interview was also significantly associated with children’s numeracy performance. Compared to children who had fewer out-of-home activities, the average Year 3 NAPLAN numeracy scores of children who had more out-of-home activities were 18.3 points higher (396.2 and 414.5 points respectively). After adjusting for a number of socio-demographic factors, the magnitude of the “out-of-home activities advantage” was about six weeks (8.3 points) of Year 3 schooling.

Table 4.6: Children’s reading and numeracy NAPLAN scores, by number of out-of-home activities

NAPLAN scores	Out-of-home activities (non-adjusted)		Adjusted difference
	0–2 (n = 2,156)	3–5 (n = 1,700)	
Reading scores (mean = 428.9; SD = 91.5)	417.7	444.3	14.0 ***
Numeracy scores (mean = 403.9; SD = 74.7)	396.2	414.5	8.3 ***

Note: The adjusted difference represents the difference in average NAPLAN scores between more or less stimulating home learning environments that remains after controlling for socio-demographic factors. *** $p < .001$; ** $p < .01$; * $p < .05$.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

Combined measures of the home learning environment

Finally, we assessed the unique contribution of each aspect of the home learning environment to children’s school performance by including all four aspects in the same model and adjusting for family and social factors.

As shown in Table 4.7 (on page 73), all four aspects of the home learning environment were each significantly associated with Year 3 reading scores, after taking family and social factors into account. Each aspect of the home learning environment was associated with children’s reading scores independently, regardless of parents conducting other learning activities with their child. The most beneficial early home activities for children’s reading achievement in primary school were: reading to the child, and having more than 30 children’s books at home. In particular, reading to the child at least six days a week and having more than 30 books at home were associated with better performance on NAPLAN reading tests.

In addition, reading to the child, the number of children’s books at home and out-of-home activities showed significant independent associations with children’s numeracy skills. However, after adjusting the contributions of other home learning environment features, the difference in children’s numeracy performance between children who were engaged in high levels of at-home activities and those who engaged in low levels of at-home activities was no longer evident. This result suggests that home activities might not have an independent association with children’s numeracy skills.

Table 4.7: Significance of difference in average NAPLAN scores between children, by levels of measures of the home learning environment

NAPLAN scores	Home activities	Reading to child	No. of children's books	Out-of-home activities
Reading scores	*	***	**	**
Numeracy scores	ns	**	***	*

Note: Multivariate analysis was performed to test the unique contribution of different aspects of home learning environment on numeracy and reading scores, adjusting for socio-demographic factors. *** $p < .001$; ** $p < .01$; * $p < .05$; ns = not significant.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

4.5 Does the association between the early home learning environment and children's learning outcomes vary by socio-demographic characteristics?

This section focuses on the second research question and examines whether the association between the home learning environment and children's learning outcomes varies across different groups within the sample (child gender, socio-economic position, mother's language spoken at home, and family type).

Firstly, we examine the "gaps" in NAPLAN scores for each of the groups of interest. The gap is the difference in Year 3 NAPLAN scores between children who had a higher quality home learning environment (e.g., more than 30 books at home) and those who had a lower quality home learning environment (e.g., 30 or fewer books at home) at age 2–3 years.

The gap is considered significant if the average Year 3 NAPLAN scores of children who had a higher quality home learning environment are different from those children who had a less stimulating home learning environment among subgroups (e.g., if girls who were read to every day had significantly higher reading scores than girls who were read to less frequently). The gaps in NAPLAN scores are presented for each of the groups of interest in Table 4.8 (on page 74). Significant results ($p < .05$) are bolded.

We also examine whether the gaps in NAPLAN scores vary within different groups (e.g., boys vs girls). In other words, whether the gap size was significantly larger for one subgroup (e.g., girls) than the other subgroup (e.g., boys). Significance levels of the differences in NAPLAN gaps between each subgroup are presented in Table 4.8.

In these estimations, the gap was adjusted for a number of socio-demographic factors that were related to children's cognitive development and learning outcomes, including child gender, socio-economic position, mother's language spoken at home, family type, region of residence and neighbourhood disadvantage (Aikens & Barbarin, 2008; Bracken & Fischel, 2008; Hartas, 2011; LeFevre et al., 2010; Matthews et al., 2010).

Subgroup analyses reveal that reading to children and the availability of children's books appear to be the most beneficial features of an early home learning environment. Compared to inside and out-of-home activities, these two features show stronger effects on children's reading and numeracy outcomes across almost all subgroups.

