The Roles of Home Literacy Environment and Reading Self-Concept in Reading

Comprehension

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Abstract

Reading comprehension is an essential skill when it comes to school and later societal success. However, reading comprehension skills in the Netherlands are declining. This study aimed to understand the predictors of reading comprehension skills, considering both environmental and psychological factors. More specifically, it investigated the relationship between home literacy environment (environmental) and reading self-concept (psychosocial), using a sample of 2214 Dutch fourth grade children from the Progress in International Reading Literacy Study (PIRLS) 2016. The PIRLS assessed reading comprehension skills with a reading comprehension test, while home literacy environment (HLE) and reading self-concept were measured with parental and student questionnaires. Regression analyses showed that HLE significantly predicted reading comprehension, also after controlling for socioeconomic status. Results from a mediation analysis showed partial mediation of the relation between HLE and reading comprehension through reading self-concept. These findings support the inclusion of both psychosocial and environmental factors when studying reading comprehension. Furthermore, this study demonstrates the importance for schools, teachers and parents to be aware of the impact of the HLE. Fostering positive HLEs could result in more positive reading self-concept and eventually better reading comprehension skills.

Keywords: home literacy environment, reading self-concept, reading comprehension

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Problem definition

Understanding written texts is one of the most important abilities to be acquired during the

school years. Deficits in reading comprehension will not only affect achievement in school,

but are also detrimental for later social and professional success (Locascio, Mahone, Eason, &

Cutting, 2010; Potocki, Sanchez, Ecalle, & Magnan, 2017). Unfortunately, the latest PISA

report showed that Dutch student's reading literacy skills are declining (Gubbels, van Langen,

Maassen, & Meelissen, 2019). Comparing to other EU countries, Dutch students show

significant lower reading literacy scores (Gubbels et al., 2019). These results indicate an

urging need for more understanding of the factors contributing to reading comprehension

success or failure.

Research indicated that psychosocial (i.e., reading self-concept) and environmental (i.e.,

home literacy environment) factors both influence reading comprehension (Retelsdorf, Köller,

& Möller, 2014; Sénéchal, 2006). These factors are likely to be related to each other, but it is

unclear how and to what extent. Therefore, this study aimed to reveal the impact of home

literacy environment on reading comprehension, and to discover if reading self-concept has a

mediating role in this relation. In this way, the present study can contribute to the

understanding of predictors of reading comprehension, and can create guidelines for policy

makers and teachers in primary education for helping parents and children to create contexts

in which reading comprehension skills can be optimally developed.

Theoretical framework

Reading comprehension.

Reading comprehension is a complex ability, involving many different cognitive

processes needed to construct a mental representation of the text (Kendeou, McMaster, &

Christ, 2016). A seminal model of reading comprehension is the simple view of reading

(Gough & Tunmer, 1986; Hoover & Gough, 1990). The simple view of reading posits reading

comprehension as the product of both decoding and language comprehension. Hoover and

Gough (1990) found that the product of decoding and language comprehension could explain

substantial variation in reading comprehension. *Decoding* is the ability of translating print text

into spoken words or units (Melby-Lervåg & Lervåg, 2014). *Language comprehension*

considers the process of interpreting given lexical information, sentences and discourses

(Gough & Tunmer, 1986).

Although the simple view of reading has been very influential, it is not a comprehensive

model (Kendeou et al., 2016). Not all substantive variance in reading comprehension can be

explained by the combination of decoding and language comprehension (Chen & Vellutino,

1997). Apart from cognitive and linguistic skills, psychosocial and environmental factors

contribute to reading comprehension as well (e.g., Fletcher et al., 2002).

Reading self-concept

To augment the simple view of reading, scholars have increasingly paid attention to the

inclusion of psychosocial factors, such as children's attitudes toward reading and their

perceptions about their reading ability. The latter is closely related to the notion of self-

concept, which has been linked to academic achievement in many different domains (Marsh

& Craven, 2006). Self-concept in general can be defined as a person's perception of himself,

formed through experience with his environment (Shavelson, Hubner, & Stanton, 1976). Self-

concept is a multidimensional construct, which means that competence beliefs can vary across

different subject domains and can have different effects on achievement (Marsh & Craven,

2006; Shavelson et al., 1976). Within the domain of reading, one can speak of a child's

reading self-concept.

However, conceptualizations of domain-specific academic self-concept (e.g., reading self-concept) differ within the literature. Self-concept is closely aligned with affect components within a given academic domain. Scholars therefore often assume that self-perceived competence and affect together form a unidimensional construct (Marsh & Craven, 2006). However, there is no general agreement among researchers whether affective reactions to tasks are part of academic self-concept, or if they form different constructs (Bong & Skaalvik, 2002). Within reading self-concept research, this disagreement is visible as well. Some studies explicitly included affect as part of reading self-concept (e.g., Chapman & Tunmer, 1995), whereas others consider them as distinct constructs (e.g., Retelsdorf, Köller, & Möller, 2011).

