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Citation

Boerma, I. E., Mol, S. E., & Jolles, J. (2017). The Role of Home Literacy Environment, Mentalizing, Expressive Verbal Ability, and Print Exposure in Third and Fourth Graders' Reading Comprehension. *Scientific Studies Of Reading*, 21(3), 179-193. Retrieved from <https://hdl.handle.net/1887/58049>

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Note: To cite this publication please use the final published version (if applicable).



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To cite this article: Inouk E. Boerma, Suzanne E. Mol & Jelle Jolles (2017) The Role of Home Literacy Environment, Mentalizing, Expressive Verbal Ability, and Print Exposure in Third and Fourth Graders' Reading Comprehension, *Scientific Studies of Reading*, 21:3, 179-193, DOI: [10.1080/10888438.2016.1277727](https://doi.org/10.1080/10888438.2016.1277727)

To link to this article: <https://doi.org/10.1080/10888438.2016.1277727>



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Published online: 25 Jan 2017.



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The Role of Home Literacy Environment, Mentalizing, Expressive Verbal Ability, and Print Exposure in Third and Fourth Graders' Reading Comprehension

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ABSTRACT

Children with a rich home literacy environment generally show better reading comprehension. For children in the higher grades of primary school, this relation is thought to be indirect. We propose a model in which this relation ran via children's higher order language and cognitive skills (i.e., expressive verbal ability and mentalizing ability) and via print exposure. In our correlational study with 117 children ages 8–11, we found both a direct relation between children's home literacy environment and reading comprehension and 2 indirect relations: via children's print exposure and via mentalizing abilities. There was no significant indirect relation via expressive verbal abilities. Our findings imply that enhancing children's mentalizing abilities and encouraging them to read books might contribute to their reading comprehension. In addition, parental involvement in children's reading activities can contribute to their reading performance, both directly and indirectly, even in this age group.

The relation between children's home literacy environment, reading behavior, and reading comprehension has been well established in previous studies. For example, a meta-analysis showed that primary school children who read frequently during their leisure time perform better on a variety of language and reading tasks (Mol & Bus, 2011). Furthermore, an international comparative study showed that fourth graders' reading comprehension was predicted by their home literacy environment, consisting of a variety of parental attitudes, literacy resources, and home activities related to reading (Park, 2008). In the current study, parental print exposure and the availability of reading materials at home are examined as indicators of children's home literacy environment.

Print exposure is considered a proxy of reading volume (Mol & Bus, 2011; Stanovich, 2000; Stanovich & West, 1989). It has been shown to be related to actual leisure-time reading behavior (Allen, Cipielewski, & Stanovich, 1992; Rain & Mar, 2014; West, Stanovich, & Mitchell, 1993). More specifically, parents with more knowledge of books are expected to read more. Parents' print exposure is further considered an important aspect of children's home literacy environment. Home literacy environment is also thought to be reflected in the amount of books at home, which can be considered an indication of parents' reading attitude and reading behavior (e.g., Katzir, Lesaux, & Kim, 2009). In addition, the availability of many books at home provides more opportunities to engage in literacy activities with the child, such as shared reading (e.g., Burgess, Hecht, & Lonigan, 2002; Bus, Van IJzendoorn, & Pellegrini, 1995; De Jong & Leseman, 2001; Evans, Kelley, & Sikora, 2014; Katzir et al., 2009; Leseman & De Jong, 1998; Scarborough & Dobrich, 1994; Tichnor-Wagner, Garwood, Bratsch-Hines, &

Vernon-Feagans, 2015). Finally, research shows that parents who read and have plenty of books at home are more likely to have children who read for pleasure (e.g., Gonzalez-DeHass, Willems, & Doan Holbein, 2005; Mol & Bus, 2011).

Most studies of children's home literacy environment have focused on the early school years (e.g., preschool, kindergarten, first grade), and these studies have generally found positive relations with children's early literacy skills (e.g., Burgess et al., 2002; Bus et al., 1995; Scarborough & Dobrich, 1994; Tichnor-Wagner et al., 2015; Van Steensel, 2006). A few longitudinal studies have followed young children into primary school, and these studies have shown that the direct effect of a rich home literacy environment before first grade on children's later reading comprehension decreases or even disappears in the higher grades of primary school (Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001; Bus et al., 1995; Katzir et al., 2009). Instead, the relation seems to be an indirect one (e.g., De Jong & Leseman, 2001; Sénéchal, 2006; Sénéchal, Ouellette, & Rodney, 2006; Snow, 1999). Perhaps for children beyond the early stages of reading development, higher order level language and cognitive skills become more important in predicting their reading comprehension, as well as their reading behavior or print exposure. In the current study, we examine the relations between third graders' and fourth graders' home literacy environment and their reading comprehension by taking (a) children's higher order language and cognitive skills and (b) their own print exposure into account.

