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Reading with 1–2 year olds impacts academic achievement at 8–11 years

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ABSTRACT

Parent-child book reading with infants is widely recommended and considered one of the most effective parent-child activities for promoting language and literacy development; however, there is limited evidence that reading books with infants (1–2 years) strengthens later literacy skills. The present study examined the long-term impact of parent-child book reading at 1–2 years with literacy, language, and numeracy skills at 8–11 years. Participants were 3547 infants and their caregivers from a nationally representative study. The number of minutes caregivers reported reading books with their infants (1–2 year) were examined with literacy, language, and numeracy skills on a national assessment program in Grades 3 (8–9 years) and 5 (10–11 years). Covariates included sex, age, race, language background, socioeconomic position, and cognition. Small and positive relationships were found between parent-child book reading at 1–2 years and reading, spelling, grammar, and numeracy scores in Grade 3 (8–9 years) and reading, writing, spelling, and grammar scores in Grade 5 (10–11 years). Infants (1–2 years) whose parents read with them for 11 minutes or more per day had stronger reading, spelling, and grammar skills in Grades 3 and 5.

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Reading; Young children; Literacy; Language; Numeracy; Growth trajectories Reading with 1–2 year olds impacts academic achievement at 8–11 years

Setting children up for success with mastering literacy begins with reading books during infancy. Literacy achievement is a strong predictor of later outcomes in adulthood. Researchers examining the trajectories of individuals from childhood to adulthood have highlighted the impact of literacy difficulties for academic achievement, mental health, quality of life, and long-term employment (Law et al., 2009; McLaughlin et al., 2014; Schoon et al., 2002). Moreover, mastering literacy equips adults to actively participate in every-day life activities (e.g., reading street signs, menus, instructions). Given the long-term impact of poor literacy outcomes, strategies to promote strong literacy skills are important. One such strategy that can be implemented with children from birth is parent-child book reading. Parent-child book reading, also referred to as shared reading or early storybook reading, is when a parent reads a book with their child.

Book reading with children in the first two years of life provides an opportunity for strengthening neural pathways through parent-child interactions, using a multi-modal learning environ-

ment (visual, auditory, and kinaesthetic; Brown et al., 2019). Communication development is rapid in the first two years of life as neural pathways are established, from which later language, social communication, and literacy skills are built (Kuhl, 2004). The importance of reading books with infants during the first two years of life has been well recognized with countries around the world investing in education programs to encourage parents to read books with infants with the ultimate aim of improving early language skills to set children up for success with mastering literacy (Brown et al., 2018; Dickinson et al., 2012; Fletcher & Reese, 2005; Moore & Wade, 2003; Shoghi et al., 2013; Zuckerman & Khandekar, 2010). Positive outcomes have been reported including: increased frequency of reading (Barratt-Pugh & Rohl, 2015; Moore & Wade, 2003; Zuckerman & Khandekar, 2010), improved perceived child enjoyment or child interest in reading (Barratt-Pugh & Rohl, 2015; Moore & Wade, 2003; Zuckerman & Khandekar, 2010), higher vocabulary scores (Farrant & Zubrick, 2013; Zuckerman & Khandekar, 2010), and higher language and broader social communication scores (Brown et al., 2018; Farrant & Zubrick, 2013). Parents also report that they value book reading with infants and commence reading from birth (Brown et al., 2017). A meta-analysis of parent-child book reading with children aged 1–5 years has concluded that parent-child book reading improves receptive vocabulary (average effect size 0.68), expressive vocabulary (average effect size 0.38) and emergent literacy skills (average effect

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size 0.39; Law et al., 2018). Conclusions drawn from the meta-analysis emphasized the potential benefits from parent-child book reading for language and emergent literacy development. There is also evidence that book reading during infancy supports cognitive development. Findings from a nationally representative study ($n = 11,134$) of 9-month-old infants, who were part of the Growing Up in Ireland study, indicated that book reading had a positive and statistically significant relationship with cognitive scores (Murray & Egan, 2014). Given that covariates (e.g., maternal education and maternal attachment) were included in the study, the findings are encouraging and highlight the importance of book reading during infancy not only for language, but also for cognitive development.

While the research to date on book reading during infancy points to positive outcomes for language and emergent literacy achievement up until the commencement of formal schooling, the link between book reading during infancy and long-term literacy success is inconclusive. Demir et al. (2011) state “Despite the wide-spread belief in the importance of early parent-child book-reading interactions for children’s later language and reading outcomes, empirical evidence supporting this link is weak” (p. 157). In addition to the limited evidence to indicate that book reading during infancy does set children up for success with mastering literacy, researchers have also reported that some education programs promoting book reading during infancy (Goldfeld et al., 2011; Goldfeld et al., 2012) and the preschool years (Zucker et al., 2013) have not impacted children’s language and literacy outcomes. Given that countries around the world are investing in education programs that encourage parents to read books with infants, further evidence is needed to demonstrate that book reading during infancy does have a long-term impact on literacy achievement. Examining the impact of book reading during the first two years of life is of particular importance because we know that the first two years are a sensitive stage for neural development with children’s communicative, cognitive, and play skills rapidly changing and developing.

Parent-child book reading during infancy (First 2 years)

The relationship between book reading during infancy and later language outcomes at school entry have been examined. A relatively large study ($n = 2369$) using data from the Longitudinal Study of Australian Children (LSAC) found that parent-child book reading, specifically the number of minutes parents reported reading with their child daily, predicted later child vocabulary development at the commencement of formal schooling (M age = 58 months; Farrant & Zubrick, 2013). Higher levels (11 minutes or more per day) of parent-child book reading during infancy was associated with higher vocabulary skills and lower levels (10 minutes or fewer per day) of parent-child book reading was associated with poorer vocabulary outcomes around the commencement of formal schooling (Farrant & Zubrick, 2013). This finding indicates that book reading during infancy does have a long term (up until school entry) impact on children’s language skills. As the aim for many book education programs worldwide is to support literacy achievement (Brown et al., 2018; Dickinson et al., 2012; Moore & Wade, 2003; Shoghi et al., 2013; Zuckerman & Khandekar, 2010) further investigation is now needed to examine whether these findings translated into stronger literacy skills in the school years.