Retelsdorf et al. (2011) provided a clear definition of reading self-concept: it is "the individual's perceptions of competence in performing reading tasks" (p. 551). In the present study, this definition served as the guiding principle for the conceptualization of reading self-concept, which therefore focused on perceptions of competence. These perceptions of competence are related to reading comprehension. It is assumed that higher self-perceptions of competence in reading lead to higher amounts of reading, and therefore will result in better reading outcomes (Retelsdorf et al., 2014). This assumption is supported by several studies showing a relationship between reading self-concept and reading comprehension (e.g. Chapman & Tunmer, 1995; Crampton & Hall, 2017; De Naeghel, Van Keer, Vansteenkiste, & Rosseel, 2012; Katzir, Lesaux, & Kim, 2009; Retelsdorf et al., 2014).

Home literacy environment

One environmental factor related to reading comprehension is the home literacy environment (HLE; e.g., Boerma, Mol, & Jolles, 2017; Leseman & de Jong, 1998; Mol & Bus, 2011; Sénéchal, 2006). Enriching HLE's are presumed to foster reading development via cultural transmission (Van Bergen, Van Zuijen, Bishop, & De Jong, 2017). Parents who

expose their children to a rich literacy environment, can facilitate vocabulary development and the emergence of a positive association with reading, which can be beneficial for reading comprehension (Baker & Scher, 2002; Sénéchal, 2006). In that way, HLE distinguishes itself from more general environmental factors like socioeconomic status (SES). SES is related to HLE (e.g., Korat, Arafat, Aram, & Klein, 2013; Niklas & Schneider, 2013), but for reading skills, HLE is a much more specific and direct predictor (Burgess, 2002).

HLE is a multifaceted construct that has been defined and operationalized differently by various researchers (Katzir et al., 2009; Niklas & Schneider, 2013). A highly-cited theoretical model, is the 'Home Literacy Model' (Sénéchal & LeFevre, 2002). According to this model, the HLE is determined by formal and informal literacy activities. Formal literacy activities have a direct focus on print (e.g., teaching the alphabet) whereas in informal literacy activities print is present, but is not the direct focus of parent-child interaction (e.g., shared book reading). However, in other research broader conceptualizations were used. In addition to literacy activities, HLE is also determined by the literacy resources at home and parental attitudes toward literacy (Burgess, 2002; Puglisi, Hulme, Hamilton, & Snowling, 2017).

Many studies on HLE focused on early literacy skills development in young children (preschool, kindergarten, first grade). Whereas it is broadly known that HLE influences early literacy and reading skills (e.g., Sénéchal, Whissell, & Bildfell, 2017; Weigel, Martin, & Bennett, 2007), it is also important to understand if and how the HLE impacts children's reading beyond the initial stages of reading development. Around fourth grade, children generally reach a transition point from 'learning to read' to 'reading to learn'. This is a crucial stage when it comes to the development of reading comprehension skills (Chall, 1983). However, few studies focused on the impact of HLE on children's reading at this developmental stage. Studies on HLE and reading comprehension in older children generally show that HLE influences reading comprehension in higher primary school grades (Boerma et

al., 2017; Niklas & Schneider, 2017; Sénéchal, 2006; Van Bergen et al., 2017). However, these studies have not used the broad conceptualization of HLE comprising literacy activities, literacy resources and parent's attitudes toward reading, or measured HLE only in kindergarten. Katzir et al. (2009) found no significant relation between HLE and reading comprehension in fourth grade, but this study only had a small sample, and Katzir et al. suggested replication of their study with a larger sample. Further studying HLE and reading comprehension in fourth grade could provide a more comprehensive understanding of the predictive value of HLE in reading comprehension for older children.

Studies on HLE with younger children often use a quite restricted conceptualization of HLE, in which shared book reading is often seen as a prototypical form of home literacy (De Jong & Leseman, 2001). However, the frequency of home literacy activities declines as children grow older (Boerma, Mol, & Jolles, 2018). In older children, families can still provide a context for developing literacy skills, albeit in a more broad sense (De Jong & Leseman, 2001). To examine HLE in older children therefore requires a broader conceptualization of HLE (De Jong & Leseman, 2001). Hence, in this study HLE is conceptualized by three components: home literacy resources, parents' attitude toward literacy, and (formal and informal) literacy activities at home.

Reading self-concept as mediator in the relation between HLE and reading comprehension

Both reading self-concept and HLE play a role in reading comprehension. However, little research has been conducted to examine the roles of both self-concept and HLE in reading comprehension skills in one model. Several earlier studies provide reasoning for including these constructs in one model. First of all, Conlon, Zimmer-Gembeck, Creed, and Tucker (2006) proposed a model of antecedents of reading outcomes, based on the biobehavioral model of Fletcher et al. (2002). According to this model, reading outcomes are determined by

both proximal and distal factors. The model states that children's cognitive functioning (proximal) is influenced by biological factors (distal), which then have an indirect impact on reading skills. Likewise, environmental factors (distal), like the HLE have a direct impact on children's perceptions of competence and attitudes (proximal), which then directly impact reading outcomes (Conlon et al., 2006).