Reading comprehension

To understand a text, readers are required to create a mental model or situation model of the story, which is a representation of what the text is about (Glenberg & Langston, 1992). Readers are thought to construct a representation on three levels: (a) the surface level of the text, that is, the exact words, phrases, and syntactic structures; (b) the text-base level, which contains the semantic content of the text; and (c) the situational nonverbal representation of what is described by the text, that is, the situation or mental model (Kintsch, 1988; Schnotz, 2002; Zwaan & Radvansky, 1998). This mental model is based on the events described in the story, combined with the reader's prior knowledge, and is gradually updated and enriched while reading (Kintsch, 1988; Schnotz, 2002; Zwaan & Singer, 2003). It is thought that lower order language skills, such as vocabulary and syntactic knowledge, contribute especially to reading comprehension on the surface and text-base level. As such, these lower order language skills contribute to the creation of the mental model, but they are not sufficient. Readers also need to be able to connect different text parts and integrate this information with their background knowledge, which requires higher order language and cognitive skills (Cain, Oakhill, & Bryant, 2004; Kim, 2015). In the present study, the role of two higher order skills—expressive verbal ability and mentalizing skills—in children's reading comprehension is examined.

Higher order skills: Expressive verbal ability and mentalizing

Previous studies have argued that for children beyond the early stages of reading development, an indirect relation between home literacy environment and reading comprehension can be found that runs via oral language development (e.g., De Jong & Leseman, 2001; Sénéchal, 2006; Sénéchal et al., 2006; Snow, 1999). These studies indicated in particular that children's shared book reading experiences at home, and the quality of their parents' speech when talking about these stories (including inferencing, predicting, and making connections to world knowledge), supported children's oral language development (such as vocabulary and listening comprehension) during preschool or kindergarten. Early oral language development was in turn directly related to reading comprehension in Grades 3 and 4 (De Jong & Leseman, 2001; Sénéchal & LeFevre, 2002; Sénéchal, LeFevre, Thomas, & Daley, 1998; Sénéchal et al., 2006; Snow, 1991, 1999). The contribution of oral language skills to children's reading comprehension was found to increase as children get older,

whereas the contribution of decoding skills diminishes as children become better readers (Kendeou, Van den Broek, White, & Lynch, 2009).

An oral language skill that has received much attention in reading comprehension research is children's vocabulary. For example, the vocabulary of children in kindergarten was found to be a significant and unique predictor of their reading comprehension in Grade 4 (Sénéchal & LeFevre, 2002; Sénéchal et al., 2006). However, these studies measured only receptive vocabulary, whereas other studies have found that expressive vocabulary and depth of vocabulary knowledge can be even stronger predictors of reading comprehension (e.g., Ouellette, 2006; Scarborough, 2001). The wide variety of oral language skills also refers to skills beyond the semantic level. For example, narrative skills such as storytelling have been shown to be related to reading comprehension as well (Berninger & Abbott, 2010; Kim, Park, & Park, 2015). In the present study, we have included a measure that takes both children's expressive vocabulary and their narrative skills into account. We refer to this higher order *language* skill as "expressive verbal ability" throughout this article.

A higher order *cognitive* skill that is thought to be related to reading comprehension is children's mentalizing ability or theory of mind. Mentalizing can be defined as the ability to infer other people's mental state (e.g., needs, desires, feelings, beliefs, goals, purposes, and reasons) and to use this information to predict and explain their behavior (Fletcher et al., 1995; Fonagy, 2006; Frith, Morton, & Leslie, 1991; Mar, Oatley, Hirsh, dela Paz, & Peterson, 2006). Mentalizing ability contributes also to reading comprehension of narratives, because mentalizing can help improving a reader's situation model of a story. Narratives require readers to use their mentalizing ability to make inferences about the characters' mental states and to infer and understand the complex social relations that are often present in narratives, which will lead to an enriched mental model (Kim, 2015; Mar & Oatley, 2008; Mar et al., 2006; White, Hill, Happé, & Frith, 2009). It is thought that there is a bidirectional relation between mentalizing and oral language development and that the development of language and cognition can influence and promote each other (De Villiers, 2007; Milligan, Astington, & Dack, 2007). The concept of mentalizing ability seems to be closely related to pragmatic language skills, which are needed to use language in an appropriate way in different social contexts, and to talk about absent and distant people, objects, and places, that is, so-called decontextualized language (Astington & Jenkins, 1999; Norbury & Bishop, 2002; Russell & Grizzle, 2008; Snow, 1991, 1999; Willems & Varley, 2010).