Overall, differences between the subgroups were not significant except between children from English and non-English speaking families. Children from English-speaking families benefited significantly in terms of their NAPLAN performance from having a more stimulating home learning environment at age 2–3 years. Specifically, a high level of engagement in home activities was significantly more beneficial for children's numeracy scores among children from English-speaking families (10.3 points) than among children from non-English speaking families (–14.3 points), after adjusting for other family and social factors. Child gender, socio-economic position and family type were not significantly associated with the gaps in NAPLAN performance between different qualities of the early home learning environment. Having a stimulating home learning environment at 2–3 years of age appeared to be equally beneficial to children's learning outcomes across these subgroups.

Table 4.8: The gap in NAPLAN scores, by home learning environments and socio-demographic characteristics

Socio-demographic characteristics	n	Gaps in numeracy scores				Gaps in reading scores			
		Home activities	Out-of-home activities	Reading to child	No. of children's books	Home activities	Out-of-home activities	Reading to child	No. of children's books
Gender									
Boys	1,977	5.2	9.5	14.5	14.1	14.4	18.3	26.8	15.8
Girls	1,879	7.9	2.9	8.7	10.7	14.5	5.3	17.7	16.2
Differences in gaps		ns	ns	ns	ns	ns	ns	ns	ns
Socio-economic position									
Low SEP	823	11.7	2.1	4.5	12.2	16.1	10.1	19.1	20.8
Middle SEP	1,987	5.2	9.0	16.2	10.0	13.1	13.5	25.0	10.9
High SEP	1,045	2.4	3.6	7.2	19.3	15.0	9.2	18.3	23.2
Differences in gaps		ns	ns	ns	ns	ns	ns	ns	ns
Language spoken at home									
English	3,392	10.3	6.5	12.8	12.1	17.7	11.6	25.5	15.4
Non-English	464	-14.3	4.8	6.1	13.6	-2.9	13.1	7.5	16.8
Differences in gaps		sig.	ns	ns	ns	ns	ns	ns	ns
Family type									
Two-parent	3,530	6.2	6.4	10.5	14.1	15.3	12.3	22.4	15.7
Single-parent	316	6.6	5.5	16.8	0.4	6.8	11.7	23.4	18.5
Differences in gaps		ns	ns	ns	ns	ns	ns	ns	ns

Note: $n = 3,856$. The gaps present adjusted differences in NAPLAN scores between more or less stimulating home learning environments that remain after controlling for child gender, socio-economic position, mother's language spoken at home, family type, region of residence and neighbourhood disadvantage. Significant results are bolded: sig. = significant ($p < .05$); ns = not significant.

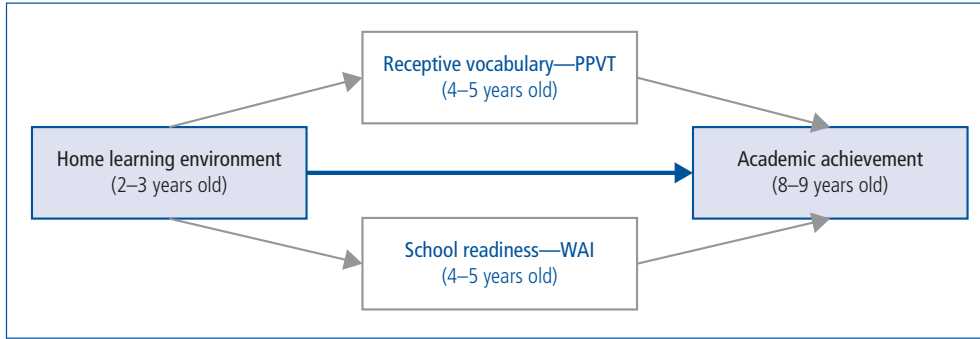
Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

It is worth noting that the lack of statistical significance of subgroup comparisons relating to family type and mothers' language spoken at home may be attributable to sample size. For example, there were only 11% of primary households headed by a single parent in this current sample (when children were 2–3 years old). In addition, LSAC is not representative of children from culturally and linguistically diverse backgrounds. Results should therefore be interpreted with caution.

4.6 Does children's cognitive development explain the association between the early home learning environment and their learning outcomes?