A second study on both HLE and reading self-concept in relation to reading comprehension was conducted by Katzir et al. (2009). They showed that reading self-concept was positively related to reading comprehension. Remarkably, they found no evidence that child and family literacy are related to reading comprehension. This contradicts with many other studies showing an effect between HLE and reading comprehension (e.g. De Jong & Leseman, 2001; Mol & Bus, 2011; Sénéchal, 2006). However, Katzir et al. (2009) did find a relationship between reading self-concept and child and family literacy practices. They suggest a possible indirect relationship between HLE and reading comprehension, in which HLE operates on reading comprehension through reading self-concept, as supposed by the biobehavioral model of reading outcomes (Conlon et al., 2006). This line of reasoning seems logical: parents who provide a positive HLE, will create more positive associations with reading for their children, which will make them more confident and successful in reading comprehension. Also, it has already been shown that parents who like reading, are more likely to have children who like and feel competent in reading (Baker & Scher, 2002).

However, a more recent study by Crampton and Hall (2017) also showed evidence for a different chain of effects regarding the influences of HLE: they found HLE to have a direct impact on reading, and reading then boosted self-concept. However, their study measured general academic self-concept instead of reading self-concept. This is a severe limitation, since self-concept is found to be highly domain-specific (Shavelson et al., 1976).

Furthermore, they used a limited measurement of HLE with only preschool literacy activities being measured.

Whereas it is evident that both HLE and self-concept are related to reading comprehension, their specific mutual relationships remain unclear. Therefore, there is a need for investigating their interrelationships, to gain a better understanding of these cognitive, psychosocial and contextual factors in predicting reading comprehension.

Present study

The present study investigated the roles of both HLE and self-concept in predicting reading comprehension skills of children in fourth grade of primary education, focusing on two main research questions:

1. What is the contribution of HLE in predicting children's reading comprehension skills in fourth grade of primary education, after controlling for socioeconomic status?

2. To what extent does reading self-concept mediate the relation between HLE and reading comprehension in fourth grade of primary education?

Considering the first question, it was hypothesized that the HLE would be positively associated to reading comprehension. In other words, a richer HLE would result in better reading comprehension skills. SES was used as a control variable, since SES and HLE are linked as well (e.g., Korat et al., 2013; Niklas & Schneider, 2013), and it is not desirable that the effect found could actually be attributed to SES instead of HLE. However, it was expected that there is a unique effect from HLE on reading comprehension, since it is a more specific and direct factor for reading skills compared to SES (Burgess, 2002). Earlier studies already found that HLE was positively related to reading comprehension in second grade or higher (Boerma et al., 2017; Niklas & Schneider, 2017; Sénéchal, 2006; Van Bergen et al., 2017). Regarding the second question, it was expected that the relation between HLE and reading comprehension could be partially explained by children's reading self-concept. This

hypothesis is supported by the biobehavioral model of reading outcomes, which states that HLE can have an impact on a child's perceptions of his reading, and that this reading self-concept contributes to reading skills (Conlon et al., 2006). Furthermore, this chain of effects has already been suggested in the study of Katzir et al. (2009).

Methods

Research design

To answer the main research questions, this study used quantitative survey data for the Netherlands from the Progress in International Reading Literacy Study (PIRLS) 2016. PIRLS is an international assessment of reading comprehension at fourth grade, which is conducted every five years. Apart from reading comprehension assessment, PIRLS also collected extensive information on the home and school contexts for learning to read (Mullis, Martin, & Sainsbury, 2015). PIRLS data are publicly available.

Participants

Participants in this study were fourth grade children who participated in the Dutch PIRLS of 2016. The sample used in PIRLS was meant to be representative for all fourth grade students in the Netherlands (Gubbels, Netten, & Verhoeven, 2017). In total, 4206 Dutch students participated in PIRLS 2016. For the current study, only students for which data were available from both the student and home questionnaire were included. Sampling was done by taking into account two stratification variables: the average pupil weight of the school and the degree of urbanization. In order to make the sample more representative, weight factors were computed by PIRLS for each student. These weight factors have been taken into consideration in the data analysis.

The sample used in this study consisted of 2214 Dutch children from 132 different schools across the country, all attending fourth grade (49,0% boys, 51,0% girls). When surveyed, the children had a mean age of 9.99 years ($SD = 0.43$). For 88,3% of the children, Dutch was

always or almost always spoken at home; 11,7% of the children sometimes or always spoke another language.

Students' parents also participated by filling in the PIRLS 'Learning to Read Survey'. 86,9% of the questionnaires were completed by female caregivers, 21,1% were completed by male caregivers. This does not equal 100, indicating that some parents filled in the questionnaire together. In this study, female caregivers are referred to as 'mothers' and male caregivers as 'fathers', although not all respondents were children's (biological) parents. Looking at parents level of education, 8,1% of the fathers was low-educated (ISCED Level $\leq$ 2), 35,0 % was middle-educated (ISCED Level 3), and 56,8% was highly educated (ISCED Level $\geq$ 5). Of the mothers, 4,6% was low-educated, 36,9% was middle-educated, and 58,5% was highly educated.