Children's mentalizing abilities seem to be rooted in the early stimulation they receive at home. Parents can contribute to the development of children's mentalizing abilities during shared book reading interactions by using mental state language. For example, they can refer to the characters' thoughts and emotions and talk about these with their children (Adrian, Clemente, & Villanueva, 2007; Adrian, Clemente, Villanueva, & Rieffe, 2005; Ensor, Devine, Marks, & Hughes, 2014; Symons, Peterson, Slaughter, Roche, & Doyle, 2005). From the age of 2, children appear to be capable of understanding other people's mental states (wanting, intending, knowing, pretending, and believing), and by the age of 6 most normally developing children are able to correctly use their mentalizing skills (Frith & Frith, 2003). Most studies on the relation between home literacy environment and mentalizing have focused on preschoolers, not on primary school children. However, individual differences in mentalizing ability persist even in adulthood (Lecce, Bianco, Devine, Hughes, & Banerjee, 2014; Liddle & Nettle, 2006). For example, adults' mentalizing skills were related to the size of an individual's inner circle of friends (Stiller & Dunbar, 2007), and 10- and 11-year-olds' mentalizing skills were positively related to teacher ratings of the child's social competence (Liddle & Nettle, 2006).

Unfortunately, mentalizing tests often suffer from ceiling effects when used with typically developing children. Recently, an advanced mentalizing task—the Strange Stories Test (SST)—has been used in samples of typically developing primary school children and was found to be a valid test to assess these children's mentalizing ability (Devine & Hughes, 2013; Lecce, Zocchi, Pagnin, Palladino, & Taumoepeau, 2010; White et al., 2009). Another advantage of this test is

that the stories can be presented aurally to children so that their reading abilities will not interfere with their performance. In the current study with third and fourth graders we therefore use this advanced test to assess their mentalizing ability.

Primary school children's own print exposure

The role of the home literacy environment remains important in stimulating older children's reading habits. For example, reading routines that parents engage in with their young children can enhance children's reading behavior and interest even through adolescence (e.g., Strommen & Mates, 2004). However, as children get older and are able to read themselves, their individual print exposure contributes to their reading comprehension as well (Mol & Bus, 2011). Therefore, in this study the role of children's own exposure to narratives in relation to reading comprehension, mentalizing, and expressive verbal ability is also examined.

Previous studies indicate that there is a positive relation between children's print exposure and their language and reading performance: Children who read more during their leisure time were found to perform better on a variety of language and reading tasks, such as reading comprehension and oral language (e.g., Mol & Bus, 2011; Schiefele, Schaffner, Möller, & Wigfield, 2012). Reading behavior has also been found to relate to mentalizing. For example, readers of fiction had higher empathy and theory-of-mind scores than readers who often read nonfiction (Mar et al., 2006; Mar, Oatley, & Peterson, 2009). Likewise, reading literary works in particular was found to lead to increased performance on tests of theory of mind (Kidd & Castano, 2013). This can be explained by the nature of fictional narratives, which are built around relationships and interactions between people. Fictional narratives mirror our actual social environments and offer readers an opportunity to practice and expand their social and empathic skills in a safe way, thereby preparing them for real-life interactions (Barnes & Bloom, 2014; Djikic, Oatley, & Moldoveanu, 2013; Dodell-Feder, Lincoln, Coulson, & Hooker, 2013; Mar & Oatley, 2008; Mar et al., 2006; Mason & Just, 2009).

This study

Whereas a direct relation has been shown between young children's home literacy environment and their reading skills, it is thought that for children in the higher grades of primary school this relation is indirect, running via higher order skills (e.g., De Jong & Leseman, 2001; Sénéchal, 2006; Sénéchal et al., 2006; Snow, 1999). In this concurrent correlational study, the relation between children's home literacy environment and reading comprehension is examined for a sample of third and fourth graders. We propose a model with both a direct path between home literacy environment and reading comprehension and paths that run via two higher order skills, that is, mentalizing and expressive verbal ability (see Figure 1). In other words, we hypothesized that home literacy environment, mentalizing ability, and expressive verbal ability would all predict reading comprehension. Furthermore, we expected that home literacy environment would directly predict children's mentalizing ability and expressive verbal ability and that the relation between home literacy environment and reading comprehension is mediated by these two higher order skills. In addition, children's print exposure was included in the model. Our participants have passed the early stages of reading, and therefore their print exposure might be related to the development of their mentalizing and expressive verbal ability and their reading comprehension. We hypothesized to find both a direct relation between children's own print exposure and reading comprehension and an indirect relation between home literacy environment and reading comprehension via children's print exposure.

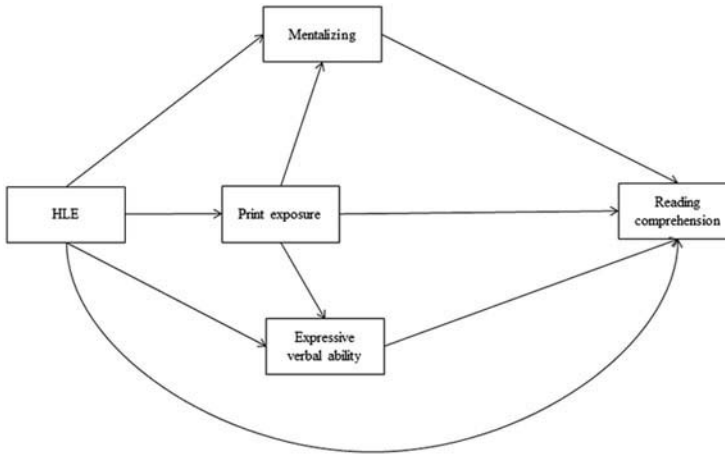


Figure 1. Hypothesized full model. *Note.* Sex, age, and school are included as covariates. HLE = home literacy environment.