One education program (Bookstart) has provided initial evidence that literacy skills, in the early primary school years, can be strengthened through parent-child book reading during infancy (Moore & Wade, 2003; Wade & Moore, 1998). The Bookstart program provided families with a free children’s book and encouraged frequent parent-child book reading as well as parent-child interactions while reading. Positive immediate and long-term benefits were reported. The children in the intervention group ($n = 41$)

were reported to have higher academic outcomes at the commencement of the first year of formal schooling as well as at approximately 7;6 years, compared to a control group of children ($n = 41$) who were not provided with the program (Moore & Wade, 2003; Wade & Moore, 1998). This encouraging finding suggests that parent-child book reading during infancy may have a long-term positive impact on later literacy success in the early school years. While Bookstart was a hallmark study for investigating the benefits of book reading during infancy, it was conducted more than 20 years ago. As literacy has a lasting impact on education, quality of life, and mental health, further research is needed to examine whether book reading during infancy supports later literacy success, in the current learning environment. Furthermore, as the study included 41 participants in the intervention group, further research with a larger sample size is needed to examine whether the positive outcomes generalize to the larger population.

Parent-child book reading with children (2–3 years)

While the long-term relationship between parent-child book reading during infancy and later literacy success requires further investigation with a larger sample size, the literature on parent-child book reading with older children (2–3 years) offers promising findings. Results from a nationally representative study ($n = 4768$), found that the frequency of parent-child book reading at 2–3 years of age was linked to children’s early academic skills six years later through receptive vocabulary and this effect was particularly stronger among children from a low socio-economic background (Shahaeian et al., 2018). Examining data from LSAC, Shahaeian et al. (2018) investigated whether frequency of parent-child book reading at 2–3 years (specifically how often parents read with their child in the past week) was related to the children’s academic achievement as measured by the National Assessment Program for Literacy and Numeracy (NAPLAN). NAPLAN is a set of standardized tests initiated by the Australian Government that is conducted in Grades 3 (8–9 years), 5 (10–11 years), 7 (12–13 years), and 9 (14–15 years) with Australian school children (Australian, Curriculum, Assessment and Reporting Authority; ACARA). There are five NAPLAN subtests: reading, writing, spelling, grammar and punctuation, and numeracy (ACARA, 2014). Frequency of parent-child book reading at 2–3 years was found to be associated with NAPLAN results in Grade 3 (8–9 years) for reading, writing, grammar, and numeracy, but was not related to spelling. These positive findings indicate that there is a relationship between the frequency of parent-child book reading with children aged 2–3 years and later literacy outcomes. Moreover, the findings indicated that frequency of book reading with 2 to 3-year-old children is an important variable that supports later academic achievement. Further research is now needed on other book reading variables such as duration of book reading. Examining the long-term impact of book reading variables will enable a more holistic view of which aspects of book reading impact the most on academic achievement, and specifically literacy success.

It is also unknown whether parent-child book reading at 2–3 years of age strengthened literacy development in the later primary school years (beyond Grade 3) once children have mastered decoding and the focus shifts from learning to read to reading to learn. As children progress through primary school the literacy demands increase (Castles et al., 2018). In the early primary school years children are still mastering their literacy skills by becoming fluent readers and learning to comprehend the text. By the later primary school years children need to have mastered literacy in order to meet the academic demands of their subjects. To understand whether book reading during infancy impacts on mastery of literacy, examination of literacy skills needs to occur in the later primary school years. Furthermore, as parents around the world

are encouraged to read with their child well before 3 years of age further research is needed to examine whether the positive outcomes reported from the [Shahaeian et al. \(2018\)](#) study hold true for even younger children.

Language and literacy

Mastering literacy is a learned skill that involves a complex interplay between multiple genes and environmental factors ([Castles et al., 2018](#)). Models and theories of reading development, such as such as a simple view of reading and the dual-route model consistently include the necessity of language skills for successful mastery of literacy ([Castles et al., 2018](#); Language and Reading Research Consortium, Dickinson et al., 2016; [Hoover & Gough, 1990](#)). Moreover, children with language difficulties are at high risk of literacy difficulties ([Catts et al., 2002](#); Gillon, 2000; Snowling et al., 2000). Vocabulary skills in particular, have been found to predict later language, literacy skills, and cognitive skills ([Dickinson et al., 2019](#); Language and Reading Research Consortium, 2015; [Marchman & Fernald, 2008](#)). Strong vocabulary skills and later reading success are thought to be mediated through phonological awareness ([Burgess & Lonigan, 1998](#); [Dickinson et al., 2019](#)). When preschool children with language and literacy difficulties are supported with a phonological awareness intervention, both their language and literacy skills have improved ([Gillon, 2000](#)).

The relationship between parent-children book reading and language and literacy achievement can be explained by the quality of parent-child interactions, attachment, the type of books read, reading environment, self-regulation and executive function ([Bus & van IJzendoorn, 1995](#); [Brown et al., 2018](#); [Demir et al., 2011](#); [Dickinson et al., 2012](#); [Fletcher & Reese, 2005](#); [Hindman et al., 2008](#); [Murray & Egan, 2014](#)). Parent-child book reading during infancy has been shown to predict vocabulary development at school entry ([Farrant & Zubrick, 2013](#)). The attachment between the parent and the child is one proposed explanation for the relationship between book reading during infancy and later language skills. With evidence indicating that parent-child attachment is related to frequency of book reading during infancy ([Bus & van IJzendoorn, 1995](#)). A nationally representative study from Ireland found that reading during infancy was correlated with infant cognitive development, even accounting for maternal attachment ([Murray & Egan, 2014](#)). The relationship between parent-children book reading and language and literacy achievement can also be explained by the parent-child interactions during book reading. Social constructivist theorists Vygotsky (1987) and Bronfenbrenner (1979) both proposed that language development is influenced by parent-child interactions as well as the cultural and historical setting in which these interactions occur. When parents are supported with strategies to promote parent-child interactions during book reading, their infants' language and social communication skills improve ([Brown et al., 2018](#)). Moreover, this improvement is rapid and is maintained for at least two years ([Brown et al., 2018](#)). While the present study does not examine the theoretical underpinning of whether it is attachment or the parent-child interactions that strengthen language and literacy it does examine whether the duration of parent-child book reading during infancy can have a long-term impact on later language and literacy success.