Instrumentation

Socioeconomic status. Socioeconomic status was used as control variable and measured in the parental questionnaire. Parents were asked about their highest educational level and their current or last occupation. Parent's highest level of education was measured according to ISCED levels. The question on parent's occupation was categorical in nature. However, for use of this component as an indication of SES, a hierarchical order was needed. Therefore, the original scores were converted into ISEI scores from the International Socioeconomic Index of Socioeconomic Status (Ganzeboom, De Graaf, & Treiman, 1992). This was done according to the classification of Caro and Cortés (2012, p. 15). Scores on educational level and occupation from both parents were averaged, or the score of only one parent was used in case of single parents.

Reading comprehension. In PIRLS 2016, reading comprehension was assessed by a reading test. The passages used in this test focused on two overarching purposes for reading: *literacy experience* and *reading to acquire and use information* (Mullis et al., 2015). The test

consisted of twelve passages, half of which was devoted to each of the purposes for reading. Furthermore, the assessment integrated four processes of reading comprehension within the test: *focus on and retrieve explicitly stated information, make straightforward inferences, interpret and integrate ideas and information,* and *evaluate and critique content and textual elements* (Mullis et al., 2015). Students only read and answered questions for two of the twelve passages. As an estimate of the overall score, five plausible values were calculated using Item Response Theory. These plausible values were scaled to have a mean of 500 points and a standard deviation of 100 points. Reliability of the reading comprehension test was measured by the median Cronbach's alpha across all different test booklets, which was $\alpha =$ .86 (Foy, Martin, Mullis, & Yin, 2017).

Reading self-concept. Students' perception of their reading self-concept was measured with the *Student Confident in Reading* (SCR) scale, part of the student questionnaire in PIRLS. This scale consisted of six items with a 4-point Likert scale: (1) *agree a lot*; (2) *agree a little*; (3) *disagree a little*; and (4) *disagree a lot*. The last four items were formulated negatively, and were therefore reverse coded. Examples of the statements in the SCR scale are 'Reading is easy for me', and 'Reading is harder for me than for many of my classmates' (reverse coded). PIRLS computed a transformed scale score for these six items, with values ranging between 2.96 and 13.47 (Martin et al., 2017). Reliability of the scale was measured by Cronbach's alpha, which was $\alpha = .85$ (Martin et al., 2017). An overview of the items can be found in Appendix A.

Home literacy environment. The HLE was measured using three scales within the 'Learning to Read Survey' of PIRLS 2016, which was filled in by parents of the participating students. The three scales were in concordance with the earlier mentioned components of HLE.

The physical home literacy environment was measured by two items relevant for HLE from the *Home Resources for Learning* (HRL) scale. The first question measured the general number of books: (1) *0 – 10 books*; (2) *11 – 25 books*; (3) *26 – 100 books*; (4) *101 – 200 books*; and (5) *more than 200 books*. The second question focused on the number of children's books: (1) *0 – 10 books*; (2) *11 – 25 books*; (3) *26 – 50 books*; (4) *51 – 100 books*; and (5) *more than 100 books*. The physical literacy environment was formed by the sum of the scores on these two items, and had a Cronbach's alpha of $\alpha = .76$.

Parent's attitude toward reading was measured by the nine items of the *Parents Like Reading* (PLR) scale. The first eight items were formulated as statements, in which parents had to indicate the degree of agreement: (1) *agree a lot*; (2) *agree a little*; (3) *disagree a little*; and (4) *disagree a lot*. An example of an item is 'I like to talk about what I read with other people'. The last item focused on the amount of reading; 'When you are at home, how often do you read for your enjoyment?'. Answer options were: (1) *every day or almost every day*; (2) *once or twice a week*; (3) *once or twice a month*; and (4) *never or almost never*. These items all used a 4-point Likert scale and had a Cronbach's alpha of $\alpha = .81$ (Martin et al., 2017). PIRLS computed a transformed scale score for the PLR scale, this score could have values between 2.72 and 13.88.

In order to measure literacy activities at home, eight items from the *Early Literacy Activities Before Primary School* (ELA) scale were used. Parents were asked to indicate how often they did certain activities (e.g., read books, tells stories, sing songs) with their child before it went to first grade of primary school. PIRLS did not measure current literacy activities, but the early literacy activities were perceived as a convenient alternative. They were therefore used in the analyses to provide a comprehensive picture of HLE. The ELA items had a 3-point Likert scale with the following answers: (1) *(almost) never*; (2)

sometimes; and (3) *often*. Transformed scale scores could vary between 2.14 and 14.70, the scale had a reliability of α = .73 (Martin et al., 2017).

The full questionnaire can be found in Appendix B. For each scale, the scale scores were transformed into z-scores. Then, a composite z-score was calculated to create a general HLE score for use in the analyses.