Method

Participants

Our sample consisted of 117 primary school students (58 girls) from the Netherlands: 79 third graders (67.5%; 44 girls) and 38 fourth graders (32.5%; 14 girls). Their mean age was 9.45 years ($SD = .67$; range = 8.2–11.4 years). Children in Grades 3 and 4 have passed the early stages of learning to read and are expected to be able to read independently. Analyses of each grade separately showed the same pattern of relations among our variables of interest for children in both grades. Therefore, we have not differentiated between Grade 3 and 4, yet we have included age as a control variable.

Participants were recruited at two primary schools in Amsterdam (27.4%) and five primary schools in the south of the Netherlands, all of which can be considered mainstream schools. The majority of families spoke Dutch and/or a Dutch dialect as their first language (91.8%). Parents gave active consent to their child's participation. In our sample, 54.7% of the children came from a highly educated family (degree at university or higher vocational level), and 43.6% came from a family with lower or intermediate (degree at intermediate vocational or higher secondary level) educational degree (1.7% missing values).

Procedure

The data were collected in two phases. First, a parental questionnaire, which included a print exposure checklist and some questions on demographics, was sent out to three classes that were selected from the participating primary schools. Children whose parents responded positively to both the questionnaire and the consent form were then tested in two individual sessions of approximately 20–30 minutes by the first author. Second, the study was extended to the other schools, where parents of children from third to sixth grade were asked to complete the parent questionnaire. For the individual test sessions, we then selected those children from the third and fourth grades who were comparable in sex and parental education to the children in the first phase. These children were tested by an experienced and trained research assistant.

During the first individual test session, the children completed the Book Cover Recognition Test (BCRT). During the second session, the children participated in the mentalizing test and the test for expressive verbal abilities. Because we had tested two twin pairs in our sample, we randomly excluded one child per twin pair so that all parental data have been included only once in our analyses.

Instruments

Instruments for parents

Home literacy environment. This composite score consisted of three aspects that tap into children's home literacy environment, that is, parental print exposure, parents' estimation of the amount of their own books at home, and parents' estimation of the amount of children's books at home. The three scales were all moderately to strongly correlated ($.51 \leq r_s \leq .71$, $ps < .001$; Cronbach's $\alpha = .84$). The home literacy environment score was created by taking the mean of the z scores of the three variables, which are explained next in more detail.

Author recognition test. Parental print exposure was assessed by means of the Author Recognition Test (ART). The ART consisted of 60 names: 40 real author names and 20 foils. Parents were asked to tick those names that they recognized as an author name (in line with Stanovich & West, 1989). All of the authors in the ART had written a book listed in the weekly or yearly book chart in the Netherlands in the 2 years prior to the study. Care was taken to include both Dutch and foreign writers and to include different narrative genres, such as literary fiction, thriller, and chick lit. Only authors of fiction were included. The fake names were selected from the editorial board of an international psychology journal and a Dutch monthly journal.

For each participant the number of correctly checked names (i.e., real authors) was counted ($M = 10.86$, range = 0–37), as well as the number of incorrectly checked names (i.e., foils; $M = .24$, range = 0–3). Proportion scores were created for both real author names and foils. The final ART score was calculated by subtracting the proportion of incorrectly checked names from the proportion of correctly identified names. The mean score was .26 ($SD = .23$), and the range of scores in our sample showed a normal distribution.

Number of (children's) books at home. Parents were asked to estimate the number of books they owned (excluding children's books, newspapers, and magazines), as well as how many children's books they had at home, which are assumed to be indicators of their "physical" home literacy environment. These questions were multiple-choice questions with six answer possibilities for the number of their own books (0–10, 11–25, 26–100, 101–200, 201–500, and more than 500 books), and five for the number of children's books (0–10, 11–25, 26–50, 51–100, and more than 100 books). These questions were taken from the parental questionnaire of the international PIRLS study on reading (IEA, 2005). For the number of the parents' own books, we added an extra answer possibility of more than 500 books. On average, parents scored 3.41 ($SD = 1.57$) for number of their own books, which indicates they owned between 26 and 200 books. For number of children's books, the mean score was 3.30 ($SD = 1.13$), which means that they owned between 26 and 100 children's books on average.