Context of the present study

Growing up in Australia: The Longitudinal Study of Australian Children (LSAC) offers an insight into a nationally representative sample of children and their families ([Gray & Sanson, 2005](#)). LSAC was designed to examine key factors related to child development and long-term outcomes and has two cohorts: (B)irth and

(K)indergarten that have been studied over eight waves of data collection ([Edwards, 2012](#); [Gray & Sanson, 2005](#)). One parent questionnaire about infants aged 1–2 years included a question related to parent-child book reading (number of minutes parents read with their child per day). Parents of children enrolled in LSAC could also provide consent for their children to have their NAPLAN data linked to their LSAC data. As outlined above, NAPLAN data is collected from Grade 3 (8–9 years) and offers insight into the child's academic achievement. NAPLAN results are standardized and reported on a scale from 0 – 1000. The children are placed into bands which represent increasing competency (ACARA, 2017). NAPLAN data from both Grades 3 (8–9 years) and 5 (10–11 years) have been used for the present study. Information collected from LSAC is used to inform policy with the aim of driving changes to strengthen current intervention and prevention programs to help children achieve the best long-term outcomes ([Edwards, 2012](#); [Gray & Sanson, 2005](#)).

Aims

Building on previous research investigating parent-child book reading with infants, the present study addressed the need for a relatively large sample to examine the long-term impact of the duration (number of minutes) of book reading with infants, on later academic achievement, and specifically literacy success. Furthermore, literacy achievement was examined both in mid primary school (Grade 3; 8–9 years) when children are still developing their literacy skills and in later primary school (Grade 5; 10–11 years) when children have mastered decoding and fluent literacy skills are needed to meet their academic needs. Duration of book reading was selected (as opposed to other book reading variables such as frequency) to expand previous work, that found book reading during infancy (1–2 years) was associated with later language (vocabulary) skills as school entry ([Farrant & Zubrick, 2013](#)). As higher levels (11 minutes or more per day) of parent-child book reading during infancy has previously been found to predict higher language (vocabulary) skills at school entry compared with lower levels (10 minutes or less per day) ([Farrant & Zubrick, 2013](#)), the present study also sought to investigate the impact of higher (11 minutes or more) and lower (10 minutes or less) levels of book reading per day on later academic achievement. Two research questions were examined in the present study:

- 1 Does the duration (number of minutes) parents report reading with their infant (1–2 years) predict academic outcomes for reading, writing, spelling, grammar, and numeracy in Grades 3 (8–9 years) and 5 (10–11 years)?
- 2 Does reading for 11 minutes or more per day predict higher academic outcomes for reading, writing, spelling, grammar, and numeracy in Grades 3 (8–9 years) and 5 (10–11 years) compared with reading for 10 minutes or less per day?

In line with previous research ([Farrant & Zubrick, 2013](#); [Moore & Wade, 2003](#); [Wade & Moore, 1998](#); [Shahaeian et al., 2018](#)), it was hypothesized that book reading would predict academic outcomes for reading, writing, spelling, grammar, and numeracy in Grades 3 (8–9 years) and 5 (10–11 year). Moreover, it was hypothesized that reading for 11 minutes or more per day would be associated with higher reading, writing, spelling, grammar, and numeracy outcomes in Grades 3 (8–9 years) and 5 (10–11 years).

Method

Recruitment of participants

Participants were 5107 children and their caregivers from LSAC from the B(irth) cohort at wave 1 (0–1 years old), wave 1.5 (in-

Table 1
Sample demographics of selected and excluded participants.

Research question 1	Included (n = 2764)	Excluded (n = 2,34)	Test statistics	P	Effect size
Female			ns		
Aboriginal or torres strait islander	2.10%	7.30%	$\chi^2 = 81.04$	$P < 0.001$	Phi = 0.13
Main language other than english	10.90%	18.60%	$\chi^2 = 61.18$	$P < 0.001$	Phi = 0.11
Socioeconomic position	0.22	-0.26	$F = 300.20$	$P < 0.001$	$d = 0.49$
Research question 2	Included (n = 2568)	Excluded (n = 2539)	Test statistics	p	Effect size
Female			ns		
Aboriginal or torres strait Islander	2.00%	7.10%	$\chi^2 = 76.13$	$P < 0.001$	Phi = 0.12
Main language other than english	10.30%	18.60%	$\chi^2 = 72.07$	$P < 0.001$	Phi = 0.12
Socioeconomic position	0.25	-0.25	$F = 338.11$	$P < 0.001$	$d = 0.52$

Note. ns = not significant; phi = 0.1 (small effect), phi = 0.2 (medium effect), phi = 0.5 (large effect); Cohen's d = 0.2 (small effect), Cohen's d = 0.5 (medium effect), Cohen's d = 0.8 (large effect).

between wave), wave 5 (Grade 3, 8–9 years), and wave 6 (Grade 5, 10–11 years). Funded by the Australian Government of Social Services, LSAC is a broadly representative national sample of Australian children (Gray & Sanson, 2005). A two-stage clustered design was conducted to recruit participants for the LSAC study (Gray & Sanson, 2005). Postcodes ($n = 311$), identified from the Australian national Medicare database were randomly selected, followed by a random selection of children who lived within those postcodes (proportionate to the number of children within each postcode; Soloff et al., 2005). Recruitment was conducted over four phases to ensure that children born in all of the months in the calendar year were represented (Soloff et al., 2005). At wave 1 interviews were conducted with caregivers (85% response rate) followed by a mail-out questionnaire at wave 1.5 (71% response rate) (Australian Institute of Family Studies, 2021; Edwards, 2012).