This section addresses the final research question and examines whether the association between the early home learning environment, measured when children were 2–3 years old, and children's academic achievement at age 8–9 years is explained by the child's cognitive development at age 4–5 years, measured by the child's level of receptive vocabulary (PPVT) and readiness for school (WAI). Figure 4.1 (on page 75) describes these associations schematically.

We refer to the association between the home learning environment and academic achievement as an "indirect association" if the path from the home learning environment to academic achievement goes via PPVT or WAI, and as "direct association" if there is a direct path from the home learning environment to academic achievement, independent of PPVT and WAI. In Figure 4.1, the direct association is presented by the bold blue arrow and indirect associations are presented by the grey arrows.



Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

Figure 4.1: Relationship between the home learning environment, vocabulary, school readiness and academic achievement

Home learning environment index

As the main aim of this analysis is to understand the role of the overall home learning environment on children’s learning outcomes, rather than the individual contribution of different aspects of the home learning environment, we developed the home learning environment index (HLEI) measure. The HLEI was derived as a sum of four binary measures used to describe the different aspects of the home learning environment examined (home activities index, reading to child, number of children’s books, and out-of-home activities), with values ranging from 0 (the lowest level of home learning environment) to 4 (the highest level of home learning environment). The score distribution of HLEI is presented in Table 4.9. Around 10% of the children aged 2–3 years were growing up in a relatively less stimulating home learning environment. These children had relatively low levels of engagement in home activities, were not read to every day, had 30 or fewer children’s books at home, and were engaged in fewer than three out-of-home activities during the month prior to the interview. At the same time, around 16% of children aged 2–3 years were growing up in a highly stimulating home learning environment. These children were frequently engaged in home activities, were read to daily, had more than 30 children’s books at home and were engaged in at least three out-of-home activities during the month prior to the interview.

Table 4.9: Distribution of home learning environment index, children aged 2–3 years		
HLEI (mean = 2.19, SD = 1.22)	% (weighted)	n (unweighted)
0	10.4	304
1	19.9	679
2	26.4	1,010
3	27.2	1,145
4	16.2	718
Totals	100.0	3,856

Note: Percentages may not total exactly 100.0% due to rounding.
 Source: Parent 1 response at Wave 2, B cohort

Associations between the early home learning environment and NAPLAN scores

Table 4.10 (on page 76) presents the results of the analysis that examined the direct and indirect associations between the home learning environment at 2–3 years old and Year 3 NAPLAN numeracy and reading scores. The contribution of direct and indirect associations are discussed in terms of:

- the corresponding NAPLAN points (columns 2 and 4); and
- the proportion of direct and indirect associations relative to the total association (columns 3 and 5).

Table 4.10: Associations between home learning environment, vocabulary and school readiness, by Year 3 NAPLAN scores

	Numeracy (mean = 403.69, SD = 74.67)		Reading (mean = 428.61, SD = 91.60)	
	NAPLAN points	%	NAPLAN points	%
Direct association	6.0 ***	55.0	10.1 ***	59.0
Indirect association via PPVT	2.7 ***	25.0	5.4 ***	32.0
Indirect association via WAI	2.2 ***	20.0	1.6 ***	9.0
Total association	10.8 ***	100.0	17.0 ***	100.0

Note: The analysis was adjusted for child gender, child's cognitive ability, socio-economic position, family type, mother's language spoken at home and region of residence. *** $p < .001$; ** $p < .01$; * $p < .05$.

Source: Year 3 NAPLAN numeracy and reading scores, B cohort, Wave 5

The results indicate that the total association between the home learning environment and numeracy scores in Year 3 was positive and statistically significant. This association was partially explained by a child's cognitive development at 4–5 years old. Even though 55% of the total association was due to the direct association of the home learning environment with numeracy scores, 25% of the association was via PPVT and 20% of the association was via WAI.

Therefore, for the total influence of the home learning environment (10.8 points or 8 weeks schooling in Year 3), part of the “gap” in NAPLAN numeracy scores (6.0 points or 5 weeks of schooling in Year 3) would be the result of a more stimulating home learning environment, while the other part of the increase in numeracy score would result from the fact that children would be more ready for school (with an increase of 2.2 points) and would have a better vocabulary (with an increase of 2.7 points).