Data analysis

Data were analyzed with IEA IDB Analyzer, which was developed for working with PIRLS and other IEA large-scale assessment data (Foy et al., 2018). The IEA IDB Analyzer generates syntax for SPSS, which makes appropriate use of plausible values to estimate reading comprehension scores and takes into account sampling weight factors. Prior to the analyses, data were checked for the absence of outliers and multicollinearity, and for the assumptions of linearity, independent errors, homoscedasticity, normality and normally distributed residuals. Assumptions were checked using SPSS, since these analyses were not supported by IEA IDB Analyzer. For reading comprehension, the mean of the five plausible values was used. The data structure of the mean plausible value was comparable to the estimate of the reading comprehension score used in the analyses in IEA IDB Analyzer.

Descriptive analyses. First, means, standard deviations and bivariate correlations were calculated for all variables: reading comprehension, home literacy environment, reading self-concept, and SES measures (control variable).

Regression analyses. In order to test the two hypotheses of this study, several regression analyses were conducted. For the first research question, a simple regression model was tested (Figure 1, conceptual model A). The effect of HLE on reading comprehension is indicated by path c in Figure 1. First, HLE was regressed on the dependent variable, reading comprehension. To test if the effect was truly an effect from HLE, and did not merely reflect SES, SES was then added as control variable in a second regression analysis.
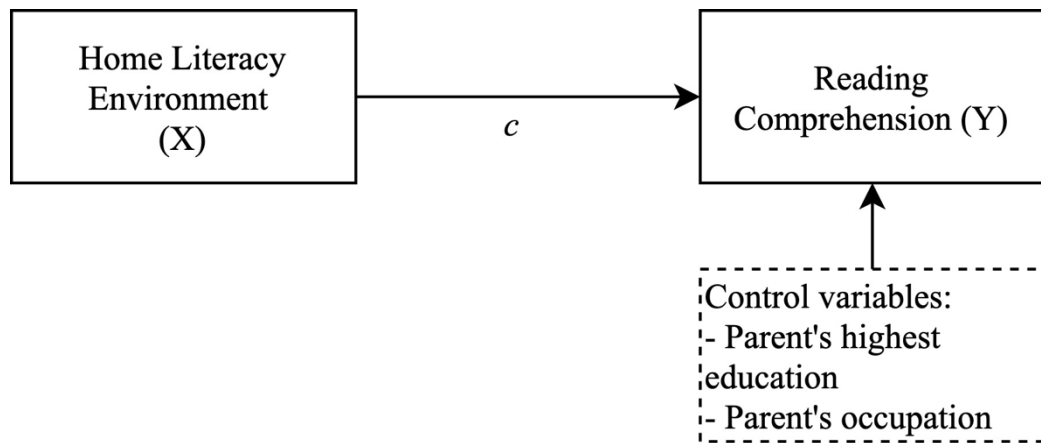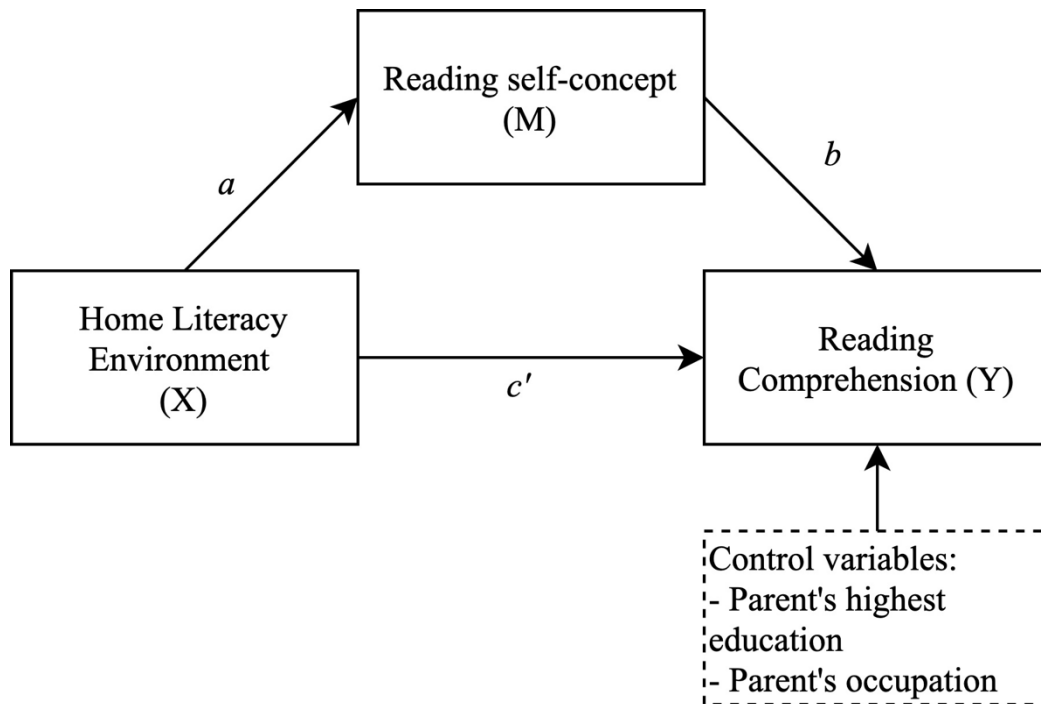
A. Direct pathway

B. Indirect (mediated) pathway.

Figure 1. Conceptual linear regression model (A) and conceptual mediation model (B). Based on the model of Baron and Kenny (1986).