Instruments for children

Book cover recognition test. We used the BCRT, a print exposure list, as a proxy for children's reading frequency or reading behavior (Davidse, De Jong, Bus, Huijbregts, & Swaab, 2011; Sénéchal, LeFevre, Hudson, & Lawson, 1996). The book covers, including book titles, were shown to the children one by one on a computer screen. For each book, the children were asked whether they recognized it, and whether they had read the book themselves or whether someone had read the book aloud to them. Furthermore, the item was also checked as "recognized" when children did not know any details about the story line yet indicated that they had seen the book in the library or heard about the book from a friend. This procedure is analogous to the ART.

The BCRT in our study consisted of 40 titles. Only narratives were included in the list. Thirty-three of these titles were selected based on either top 10 sales charts from the 3 years prior to the study or favorite book titles among third and fourth graders in a recent Dutch study (La Roi, 2010) and the nominations and tips for a yearly children's book prize that is awarded by children

(“Kinderjury,” a children’s book panel). The seven remaining titles were based on the nominations for a yearly literary children’s book award by a professional book panel. These books are generally less known among children.

One point was assigned if children recognized the book, so that a maximum score of 40 could be obtained. The BCRT score was calculated by adding up all the points for each child. The mean score in our sample was 14.67 ($SD = 3.97$), and the range of scores in our sample showed a normal distribution. Three books in our test were not recognized by any of the children. A reliability analysis showed a Cronbach’s alpha of .70 (based on 37 items).

Strange stories test. To assess children’s mentalizing skills, the eight mental state stories from the SST (White et al., 2009) were used. This test consists of eight vignettes (about 90 words on average per story) that were read to the children. They all involved some kind of mental state, for example, a lie, double bluff or a white lie. After the story was read to the children, they were asked an open question about the story characters’ behavior. To be able to explain the behavior, a correct interpretation of their mental states was required (see the appendix for an example).

In our study, we translated the mental state stories of the SST to Dutch. The stories were voice recorded and played to the children from a computer. After each story, the children were required to respond orally to the question. This was voice recorded, and the children’s answers were written out and scored according to the instructions of White and colleagues (2009). A maximum of 2 points per story could be obtained, so the maximum score was 16. In general, 1 point was assigned when children referred only to the outcome of the story or some factual information. Children were given 2 points if they showed understanding of the characters’ mental states. Children’s total scores ranged between 1 and 16, with a mean score of 9.98 ($SD = 2.85$). Cronbach’s alpha of the SST was .60.

Standard reading comprehension test. To measure children’s reading comprehension we used standard reading test scores (Cito-tests; Weekers, Groenen, Kleintjes, & Feenstra, 2011). These tests are administered annually at almost every school in the Netherlands (in January or February), including at the schools participating in this study. The test consists of a booklet with a number of texts that children read and answer comprehension questions about. The test is administered in two parts to the children, and each part contains 25 multiple-choice questions. The test contains mainly narrative texts and a few expository texts. Raw scores on these tests are converted by a computer program to ability scores and norm-referenced scores, which allows for comparison between schools and between grades. We used the standard reading comprehension test that the children took in Grade 3 as our indication of standard reading comprehension. These test scores were made available to us by the schools. A mean score of 28.44 was obtained ($SD = 13.87$, range = -5 to 70). This mean score is comparable to the national mean ability score of 25. The standard reading comprehension test has been found to be a reliable and valid measure of reading comprehension by the Dutch committee (COTAN) that is in charge of testing the psychometric quality of psycho diagnostic instruments in the Netherlands.

RAKIT. Children’s expressive verbal abilities were measured using a subtest of the RAKIT (Revised Amsterdam Children’s Intelligence Test; Bleichrodt, Drenth, Zaal, & Resing, 1984). The RAKIT is an intelligence test for children ages 4 to 11, consisting of 12 subtests. It is widely used in the Netherlands, as the Dutch test evaluation committee (COTAN) has rated the reliability and criterion validity as “good” and the construct validity as “sufficient.” Subtest 12 consists of two pictures (a lawn or garden and a living room) in which a story plot can be seen. The children are asked to (a) name as many words that they see in the picture, which can be considered a measure of verbal fluency (Dek & Kooij, 2012), and (b) describe the story that is being displayed in the picture, which gives an indication of children’s narrative production abilities. The children’s score is composed of both quantitative measures (e.g., number of

named objects and number of relations between objects or characters) and qualitative measures (i.e., the story plot; Te Nijenhuis, Tolboom, Resing, & Bleichrodt, 2004), according to this formula: (number of named objects /2) + number of relations + bonus relations + story plot. The bonus score for number of relations is maximally 16 for children in this age group and depends on the number of correctly mentioned relations between objects or characters. The maximum score possible for story plot is 12. This subtest is thought to measure naming facility and ideational fluency, sequential reasoning, and communication ability (Te Nijenhuis et al., 2004).