Participants in the B(irth) cohort

The average age for participants from the B cohort at wave 1 was 8.77 months old ($SD = 2.57$, range = 3 months to 19 months), 2608 (51%) of the children were male and 2,499 (49%) were female. English was the primary language in the family environment for 85.6% ($n = 4370$) of the participants, and 14.4% ($n = 737$) spoke language/s other than English at home. The five most common languages spoken at home, following English were: Arabic (1.6%), Vietnamese (1.3%), Italian (0.8%), Tagalog (0.8%), and Spanish (0.7%). There were 192 (3.8%) children who were identified as Aboriginal, 20 (0.4%) who identified as Torres Strait Islander, and 18 (0.4%) who identified as both Aboriginal and Torres Strait Islander descent. A total of 3547 caregivers completed the wave 1.5 question on parent-child book reading with their children whose age ranged from 15 months to 29 months at wave 1.5. The majority of caregivers (hereafter referred to as parents) who participated in wave 1.5 were the child's mother (94.7%), followed by father (3.5%), combination of mother and father (1.5%), and someone else (0.3%).

The study samples varied for both of the research questions. The eligible study sample for research question 1 included children whose parents had completed the relevant parent-report questions in wave 1, wave 1.5, and who had complete data on their Grade 3 (8–9 years) NAPLAN results ($n = 2764$). The eligible study sample for research question 2 included children whose parents had completed the relevant parent-report questions in wave 1, wave 1.5, and who had complete data on their Grade 5 (10–11 years) NAPLAN results ($n = 2568$). The eligible sample and those who were excluded from the study were tested for demographic differences (see Table 1). Overall, there were no sex differences between the eligible sample and the excluded sample. However, the eligible sample were more likely to have higher socioeconomic position and were less likely to have a language background other than English or an Indigenous background. Despite the statistical signif-

icance, the differences were of small effect sizes. The only exception was the difference in socioeconomic position between the eligible and excluded sample for research question 2, which reached a medium effect size.

Measures

Parent-child book reading

Parents responded to the question “On average, about how many minutes per day is your child read to at home” using a 5-point scale. This scale ranged from fewer than 5 minutes (1), 6–10 minutes (2), 11–20 minutes (3), 21–40 minutes (4), and more than 40 minutes per day (5). The data were collected via a mail-out questionnaire conducted at wave 1.5. The duration of parent-child book reading was measured by a single item. Considering the concrete nature of the construct, a single item measure is deemed as appropriate (Bergkvist & Rossiter, 2007; Williams et al., 2015) and have been previously shown to have predictive validity of children's academic and social-emotional outcomes (Farrant & Zubrick, 2013; Shahaeian et al., 2018; Williams et al., 2015).

Child outcomes: literacy, language, and numeracy skills

Literacy, language, and numeracy skills were measured using all five NAPLAN subtests (reading, writing, spelling, grammar and punctuation, and numeracy). In Grade 3 (8–9 years), band 1 is below the national minimum standard, bands 3–6 are above the national minimum standard (ACARA, 2017). For Grade 5 (10–11 years), band 5 is below the national minimum standard, and bands 7–10 are above the national minimum standard (ACARA, 2017). NAPLAN results were obtained through the LSAC data set.

Covariates

The covariates included in our analyses were sex (boy vs girl), child age (at the time of the NAPLAN assessment), Indigenous status (no vs yes to Aboriginal or Torres Strait Islander status), language background (main language other than English vs English), and socioeconomic position, which was a combined variable created by LSAC that included maternal and paternal education and occupational prestige in addition to the total household income (Blakemore, Gibbings, & Strazdins, 2006). The mean for the socioeconomic position variable was zero and standard deviation was one. Cognitive abilities (non-verbal intelligence) at 6–7 years were also controlled for the NAPLAN Grade 3 (8–9 years) analyses and cognitive abilities at 8–9 years for the NAPLAN Grade 5 (10–11 years) analyses. Children's cognitive abilities were measured using the results from the WISC_IV Matrix Reasoning (Wechsler, 2003), which were standardized using the age norms from the WISC-IV manual.

Table 2
Means, standard deviations, and correlations between parent-child book reading and achievement at Grade 3 (8–9 years; n = 2764).

	1	2	3	4	5	6	7	8	9	10	11	12
1 Sex												
2 Age at grade 3 test (months)	-0.11**											
3 Average min child was read to	0.03	0.01										
4 Indigenous status	-0.02	0.00	-0.03									
5 Language background other than English	-0.01	0.03	0.09**	0.04*								
6 Socioeconomic position	-0.02	0.00	0.17**	-0.13**	0.01							
7 Cognitive abilities at 8–9 years	0.02	-0.11**	0.06**	-0.02	-0.01	0.20**						
8 Grade 3 reading	0.06**	0.13**	0.20**	-0.07**	-0.01	0.34**	0.33**					
9 Grade 3 writing	0.22**	0.06**	0.07**	-0.08**	-0.08**	0.30**	0.24**	0.53**				
10 Grade 3 spelling	0.13**	0.08**	0.10**	-0.07**	-0.12**	0.29**	0.30**	0.66**	0.60**			
11 Grade 3 grammar	0.12**	0.08**	0.16**	-0.08**	-0.06**	0.35**	0.34**	0.75**	0.59**	0.72**		
12 Grade 3 numeracy	-0.08**	0.12**	0.11**	-0.06**	-0.04*	0.36**	0.42**	0.67**	0.51**	0.61**	0.66**	
Mean	NA	102.56	2.58	NA	NA	0.22	10.97	443.21	427.32	422.79	444.35	414.57
Standard Deviation		(4.34)	(1.08)			(1.08)	(2.97)	(88.76)	(61.60)	(76.38)	(91.17)	(73.27)

Note. NA, not applicable

* = P < 0.05

** = P < 0.01.

Data analyses

To answer both of the research questions, multiple regression analyses were conducted exploring the role of parent-child book reading at 1–2 years of age on the children’s NAPLAN reading, writing, spelling, grammar, and numeracy scores at Grades 3 (8–9 years) and 5 (10–11 years). For the first research question, we used the parent-child book reading variable in the original five-point scale (5 minutes, 6–10 minutes, 11–20 minutes, 21–40 minutes, and more than 40 minutes per day). For the second research question, we used the same parent-child book reading variable; however, they were dichotomized into two groups: 10 minutes or less per day and 11 minutes and more per day, following the same dichotomizing of the variable used by Farrant and Zubrick (2013). Parents who reported reading for on average fewer than 5 minutes and 6–10 minutes were grouped together into the 10 minutes or less per day group (50.6%). Likewise, parents who reported reading for on average 11–20 minutes, 21–40 minutes, and more than 40 minutes per day were combined into the 11 minutes and more per day group (49.4%).