For the second research question, the mediation model shown in Figure 1 (conceptual model B) was tested according to the guidelines of Baron and Kenny (1986). Regression coefficients for each of the paths indicated in Figure 1 were computed. Again, SES was used as a control variable in these analyses. The indirect effect in the mediation analysis was assessed using the Monte Carlo (MC) confidence interval method (MacKinnon, Lockwood, & Williams, 2004; Selig & Preacher, 2008). MC uses the parameter estimates of path a and b and their variances. MC simulates random draws from the joint distribution of a and b, and computes the product of these values. This procedure is repeated 20,000 times to estimate a 95% confidence interval of the indirect effect. Although MC does not perform as well as bias-corrected bootstrap methods, MC is a useful alternative if raw data are unavailable. MC is also more reliable than the extensively used Sobel test (MacKinnon et al., 2004; Preacher & Selig, 2012). Therefore, this method was used, since no raw data on reading comprehension scores were available in the PIRLS data. As an indication of the size of the indirect effect, the ratio of the indirect effect (ab) to the total effect (c) was computed as well:

$$P_{\mathrm{M}} = \frac{ab}{c}$$

Effect sizes within mediation analysis are often problematic and should always be interpreted with caution (Preacher & Kelley, 2011; Wen & Fan, 2015). Under current understanding, reporting P_{M} within basic mediation models is preferred, as it provides meaningful information on the magnitude of the effect (Wen & Fan, 2015).

Results

Assumptions

Scatterplots showed a linear relationship between the independent variables and the dependent variable (mean of five plausible values for reading comprehension). No outliers were detected. Multicollinearity was checked with VIF and tolerance statistics and showed that the VIF values were all well below 10 and tolerance statistics were all above 0.2,

indicating that multicollinearity was not a problem within the data (Bowerman & O'Connell, 1990). The Durbin-Watson test statistic had a value of 1.812, which is close to 2, meaning that the assumption of independent errors has been met (Field, 2013). A scatterplot of the standardized residuals and standardized predicted values did not show funneling of the data distribution, so the assumption of homoscedasticity has been met. At last, reading comprehension scores were normally distributed according to the histogram, and a normal probability plot showed that the residuals were normally distributed as well. All assumptions have thus been met.

Descriptive statistics and correlations.

The range, means and standard deviations of the studied variables are displayed in Table 1. Correlation coefficients are presented in Table 2. As can be seen, all variables were significantly correlated.

Table 1

Descriptive statistics.

	N	Sum of student weights	Range Min	Range Max	M	SD
SES						
Parent's highest education	2181	87083	1.50	9.00	5.61	1.60
Father's highest education	2134	85203	1.00	9.00	5.57	1.85
Mother's highest education	2147	85442	1.00	9.00	5.65	1.78
Parent's occupation	2145	85550	22.00	73.00	52.77	11.68
Father's occupation	2073	82409	22.00	73.00	52.46	13.86
Mother's occupation	2052	80987	22.00	73.00	52.47	13.29
Reading comprehension						
Estimated RC score	2214	88292	-	-	552.86	60.15
Reading self-concept	2214	88292	2.96	13.47	10.11	2.16

		Range				
	N	Sum of student weights	Min	Max	*M*	*SD*
Home Literacy Environment (z-score)	2214	88292	-2.63	2.06	-0.04	0.76
Physical literacy environment (books)	2214	88292	2.00	10.00	6.61	2.16
Amount of books	2214	88292	1.00	5.00	3.27	1.30
Amount of children's books	2214	88292	1.00	5.00	3.34	1.10
Early literacy activities	2214	88292	3.96	14.70	10.27	1.69
Parent's attitude toward reading	2214	88292	2.72	13.88	10.01	1.86

Note. N = sample size, Min = minimum, Max = maximum, *M* = mean, *SD* = standard deviation.

Table 2

Pearson correlations coefficients for analysis variables (*N* = 2127).

	1	2	3	4	5	6	7	8
SES								
1. Parent's highest education	1.00							
2. Parent's occupation	.66**	1.00						
Reading comprehension								
3. Estimated RC score	.33**	.30**	1.00					
Reading self-concept								
4. Reading self-concept score	.07**	.05*	.37**	1.00				
Home literacy environment								
5. HLE total z-score	.42**	.38**	.31**	.16**	1.00			
6. Total amount of books	.50**	.45**	.30**	.09**	.77**	1.00		
7. Early literacy activities	.11**	.09**	.14**	.11**	.69**	.26**	1.00	
8. Parent's attitude toward reading	.32**	.30**	.26**	.16**	.79**	.47**	.30**	1.00

Note. **p < .001, *p < .05. RC = reading comprehension.