The mean score for the first picture was 34.68 ($SD = 8.72$, range = 12–57), and the mean score for the second picture was 33.59 ($SD = 8.00$, range = 11–52). A sum score of expressive verbal ability was obtained for each child ($M = 68.27$, $SD = 14.19$, range = 23–105).

Statistical analyses

We performed path analyses using AMOS to examine whether our hypothesized model (see Figure 1) fitted the data and to further explore the direct and indirect relations between home literacy environment, reading behavior, and higher order skills on children's reading comprehension. The overall model fit was assessed by chi-square, root mean square error of approximation (RMSEA), and comparative fit index (CFI). A nonsignificant chi-square, $RMSEA < .05$, and $CFI > .95$ together indicate a strong fit of the data with the model (Hu & Bentler, 1999; Kline, 2005).

Results

Descriptive statistics

In Table 1 the means, standard deviations, and correlations are shown for each measure. We found significant correlations between all our variables of interest, except between children's expressive verbal ability and print exposure ($r = .15$, $p = .105$) and between expressive verbal ability and mentalizing ability ($r = .18$, $p = .056$).

In subsequent analyses sex, age, and school were included as covariates. An independent samples t test showed that girls scored higher than boys on the print exposure list (BCRT), $t(107.88) = -3.53$, $p = .001$, but not on our other variables of interest. No significant differences on these variables were found between third and fourth graders. Children in Grade 3 and 4 differed only in age, $t(115) = -11.65$, $p < .001$, because the fourth graders were obviously older ($M = 10.16$) than the third graders ($M = 9.11$). School was included as a final covariate. One-way analyses of variance showed differences between schools on all our variables of interest: home literacy environment, $F(6, 110) = 6.47$, $p < .001$; BCRT, $F(6, 110) = 8.87$, $p < .001$; SST, $F(6, 110) = 2.97$, $p = .010$; RAKIT, $F(6, 110) = 2.98$, $p = .010$; reading comprehension, $F(6, 110) = 3.72$, $p = .002$.

Path analyses

First, the full model including direct and indirect effects, and covariates (see Figure 1) was tested. The fit indices indicated a good model fit, $\chi^2(1) = .53$, $p = .465$, $CFI = 1$, $RMSEA < .001$. Three paths were not statistically significant: BCRT—RAKIT ($\beta = -.04$, $p = .701$), BCRT—SST ($\beta = .12$, $p = .243$),

Table 1. Descriptive statistics and correlations for the variables of interest.

	<i>M</i>	<i>SD</i>	1	2	3	4	5
Home literacy environment	-.02	.86	—				
Print exposure (BCRT)	14.67	3.97	.35**	—			
Mentalizing ability (SST)	9.98	2.85	.26**	.30**	—		
Expressive verbal ability (RAKIT)	68.27	14.19	.26**	.15	.18	—	
Reading comprehension (standard reading comprehension test)	28.44	13.87	.37**	.34**	.29**	.24*	—

Note. BCRT = Book Cover Recognition Test; SST = Strange Stories Test; RAKIT = Revised Amsterdam Children's Intelligence Test.
* $p < .05$. ** $p < .01$.

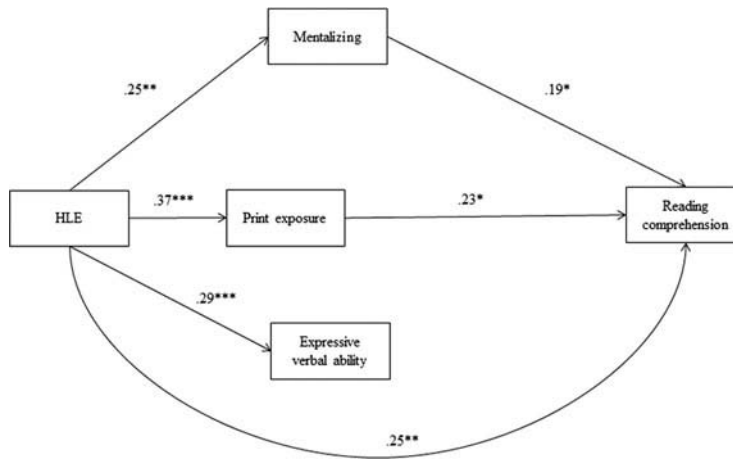


Figure 2. Final model, including the standardized estimates of the variables predicting children's reading comprehension. Note. Sex, age, and school are included as covariates. HLE = home literacy environment. * $p < .05$. ** $p < .01$. *** $p \leq .001$.

and RAKIT—reading comprehension ($\beta = .13$, $p = .12$). For reasons of parsimony, we removed these paths one by one from the full model, starting from the path with the smallest standardized loading. For all these paths $\Delta\chi^2$ were nonsignificant, indicating that there was no deterioration in model fit.

The final model fitted the data well, $\chi^2(4) = 4.41$, $p = .353$, CFI = .996, RMSEA = .03, explaining 22% of variance in reading comprehension ($R^2 = .22$). The final model is shown in Figure 2. It is shown that for children in this age group home literacy environment both directly and indirectly predicts their reading comprehension. The indirect effects run via mentalizing ability and print exposure but not via expressive verbal ability.