A very similar pattern of associations was observed between the home learning environment and NAPLAN reading scores. The total association of the home learning environment in which a child was growing up at age 2–3 years on his/her reading achievement at 8–9 years old was positive and statistically significant, suggesting that growing up in a stimulating home learning environment would benefit children's NAPLAN reading scores by the equivalent of more than four months of schooling in Year 3 (17.0 points). Fifty-nine per cent of this increase (10.1 points) would be due to the direct association of differences in the home learning environment, whereas 32% of the association (5.6 points or one month of schooling) would result from children having a more developed vocabulary and 9% of the association (1.6 points or about 1 week of schooling) would result from children's greater school readiness.

To sum up, the home learning environment was related to children's later academic performance through children's early cognitive development and school readiness. A stimulating home learning environment at the age of 2–3 years was significantly associated with better language development and school readiness at 4–5 years and, in turn, was associated with better academic performance at Year 3. In addition, the direct association of the home learning environment with children's academic achievement was also significant. Importantly, the direct association was not trivial. This suggests that, even after adjusting for a rich set of socio-demographic factors related to a child's academic achievement, the home learning environment (measured when children were 2–3 years old) has a direct positive association on a child's academic results measured six years later, independent from children's cognitive development and school readiness at school entry.

It is important to emphasise that academic performance is highly correlated with the home learning environment at all ages, not only when children are 2–3 years old. At the same time, the home learning environment has been reported to be relatively stable over time (Dallaire & Weinraub, 2005; Masur & Turner, 2001). Children who live in a cognitively stimulating home learning environment at 2–3 years are more likely than others to continue to have a stimulating environment as they grow older; that, in turn, leads to better learning outcomes (Rodriguez & Tamis-LeMonda, 2011). In the analysis discussed in this section, we did not take into account the home learning environment at different ages, and the direct association we observed in Table 4.10 may therefore reflect the cumulative influence of the home learning environment as children grow older.

4.7 Summary and discussion

This investigation extended our understanding of the home learning environment during early childhood—a period in which child development has been shown to be particularly sensitive to environmental influences in the home—and its association with learning outcomes when children are in Year 3, using a large, nationally representative sample of Australian families.

Overall, the results present a positive picture of the home learning environment in Australia. Across all social groups, most parents made good efforts to provide a stimulating home environment for their child. However, children from families of low socio-economic position, those with mothers who spoke a language other than English and those who lived in disadvantaged neighbourhoods had fewer learning opportunities at home than others. Similar patterns have been reported in previous studies. For example, compared to children in high SEP households, children from low SEP households are half as likely to be taken to a museum, library or theatre, and they are less likely to participate in culturally enriching activities (Bradley & Corwyn, 2002). In addition, families from non-English speaking backgrounds tend to have less social support and limit the amount of time they spend outside their homes (Wilson & Dollman, 2007).

This chapter assessed the relationships between four aspects of the early home learning environment and children's later learning outcomes, and further demonstrated the power of what parents can do to promote their children's academic achievement. Shared activities at home are important in the development of language and numeracy skills later on. The association with children's reading ability was substantial and significant, even after considering a variety of socio-demographic factors. In line with previous studies, parental involvement had a significant association with child outcomes over and above the influence of social risk factors such as families' socio-economic position and parental education (Sylva et al., 2004). However, home activities did not show an independent correlation with children's numeric skills after considering other aspects of the home learning environment.

Children whose parents read to them every day when they were 2–3 years old demonstrated better reading ability at Year 3 than other children. This is in line with a previous study using LSAC K cohort data, suggesting that parent-to-child reading during childhood is significantly associated with children's reading attitudes at 10–11 years of age (Mullan & Daraganova, 2012).

In addition, children's early reading activities were also related to their numeracy outcomes in Year 3. This is consistent with a study by Kalb and Van Ours (2014), which used LSAC K cohort data and showed that children who were read to more frequently at age 4–5 were more likely to achieve high scores on the NAPLAN numeracy tests, though these effects were smaller compared to the effects on the NAPLAN reading tests. LeFevre et al. (2010) also found that exposure to children's books was significantly beneficial for Greek children's numeracy skills in Year 3, though it was not significant for Canadian children.

In addition, reading materials that parents provide to their children at home represent an important part of the home learning environment. The results reveal a significant association between the number of children's books available at home and children's reading and numeracy performance. Having books at home enhances parent–child verbal interaction and facilitates shared literacy activities, thus exerting a substantial effect on a child's language development (Korat, Arafat, Aram, & Klein, 2012). The availability of children's books at home may reflect parents' engagement with children and their general investment in their children's learning.