For both sets of analyses we controlled for the effect of demographic variables, namely sex, child age, Indigenous status, language background, and socioeconomic position. We also controlled for the effect of child cognitive abilities on Grades 3 (8–9 years) and 5 (10–11 years) NAPLAN results.

Results

The means, standard deviations of parent-child book reading, covariates, academic achievement variables, and the correlations among variables are presented in Table 2 for Grade 3 (8–9 years) academic achievement and Table 3 for Grade 5 (10–11 years) academic achievement. As shown in Tables 2–3, parents reported the average number of minutes their children aged 1–2 years were read to (“On average, about how many minutes per day is your child read to at home?”). Parents reported reading to their children for fewer than 5 minutes (18.9%), 6–10 minutes (31.7%), 11–20 minutes (29.7%), 21–40 minutes (15.9%), and more than 40 minutes (3.8%) per day. The correlations indicated that parent-child book reading at 1–2 years had significant, positive and small¹ relationships with children’s academic achievement in all five subtests of NAPLAN (i.e., reading, writing, spelling, grammar, and nu-

meracy) seven years later when they were in Grade 3 (8–9 years; see Table 2) and as well as nine years later when they were in Grade 5 (10–11 years; see Table 3). The average number of minutes parents reported reading with their child was also positively correlated with socio-economic position, language background other than English, and cognitive abilities at both Grade 3 (8–9 years; see Table 2) and Grade 5 (10–11 years; see Table 3). Indigenous status was not correlated with the average minutes parents reported reading with their child at Grade 3 (8–9 years), but was negatively correlated at Grade 5 (10–11 years).

The role of parent-child book reading and children’s academic achievement

Parent-child book reading (1–2 years) positively predicted, with small effect sizes, children’s Grade 3 (8–9 years) reading ($\beta = 0.13$, $P < 0.001$), spelling ($\beta = 0.05$, $P < 0.01$), grammar ($\beta = 0.09$, $P < 0.001$), and numeracy scores ($\beta = 0.05$, $P < 0.01$), after controlling for sex, age, Indigenous status, language background, socioeconomic position, and cognitive abilities at 6–7 years (Table 4). There was no association between parent-child book reading (1–2 years) and children’s Grade 3 (8–9 years) writing scores. On average, girls had higher reading, writing, spelling, and grammar scores than boys; whereas, boys had higher numeracy scores than girls. Children who were older, who came from families with higher socioeconomic position, and who achieved higher scores in cognitive abilities at 6–7 years scored higher in all of the five subtests at Grade 3 (8–9 years). There were no significant differences in children’s Grade 3 (8–9 years) academic achievement outcomes between children who were identified as having Indigenous and non-Indigenous background. Children whose language background was identified as speaking languages other than English at home had higher writing, spelling, grammar, and numeracy scores (but not reading scores) at Grade 3 (8–9 years) than children whose main language spoken at home was English. This finding is consistent with previous research examining the relationship between multilingualism and academic outcomes for children (McLeod et al., 2016). Children who spoke language/s in addition to English, who lived in Australia, were reported to achieve better or equal academic outcomes compared with children who spoke English only (McLeod et al., 2016). These models explained 23% reading, 19% writing, 19% spelling, 24% grammar, and 28% numeracy of the children’s Grade 3 (8–9 years) scores (Table 4).

For children’s academic achievement in Grade 5 (10–11 years), parent-child book reading (1–2 years) positively predicted, with small effect sizes, children’s reading ($\beta = 0.11$, $P < 0.001$), writ-

¹ We followed the guidelines of $r = 0.1$ (small effect), $r = 0.3$ (medium effect), and $r = 0.5$ (large effect).

Table 3
Means, standard deviations, and correlations between parent-child book reading and achievement at Grade 5 (10–11 years; n = 2568).

	1	2	3	4	5	6	7	8	9	10	11	12
1 Sex												
2 Age at grade 5 test (months)	-0.10**											
3 Average min child was read to	0.03	0.03										
4 Indigenous status	-0.01	0.03	-0.06**									
5 Language background other than english	-0.01	0.03	0.11**	0.03								
6 Socioeconomic position	-0.02	0.01	0.17**	-0.12**	0.01							
7 Cognitive abilities at 8-9 years	0.05**	-0.09**	0.09**	-0.03	-0.02	0.21**						
8 Grade 5 reading	0.05*	0.08**	0.18**	-0.06**	0.00	0.34**	0.40**					
9 Grade 5 writing	0.22**	0.03	0.12**	-0.08**	-0.07**	0.27**	0.30**	0.51**				
10 Grade 5 spelling	0.13**	0.03	0.12**	-0.07**	-0.11**	0.27**	0.34**	0.62**	0.58**			
11 Grade 5 grammar	0.09**	0.03	0.15**	-0.06**	-0.05*	0.35**	0.44**	0.74**	0.54**	0.69**		
12 Grade 5 numeracy	-0.11**	0.06**	0.08**	-0.04	-0.06**	0.35**	0.48**	0.65**	0.46**	0.55**	0.67**	
Mean	NA	126.23	2.59	NA	NA	0.25	10.82	524.2	481.93	506.28	523.82	507.01
Standard deviation		3.91	1.07			0.95	2.91	78.75	63.54	71.45	82.58	70.54

NA, not applicable

* = P <0.05

** = P <0.01.

Table 4
Parent-child book reading (1–2 years) and children’s academic achievement at Grade 3 (8–9 years; n = 2764).