Discussion

The present study showed that variance in primary school children's reading comprehension can be explained by differences in children's current home literacy environment, print exposure, and mentalizing ability. An indirect path was found between children's home literacy environment and their reading comprehension via print exposure and via mentalizing abilities, a higher order cognitive skill. Unexpectedly, this was not the case for the higher order language skill that we examined, that is, expressive verbal ability. Our findings are important, as they are aligned with two lines of evidence that have been regarded as conflicting until now. First, support is given to earlier studies that have found relations between home literacy environment and reading behavior, on one hand, and reading comprehension, on the other hand (e.g., Burgess et al., 2002; Bus et al., 1995; Mol & Bus, 2011; Scarborough & Dobrich, 1994; Tichnor-Wagner et al., 2015; Van Steensel, 2006). Second, our findings also support studies that claimed that the relations between home literacy environment and reading comprehension are mediated by other variables (e.g., De Jong & Leseman, 2001; Sénéchal, 2006; Sénéchal et al., 2006; Snow, 1999).

We hypothesized that children's reading comprehension would be related to their home literacy environment, mentalizing abilities, expressive verbal abilities, and print exposure. Furthermore, home literacy environment was expected to directly relate to mentalizing abilities, expressive verbal abilities, and print exposure. Bivariate correlations indeed showed these relations. When all relations were tested simultaneously in one model, however, expressive verbal ability (i.e., including expressive vocabulary and narrative productive skills) was no longer related to reading comprehension. Hence, children's home literacy environment, mentalizing

abilities, and print exposure appeared to be stronger predictors of third and fourth graders' reading comprehension than expressive verbal ability.

These results suggest an important role of mentalizing over and above expressive verbal ability in explaining primary school children's reading comprehension. Perhaps as children get into the higher grades of primary school they are presented with more difficult texts that require complex inferencing skills about mental states and social relationships. To understand these texts, children might need more than sufficient expressive vocabulary and narrative skills and may benefit more from well-developed mentalizing skills (Norbury & Nation, 2011). When readers use their mentalizing abilities to imagine what the characters might be feeling or thinking, this improves their mental model of the story and contributes to their reading comprehension (Boerma, Mol, & Jolles, 2016; Bell, 1991; De Koning & Van Der Schoot, 2013; Snow, 2002).

In the current study, mentalizing and expressive verbal ability were not significantly correlated. This result is in line with a previous study with 10- to 11-year-olds that found no clear pattern of significant associations between mental state words and vocabulary (Lecce et al., 2010). Perhaps this is related to the age of the children in both our study, and in the study by Lecce and colleagues, for it has been shown that the relations between oral language and mentalizing are strong for preschoolers but decrease for children in the higher grades of primary school (e.g., Astington & Jenkins, 1995; Ruffman, 2014) and even seem to disappear for adolescents (O'Connor & Hirsch, 1999). For children in Grades 3 and 4, individual differences in expressive verbal ability may not capture enough variance to contribute to individual differences in reading comprehension scores anymore. Furthermore, some previous studies have questioned whether mentalizing can be considered a separate construct by suggesting that this construct is heavily confounded with reading and language abilities, such as listening comprehension, vocabulary, and inferencing (e.g., Ford & Milosky, 2008; Milligan et al., 2007). However, other studies have shown that mentalizing and reading comprehension are indeed related, but separate, constructs (Ricketts, Jones, Happé, & Charman, 2013; Strasser & Del Rio, 2014; White et al., 2009). For example, autistic participants had comprehension problems only when they read texts that required mentalizing. Their comprehension of nonmental stories (e.g., about natural events) was intact (White et al., 2009).

In addition to the indirect effect of children's mentalizing skills, we also found an indirect relation between home literacy environment and reading comprehension that ran via children's print exposure. That is, children from a rich literacy environment were familiar with more books that are appropriate for their age group than children from lower quality literacy environments. This in turn predicted their reading comprehension. This pathway seems in line with the process of reciprocal causation (Mol & Bus, 2011; Stanovich, 1986), which describes how children who are encouraged to read from an early age are more likely to enter a positive reading spiral. These children start school with more literacy knowledge and therefore will develop good reading skills more easily. Consequently, they will be more likely to find reading an enjoyable activity, engage in more reading activities, and hence develop their reading skills even more.

We further expected to find a significant path between print exposure and mentalizing, as reading narratives can provide a mental simulation of social experiences. In adolescents and adults, reading narratives have been shown to be related to mentalizing skills (e.g., Mar et al., 2006; Mar et al., 2009) or even to improve these skills (Kidd & Castano, 2013). In our younger sample, we found a positive correlation between print exposure and mentalizing. However, this relation disappeared when home literacy environment was included in the model. This indicates that for this age group the home environment may still be more decisive than their own print exposure in predicting children's mentalizing abilities.