It is interesting to observe the positive relationship between children's book exposure (reading to the child and the number of books available) and children's numeracy skills. It is likely that parents who invest more in children's literacy practices also engage in other learning-related activities, and have higher expectations for their children's academic achievement (LeFevre et al., 2010). Additionally, children who engaged in reading activities at an early age enter school with more advanced cognitive skills (Mol & Bus, 2011) and are more ready for school, which may also enhance their ability to develop numeracy skills.

Most literacy research has focused on parent–child reading behaviours, and few studies have investigated other learning-related activities (e.g., visiting a museum) in relation to children's numeric ability. This chapter demonstrates the important relationship between out-of-home activities and children's later academic achievement. Activities outside the home require children to use skills

such as counting, planning and categorising in the context of social interactions with their parent(s) or other family members, which enhances their math competence (Baker & Iruka, 2013).

In general, the relationship between the home learning environment and children's learning outcomes did not vary substantially according to the child's gender, family type or socio-economic position. Engaging in frequent in- and out-of-home activities with parents and having more than 30 children's books at home at 2–3 years appeared to be more beneficial for children from two-parent families than children from single-parent families. However, this finding needs to be interpreted with caution due to the small proportion of single-parent families in the current sample. Children from all socio-economic groups benefited from growing up in a rich and stimulating learning environment. However, the relationship between home activities and children's reading performance was language-specific. Children whose mothers spoke a language other than English at home did not benefit significantly from shared home activities with their parents in terms of reading and numeracy performance. These results suggest that the association between home learning experiences and children's learning outcomes might differ according to family culture or language.

In the current chapter, we assessed the association between how often children were read to, their engagement in home activities and their later NAPLAN scores. However, detailed information about “how” children were read to and “how” they interact with their parents during home activities was not available. It is possible that English-speaking parents used more numeric words or more frequently encouraged mathematics during home activities than non-English speaking parents. For example, a Canadian study by Van Zeijl et al. (2006) found that Canadian parents were found to more often teach their child counting and measuring while cooking than Greek parents living in Canada. In addition, children's literacy-related experiences in their first language do not always benefit their acquisition of a second language (Gottardo & Mueller, 2009). A study in the United States found that parents' literacy-related behaviour in Spanish among Latino immigrant families was negatively associated with their children's English language skills (Farver et al., 2013). That is, children may interact with their parents in a language other than English, which can disrupt their learning in English. However, it is important to note that children whose mother did not speak English at home achieved higher levels of reading and numeric performance on average than those whose mother did speak English at home. Further investigation is needed to explain this result, but one explanation could be that these children may respond more to other home learning opportunities or formal training in English literacy and numeracy skills development. However, given that non-English speaking families were under-represented in the LSAC study, this result must be interpreted with caution.

It is worth noting that despite the home learning environment significantly influencing children's school performance, a great deal of variation in children's academic performance remains unexplained. In future studies, many other child or family factors, such as a child's temperament in early childhood, could be explored to explain children's later school achievement. To more accurately understand and predict children's academic development, the complex interactions of a wide range of socio-cultural, family and child factors should be further investigated.

This chapter explored the direct and indirect associations between the home learning environment and children's later academic outcomes, after taking into account the children's early cognitive development and a range of socio-demographic factors. It was found that children's early cognitive development, such as their early language development and school readiness, were two pathways through which the early home learning environment was related to children's later reading and numeracy skills. This result is consistent with existing studies that report that a higher quality of home learning environment predicts better cognitive development during preschool years (Brooks-Gunn & Markman, 2005; Hood et al., 2008), and children's early cognitive development predicts their school performance (Duncan et al., 2007; Jordan et al., 2007). However, the direct influence of the home learning environment on children's academic outcomes was found to be larger than its indirect influence through early language development and school readiness. It should be noted that this finding likely reflects the cumulative influences of home learning environments on children's academic performance from 2–3 years of age through to Year 3.

These findings highlight the important role that parents play in fostering children's early literacy and cognitive development to help them build a strong foundation for future learning in school. In this context, the main challenge for policies and practice is not only to encourage parents in their efforts to increase their capacity to provide a rich learning environment for their children, but

also to support less advantaged families to provide their children with rich, cognitively stimulating environments during their early childhood.

4.8 References

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