	Grade 3 reading	Grade 3 writing	Grade 3 spelling	Grade 3 grammar	Grade 3 numeracy
Sex	0.08***	0.23***	0.14***	0.13***	-0.07***
Age at grade 3 test	0.17***	.11***	0.13***	0.13***	0.15***
Parent-child book reading duration	0.13***	0.02	0.05**	0.09***	0.05**
Indigenous status	-0.03	-0.03	-0.03	-0.03	-0.01*
Language background other than English	-0.02	-.09***	-0.12***	-0.07***	-0.05**
Socioeconomic position	0.26***	.26***	.23***	0.28***	0.27***
Cognitive abilities at 6-7 years	0.28***	.20***	0.26***	0.29***	0.38***
n	2764	2764	2764	2764	2764
F (7,2756)	120.93***	93.84***	95.61***	126.79***	157.58***
Adjusted R ²	0.23	0.19	0.19	0.24	0.28

Note. All coefficients are standardized β

* = P <0.05

** = P <0.01

*** = P <0.001.

Table 5
Parent-child book reading (1-2 years) and children’s academic achievement at Grade 5 (10-11 years; n = 2,568).

	Grade 5 reading	Grade 5 writing	Grade 5 spelling	Grade 5 grammar	Grade 5 numeracy
Sex	0.04*	0.21***	0.13***	0.08***	-0.12***
Age at grade 5 test	0.11***	0.07**	0.06**	0.07**	0.09**
Parent-child book reading duration	0.11***	0.05**	.06***	0.08***	0.01
Indigenous status	-0.01	-0.04*	-0.02	-0.01	0.01
Language background other than English	-0.01	-0.07***	-0.11***	-0.05**	-0.06**
Socioeconomic position	0.25***	0.21***	0.20**	0.26***	0.25***
Cognitive abilities at 8-9 years	.35***	.24***	.29***	0.38***	0.44***
n	2568	2568	2568	2568	2568
F (7,2560)	124.05***	87.20***	87.09***	144.80***	158.71***
Adjusted R ²	0.25	0.19	0.19	0.28	0.32

Note. All coefficients are standardized β

* = P <0.05

** = P <0.01

*** = P <0.001

ing (β = 0.05, P < 0.01), spelling (β = 0.06, P < 0.001), and grammar (β = 0.08, P < 0.001), after controlling for sex, age, Indigenous status, language background, socioeconomic position, and cognitive abilities at 8-9 years. There was no association between parent-child book reading (1–2 years) and children’s Grade 5 (10–11 years) numeracy scores. The pattern of the relationships between the covariates and children’s Grade 5 (10–11 years) academic achievement was similar to that for Grade 3 (8-9 years) academic achievement. Specifically, girls had higher reading, writing, spelling, and grammar scores than boys, whereas boys had higher numeracy scores than girls. If children were older when they took the test, came from families with higher socioeconomic position,

and scored higher in cognitive abilities at 8–9 years, they achieved higher scores in all of the five subtests at Grade 5 (10–11 years). There were no significant differences in children’s reading, spelling, grammar, and numeracy scores between children who were identified as having Indigenous and non-Indigenous background. However, children who were identified as having Indigenous background scored lower on writing (β = -0.04, P < 0.05). Children whose language background was identified as speaking languages other than English at home had higher writing, spelling, grammar, and numeracy scores (but not reading scores) at Grade 5 (10–11 years) than children whose main language spoken at home was English. As noted above, these findings mirror previous research

Table 6
Parent-child book reading (1–2 years) and children's academic achievement at Grade 3 (8–9 years; $n = 2764$).

	Grade 3 reading	Grade 3 writing	Grade 3 spelling	Grade 3 grammar	Grade 3 numeracy
Sex	0.08***	0.23***	0.14***	0.13***	-0.07***
Age at Grade 3 test	0.17***	0.11***	0.13***	0.13***	0.15***
Parent-child book reading (10 minutes or less vs 11 minutes or more)	0.10***	0.01	0.03	0.07***	0.04*
Indigenous status	-0.03	-0.03	-0.03	-0.03*	-0.01
Language background other than English	-0.02	-0.08***	-0.12***	-0.07***	-0.05**
Socioeconomic position	0.27***	0.26***	0.23***	0.28***	.27***
Cognitive abilities at 6–7 years	0.28***	0.20***	0.26***	0.29***	0.38***
n	2764	2764	2764	2764	2764
$F(7, 2756)$	115.95***	93.81***	94.76***	124.07***	157.77***
Adjusted R^2	0.23	0.19	0.19	0.24	0.28

Note. All coefficients are standardized β

* = $P < 0.05$

** = $P < 0.01$

*** = $P < 0.001$.

Table 7
Parent-child book reading (1–2 years) and children's academic achievement at Grade 5 (10–11 years; $n = 2,0568$).

	Grade 5 reading	Grade 5 writing	Grade 5 spelling	Grade 5 grammar	Grade 5 numeracy
Sex	0.05**	0.21***	0.13***	0.08***	-0.12***
Age at grade 5 test	0.11***	0.07***	0.07***	0.07***	0.09**
Parent-child book reading (10 minutes or less vs 11 minutes or more)	0.08***	0.04*	0.04*	0.05**	0.003
Indigenous status	-0.01	-0.04*	-0.03	-0.01	0.01
Language background other than English	-0.01	-0.06***	-0.11***	-0.05**	-0.06**
Socioeconomic position	0.25***	0.22***	0.21***	0.27***	0.25***
Cognitive abilities at 8–9 years	0.35***	0.24***	0.29***	0.38***	0.44***
n	2568	2568	2568	2568	2568
$F(72560)$	120.40***	86.49***	85.61***	142.67***	176.33***
Adjusted R^2	0.25	0.19	0.19	0.28	0.32

Note. All coefficients are standardized β

* = $P < 0.05$

** = $P < 0.01$

*** = $P < 0.001$

by McLeod et al. (2016), which indicate that multilingual children perform better or equally as well as monolingual English speaking children from Australia. These models explained 25% reading, 19% writing, 19% spelling, 28% grammar, and 32% numeracy of children's Grade 5 (10–11 years) scores.