Unexpectedly, no direct relation was found between children's own print exposure and expressive verbal ability. This was surprising, because it is thought that children who are exposed to many books read more frequently and therefore have more opportunities to acquire a rich vocabulary (Mol & Bus, 2011; Schiefele et al., 2012). Independent silent reading may appeal particularly for receptive skills, however. It might be that the expressive skills that we measured tap into a different aspect of oral language ability. We asked children to describe a story that was displayed in a picture, which

could depend more on other literacy activities, such as talking about books. It has been shown that young children's expressive vocabulary is particularly supported by shared book reading experiences in which parents and children engage in dialogic reading (Mol, Bus, De Jong, & Smeets, 2008). It can therefore be expected that children who read books independently will have to keep on talking about books in order to train their narrative production skills.

It might be interesting for future studies to examine whether a broader range of text genres, such as nonfiction, will reveal the same results as the current study on exposure to fictional narratives. It might be expected that children with lower mentalizing abilities have other book preferences than those included in our print exposure list simply because these children are not that interested in reading about characters' emotions, thoughts, and feelings. However, there are nonfictional narratives that convey factual information yet may also require children to mentalize (Gutkind, 2012), and fictional texts also differ in the amount of mental states that are used (Barnes & Bloom, 2014). Hence, mentalizing abilities might also be involved in the comprehension of other text types. Future studies might more specifically look into the relation between different text genres, mentalizing, and reading comprehension.

Limitations

Our study had a concurrent correlational design, so we cannot be certain about the directions of our findings. Experimental and longitudinal studies should be conducted to shed more light on the direction and causality of the relations, especially concerning the role of the higher order skills. Second, we used a combination of parental print exposure (measured by the author recognition test) and the availability of books at home as our proxy measure of home literacy environment. Based on existing literature (e.g., Burgess et al., 2002; Evans et al., 2014), we expect that parents who score high on our composite measure will also score high on other home literacy environment indicators such as home literacy activities. Third, we adapted the BCRT for use with third and fourth graders to measure their own print exposure (i.e., their recognition and knowledge of each book by showing book covers, including titles) in an individual test session. This differs from the more common approach in which children independently check all book titles they know. Replicating this study with a paper version of our print exposure checklist should reveal whether results are comparable with our current findings. However, the moderate correlation that we found between our home literacy environment measure and children's BCRT scores is consistent with previous literature that shows that children from higher quality home literacy environments are more familiar with age-appropriate books (Mol & Bus, 2011). Finally, we had seven participating schools in our study, and therefore we used school as a covariate in our analyses. As differences in socioeconomic status are often found among schools, this might have consequences for children's scores on our measures of expressive verbal ability and mentalizing. Future studies on these higher order skills, and the relations with socioeconomic status, are needed.

Implications and conclusions

This study, which took the current home literacy environment of third and fourth graders as a starting point, showed that children's home literacy environment still contributes to the reading comprehension of children in the higher grades of primary school. Parents should (continue to) provide a rich literacy climate to their children, even when their children are capable of reading themselves, because positive relations have been shown with children's reading comprehension, reading behavior, mentalizing abilities, and expressive verbal ability.

The current study also stresses the importance of children's mentalizing abilities for explaining variance in reading comprehension. The development of children's mentalizing abilities can be stimulated by parents by their providing a rich home literacy environment but also by teachers, for example, by their organizing reading activities in which children can discuss the emotions, thoughts, and intentions of characters. This is especially important as children get older, because children who have learned to read independently can be expected to have fewer opportunities for

shared reading practices (with parents and teachers). Organizing activities such as book clubs and literature circles (see, e.g., Daniels, 2002) in which children can discuss these issues with the teacher and with peers might contribute to the development of their mentalizing ability.

Finally, our model shows that frequent exposure to fiction is directly related to children's reading comprehension. Most parents and teachers are very much aware of this, and they encourage children to read books, both at home and at school. Our study proves once more that leisure reading is related to better reading comprehension skills.

Acknowledgments

The authors thank Marije Broens-Paffen for her assistance in collecting the data, and Karin Vander Heyden for her help in analyzing the data. We also thank the participating schools, students, and parents for their contributions to this study.

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Appendix: Example Strange Story

A burglar who has just robbed a shop is making his getaway. As he is running home, a policeman on his beat sees him drop his glove. He doesn't know the man is a burglar, he just wants to tell him he dropped his glove. But when the policeman shouts out to the burglar, "Hey, you! Stop!" the burglar turns round, sees the policeman and gives himself up. He puts his hands up and admits that he did the break-in at the local shop.

Q: Why did the burglar do that?

2 points—reference to belief that policeman knew that he'd burgled the shop

1 point—reference to something factually correct in story

0 points—factually incorrect/irrelevant answers

Note. White et al. (2009).