Home literacy environment and reading comprehension

Table 2 shows that the overall HLE z-score was significantly correlated with reading comprehension scores, $r = .31$, $p < .001$. This is a moderate correlation according to Cohen (1988). When considering the three components of HLE separately, all components were significantly related to reading comprehension. The total amount of books and parent's attitude toward reading were both moderately correlated with reading comprehension ($r = .30$ and $r = .26$ respectively). The correlation coefficient for early literacy activities and reading comprehension was small ($r = .14$; Cohen, 1988).

To answer the first research question, it was examined how HLE predicted reading comprehension scores. The simple linear regression analysis showed that HLE significantly predicted reading comprehension, $b = 24.79$, s.e. = 1.89, $\beta = .31$, $t = 13.09$, $p < .001$. The total model was significant, $R^2 = .10$, $F(1, 2212) = 238.54$, $p < .001$ (model 1 in Table 3). Next, a multiple regression analysis was run to assess if this relation persisted when SES was added to the model. Therefore, parent's level of education and parent's occupation were used as control variables. When controlling for SES (model 2 in Table 3), the regression coefficient for HLE reduced, but HLE still significantly predicted reading comprehension, $b = 15.34$, s.e. = 2.30, $\beta = .19$, $t = 6.67$, $p < .001$. The total model was significant, $R^2 = .15$, $F(3, 2123) = 125.23$, $p < .001$.

Home literacy environment, reading self-concept and reading comprehension

For answering the second research question, the interrelationships between HLE, reading self-concept and reading comprehension were considered. Table 2 reveals significant correlations between these three variables. However, this does not expose any directions of the relations between variables. Therefore, the mediation model displayed in figure 1 was tested with a series of multiple regression analyses, as suggested by Baron and Kenny (1986). These analyses aimed to examine if reading self-concept mediated the relation between HLE

and reading comprehension. In these analyses, SES was again added as a control variable.

The results of these analyses are presented in Table 3.

Table 3

Results from regression analyses.

Variable	b	s.e.	β	t	p	R^2
Model without mediator						
Model 1 (without control variables)						.10
HLE	24.79	1.89	.31	13.09	<.001	
Model 2 (with control variables)						.15
HLE	15.34	2.30	.19[c]	6.67	<.001	
Parent's highest education	6.40	1.86	.17	3.44	<.001	
Parent's occupation	0.57	0.23	.11	2.50	.01	
Model with mediator						
Model 3: reading self-concept as DV						.03
HLE	0.47	0.07	.17[a]	7.04	<.001	
Parent's highest education	0.03	0.05	.02	0.66	.51	
Parent's occupation	-0.01	0.01	-.03	-0.73	.47	
Model 4: reading comprehension as DV						.26
HLE	11.02	2.27	.14[c']	4.85	<.001	
Reading self-concept	9.11	0.78	.33[b]	11.62	<.001	
Parent's highest education	6.12	1.78	.16	3.45	<.001	
Parent's occupation	0.62	0.20	.12	3.06	.002	

Note. *c*, *a*, *b*, and *c'* represent the standardized coefficients for the corresponding paths

displayed in figure 1. DV = dependent variable, *b* = unstandardized regression coefficient, s.e.

= standard error, β = standardized regression coefficient, R^2 = proportion of explained

variance.

The regression of path *a*, testing the effect of HLE on the mediator, reading self-concept, was significant, $b = 0.47$, s.e. $= 0.07$, $\beta = .17$, $t = 7.04$, $p < .001$. The total model was significant as well, $R^2 = .03$, $F(3, 2123) = 19.83$, $p < .001$. SES measures appeared to be unrelated to reading self-concept in this model, $t_{education} = 0.66$, $p = .51$, $t_{occupation} = 0.47$, $p = .47$.

The next step of the mediation process showed that the mediator (reading self-concept), controlling for HLE and SES, was significant (path *b*), $b = 9.11$, s.e. $= 0.78$, $\beta = .33$, $t = 11.62$, $p < .001$. The last step of the analyses revealed that, controlling for the mediator (reading self-concept) and SES, HLE remained a significant predictor of reading comprehension, $b = 11.02$, s.e. $= 2.27$, $\beta = .14$, $t = 4.85$, $p < .001$. This is the direct effect in the mediation model (path *c'*). This final model with HLE and reading self-concept as independent variables accounted for 26% of the variance in reading comprehension scores ($R^2 = .26$, $F(4, 2122) = 184.32$, $p < .001$; model 4 in Table 3). The (unstandardized) indirect effect of HLE on reading comprehension through reading self-concept was assessed with the Monte Carlo confidence interval method, and was significant, $ab = 4.32$, 95% CI [2.974, 5.801]. The ratio of the indirect effect ($ab = 4.32$) to the total effect ($c = 15.34$; measured in model 2) was:

$$P_M = \frac{ab}{c} = .28$$

This means that the indirect effect of HLE on reading comprehension via reading self-concept had a proportion of .28 relative to the total effect of HLE on reading comprehension.