Minutes of parent-child book reading related to children's academic achievement

The second aim examined the relationship between book reading during infancy for 11 minutes or more, and 10 minutes or less, per day, on later academic achievement. Parent-child book reading (1–2 years) for on average 11 minutes or more per day was linked to children's higher Grade 3 (8–9 years) reading ($\beta = 0.10$, $P < 0.001$), grammar ($\beta = 0.07$, $P < 0.001$), and numeracy scores ($\beta = 0.04$, $P < 0.05$), compared to parent-child book reading for on average 10 minutes or less per day, after controlling for the set of covariates (Table 6). Similarly, parent-child book reading (1–2 years) for 11 minutes or more per day was linked to children's higher Grade 5 (10–11 years) reading ($\beta = 0.08$, $P < 0.001$), writing ($\beta = 0.04$, $P < 0.05$), spelling ($\beta = 0.04$, $P < 0.05$), and grammar ($\beta = 0.05$, $P < 0.01$), compared to parent-child book reading for 10 minutes or less, after controlling for the set of covariates (Table 7). The pattern of relationship between covariates and children's Grade 3 and Grade 5 academic achievement was the same as the results from the first research question. The one exception was that children who were identified as having Indigenous background scored lower on Grade 3 grammar skills ($\beta = -0.03$, $P < 0.05$).

Discussion

The present study contributed to the literature by examining the relationship between parent-child book reading during infancy (1–2 years), when neural pathways are still being established, and later academic outcomes both in mid primary school (Grade 3; 8–9 years) when children are still mastering literacy and in later primary school (Grade 5; 10–11 years) when children have mastered literacy and need to be fluent readers. Duration (number of minutes) of book reading was examined to extend previous research which reported that duration of book reading during infancy predicted vocabulary outcomes at school entry (Farrant & Zubrick, 2013).

Early vocabulary knowledge is known to predict later academic achievement and cognitive abilities (Dickinson et al., 2019; Language and Reading Research Consortium, 2015; Marchman & Fernald, 2008). While parent-child book reading is known to support vocabulary development, there are several explanations as to why this may occur. There is evidence that the attachment between the parent and child increases frequency of parent-child book reading (Bus & van Ijzendoorn, 1995). Social constructivist theorists argue that it is the parent-child interactions that strengthen language development (Bronfenbrenner, 1979; Vygotsky, 1987). Evidence in favor of parent-child interactions improving language and social communication skills during parent-child book reading also have been reported (Brown et al., 2018). This study did not control for attachment, parent-child interactions, or other indirect effects; therefore, the underlying theoretical explanation for why parent-child book reading strengthens later literacy achievement was not examined. Rather, this study explored how the duration of min-

utes spent reading during infancy impacted on later language and literacy development.

Parent-child book reading and academic outcomes in grades 3 (8–9 years) and 5 (10–11 years)

To address our first research question, the relationship between parent-child book reading during infancy and academic outcomes in primary school were examined within a relatively large sample ($n = 3547$). Consistent with our hypothesis, parent-child book reading at 1–2 years was positively associated with mid primary school (Grade 3; 8–9 years) academic outcomes, including reading, spelling, grammar, and numeracy when the children were becoming fluent readers (learning to read). The hypothesis was also congruent with the Grade 5 (10–11 years) results, with parent-child book reading during infancy (1–2 years) predicting reading, writing, spelling, and grammar when children were reading to learn. Given that mastering literacy is a salient predictor of later life outcomes (Law et al., 2009; McLaughlin et al., 2014; Schoon et al., 2002), the finding that parent-child book reading during infancy (1–2 years) is associated with later literacy success, addresses the gap in the literature on the long-term impact of parent-child book reading and literacy achievement. Setting children up for success with mastering literacy is recognized across the world and has been described as a public concern (Shoghi et al., 2013; Silverstein et al., 2002).

Interestingly, the duration of parent-child book reading during infancy (1–2 years) was not related to writing skills in Grade 3 (8–9 years). It is possible that sleeper effects (impact increases with time) were at play as writing skills in Grade 5 (10–11 years) were predicted from parent-child book reading during infancy (1–2 years). A different pattern was also observed in Grade 5 (10–11 years), with duration of book reading during infancy (1–2 years), no longer predicting numeracy outcomes, even though duration of book reading did predict numeracy outcomes in Grade 3 (8–9 years). It is possible that the numeracy skills that are learned in mid primary are more concept focused, requiring an understanding of language (such as addition, subtraction, multiplication) and the numeracy skills learned in later primary more numerically focused (such as geometry), requiring less of an understanding of language concepts.

A different pattern of results was also observed when comparing the findings from the present study with the Shahaieian et al. (2018) study. While the present study investigated the duration (number of minutes) of book reading with infants aged 1–2 years and academic outcomes in Grades 3 (8–9 years) and 5 (10–11 years), the Shahaieian et al. (2018) study explored the frequency (how often) of parent-child book reading with children aged 2–3 years and academic outcomes in Grade 3 (8–9 years). Frequency of book reading with children aged 2–3 years positively predicted reading, writing, grammar, and numeracy skills in Grade 3 (8–9 years); frequency of book reading was also linked to better spelling through better early academic skills. It is possible that different book reading variables (e.g., duration, frequency, turn taking) impact on different academic skills differently and at different ages. It is important to note that the children in the Shahaieian et al. (2018) study were older than the children in the present study in addition to different book reading variables being examined. Regardless of the differing patterns, the present study consistently predicted literacy, spelling, and grammar outcomes at both Grades 3 (8–9 years) and 5 (10–11 years). This is an important finding as literacy success is thought to support overall academic achievement, positively predicting later life outcomes (Law et al., 2009; McLaughlin et al., 2014; Schoon et al., 2002).

Duration (Number of minutes) of parent-child book reading and academic outcomes in grades 3 (8–9 years) and 5 (10–11y)

The second question addressed in the present study aimed to build upon previous research reporting that parent-child book reading during infancy for 11 minutes or more per day predicted higher vocabulary outcomes at school entry compared with parent-child book reading for 10 minutes or less (Farrant & Zubrick, 2013). It was hypothesized that parent-child reading for 11 minutes or more per day, during infancy (1–2 years), would predict higher academic outcomes in Grades 3 (8–9 years) and 5 (10–11 years) compared with reading for 10 minutes or less per day. In line with our hypothesis and previous research, reading for 11 minutes or more per day was associated with higher academic outcomes for reading, grammar, and numeracy in Grade 3 (8–9 years) and reading, writing, spelling, and grammar in Grade 5 (10–11 years), even after controlling for demographics, especially socioeconomic position and cognitive abilities that have been consistently shown as predictors of children's academic achievement (Justice et al., 2005; Law et al., 2009; McLaughlin et al., 2014; Schoon et al., 2002). Thus, duration (number of minutes) of parent-child book reading during infancy is associated with later academic success. Understanding which parent-child book reading variables during infancy support later academic achievement and specifically literacy success is necessary in order to ensure education programs equip parents with evidence-based information to support later language and literacy outcomes. The finding that parent-child book reading for 11 minutes or more per day is correlated with stronger academic outcomes including literacy scores up to nine years later provides practical and specific information that may empower parents and encourage them to read for 11 minutes or more per day. Educators, policy makers, health promotion organizations, and clinicians can use this evidence to support parents to engage in book reading for 11 minutes or more per day.

Limitations

The present study had a relatively large sample size; however, the participants from the eligible sample were more likely to have a higher socio-economic position (medium effect size), speak English as their primary language (small effect size), and were less likely to have an Indigenous background (small effect size). Even though the eligible sample mirrors samples found in previous research (Farrant & Zubrick, 2013; Shahaieian et al., 2018) these findings should be interpreted in light of this limitation.

Limitations about the measure of parent-child book reading also need to be acknowledged. First, the duration of parent-child book reading was measured using a five-point scale which reduced the variability in the information collected. Second, while parent report about parent-child book reading has been used in previous research studies (Brown et al., 2017; Farrant & Zubrick, 2013; Murray & Egan, 2014; Shahaieian et al., 2018; Williams et al., 2015), it is possible that the parents may have shaped their responses to what is considered socially desirable, which could bias the results. Using more objective measures such as video recorded interactions of parent-child book reading may reduce bias, provide more detailed information, and may allow for examination of other variables of parent-child book reading such as the quality of parent-child interactions and exploration for the interactions between quality and duration of parent-child book reading. It is possible that high quality parent-child book reading (e.g., Brown et al., 2018) may buffer the negative effect associated with short duration of reading.

The positive effect of parent-child book reading may be a proxy of a broader constellation of factors such as parent involvement and engagement, parent-child relationships, parental values and aspirations, and family support, and other indirect effects, that

were not controlled for in the present study. In particular, this study did not control for attachment because these data were not available in the LSAC data set. The present study did control for socioeconomic position that is a combination of maternal and paternal education, occupation, and family income. Socioeconomic status has been shown to be consistently linked to a range of child outcomes (Letourneau et al., 2013). Nonetheless, the results should not be viewed as indicating causality. Future research and intervention efforts are encouraged to integrate multiple individual and family factors.

The relationships between parent-child book reading during infancy and children's academic achievement had small effect sizes. Similar effect sizes were found in previous large scale longitudinal studies (Shahaeian et al., 2018; William et al., 2015) and indicated that other factors could be taken into account.

Future research

It has previously been argued that the link between parent-child book reading during infancy and later literacy achievement is weak (Demir et al., 2011). The findings from the present study provide evidence from a relatively large sample that parent-child book reading at 1–2 years is related to later literacy achievement. Further research is now needed to document the mechanisms by which early reading impacts later language and literacy, and to examine how best to support parents with infants to engage in parent-child book reading for 11 minutes or more per day. This may involve empowering parents with the knowledge of the long-term impact of parent-child book reading during infancy on later success with literacy through various channels (e.g., educational programs). Subsequent research using qualitative methods could identify effective channels and empowerment strategies for parents, grandparents, and others who can support book reading during infancy.

The present study focused on one parent-child book reading variable, namely duration (number of minutes parents read with their infant per day). While this study provides evidence from a relatively large sample about the average number of minutes per day parents report reading with their infant at 1–2 years, further research is needed to understand whether duration of parent-child book reading changes given the age of the child; specifically, how the duration of parent-child book reading needs to change as children grow older. While duration of parent-child book reading is an important variable, other reading variables may also impact children's long term academic outcomes including: Further examination of other parent-child book reading variables (e.g., quality of parent-child interactions, attachment, the type of books read, reading environment, self-regulation and executive function) may broaden knowledge regarding how to support children's literacy development and ensure that the information provided to parents is evidence based. It is possible that the benefits of parent-child book reading during infancy may be accumulative and not easily untangled (Hindman et al., 2008; Law et al., 2018). For example, some variables (such as parent-child eye-contact) may initially support early language development rather than emergent literacy development; however, stronger early language skills in general may support the overall development of literacy, particularly comprehension skills, once decoding is mastered. Pathways of success to later academic outcomes could include the cumulative effect of early book reading, attachment, self-regulation, executive function, and cognition, that may offer further insight into the complex relationship between parent-child book reading and later academic outcomes. This deserves further consideration given the interplay between cognition and in particular, executive function, and language abilities (Kaushanskaya et al., (2017).

Conclusion

Based on a nationally representative sample of 3547 children aged 1–2 years, parent-child book reading for 11 minutes a day positively predicted long-term academic outcomes, specifically reading, spelling, grammar and numeracy in Grades 3 (8–9 years) and reading, spelling, grammar and writing outcomes in Grade 5 (10–11 years). Book reading during infancy (1–2 years) is related to later academic outcomes and literacy success not only when children are learning to read, but also when children are reading to learn.

Author Contributions

All authors were actively involved in each step of this manuscript resubmission as with the initial submission. Author order was agreed upon at the conceptualization stage.

Conflict of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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