Discussion

Reading comprehension is an essential skill for school and general societal success. Many cognitive, psychosocial and environmental factors are involved in predicting a child's reading comprehension level. HLE and reading self-concept are both known for being associated to reading comprehension. However, their unique contribution to reading comprehension and their interplay were not yet fully understood. Hence, the current study aimed at investigating

the predictive roles of both HLE and reading self-concept for children's reading comprehension in fourth grade, seeking an answer to two research questions.

Home literacy environment as a predictor of reading comprehension.

The first research question was the following: *What is the contribution of HLE in predicting children's reading comprehension skills in fourth grade of primary education, after controlling for socioeconomic status?*

The results showed that HLE is closely related to reading comprehension. HLE and reading comprehension were moderately correlated, and regression analyses showed that HLE significantly predicted reading comprehension. Although HLE had moderate correlations with SES measures, the relation between HLE and reading comprehension remained after controlling for SES. Therefore, it can be concluded that HLE has a unique contribution in predicting a child's reading comprehension skills, and that this contribution does not just reflect a more general influence of a child's background on reading comprehension. Enriching HLE's can provide contexts that foster the development of reading skills, even when children have passed the initial stages of their reading development. This is in line with the hypotheses, since it was expected that HLE would be a more specific, and therefore unique contributor to reading comprehension compared to SES (Burgess, 2002). These findings are also in accordance with earlier studies on HLE and reading comprehension in higher primary school grades, in which a relation between these constructs was found (Boerma et al., 2017; Niklas & Schneider, 2017; Sénéchal, 2006; Van Bergen et al., 2017).

Correlations with reading comprehension for the individual HLE components differed. Whereas the amount of books and parent's attitude toward reading showed moderate correlation, early literacy activities only had a small correlation with reading comprehension. This small correlation can either be explained by an inaccurate measurement, or by the fact that the relationship between early literacy activities and reading comprehension is simply not

that strong. Both explanations seem plausible. The early literacy activities scale was retrospective in nature, which made it more difficult for parents to give a reliable appraisal of the activities they did with their child several years ago. Another possibility is that the effects of early literacy activities do not last strongly until fourth grade. Results might have been different when current literacy activities would have been measured. This presumption is supported by the study of Boerma et al. (2018), who found that home literacy activities in grade 3 and 4 predicted children's self-reported reading interest. This could have an impact on reading comprehension skills as well.

Reading self-concept as a mediator in the relationship between HLE and reading comprehension.

The second research question in this study was: *To what extent does reading self-concept mediate the relation between HLE and reading comprehension in fourth grade of primary education?*

The inclusion of both HLE and reading self-concept (and SES as control variable) in one model, results in a substantial amount of explained variance in reading comprehension scores. Results of the mediation analysis showed a significant indirect effect of HLE on reading comprehension through reading self-concept. The direct effect (path *c'*) was also significant, which means that the indirect effect is partial. Therefore, it can be concluded that reading self-concept does partially mediate the relation between HLE and reading comprehension, which is consistent with the hypotheses. The ratio of the indirect effect to the total effect indicated that a small part of the effect can be explained by the fact that children with rich HLEs tend to be me more confident in their own reading skills.

The results provide additional support for the biobehavioral model of reading outcomes, which states that environmental factors like HLE have a direct impact on children's perceptions of competence (i.e., reading self-concept), which then in turn have a direct impact

on reading achievement (Conlon et al., 2006). As a cautious explanation for this chain of effects, it can be argued that children with rich HLEs, in which there is a lot of attention for reading and literacy, will have more frequent and positive experiences with reading. These children will have better reading models and gain more feedback on reading at home. This may positively impact their feelings of competence in reading (i.e., reading self-concept), and eventually their reading comprehension skills.

However, it is also important to note that these results do not exclude the presence of possible other mediators in the relation between HLE and reading comprehension. Part of the remaining direct effect in the results of the mediation analysis could possibly be explained by other mediators. For example, children's affect with reading was not included within the studied model, but is a psychosocial factor as well that can be expected to be affected by the home environment according to the biobehavioral model (Conlon et al., 2006). Nevertheless, the findings of the present study provide a valuable explanation for the relation between HLE and reading comprehension, that is, that the predictive value of HLE for reading comprehension can be explained by the effect that HLE has on reading self-concept.

Another remarkable finding, was that SES was not predictive for reading self-concept in a model with HLE (model 3). Whereas HLE has moderate correlations with SES, and can partly explain the same part of variance in reading comprehension, SES does not seem to explain any variance in reading self-concept at all. This finding is in accordance with the study of Crampton and Hall (2017), who found that SES only had an indirect effect on academic self-concept, which worked via HLE. This finding again shows that SES should not be used as an operationalization of HLE, although this has regularly been done in earlier studies on HLE (Burgess, 2002). Whereas HLE has predictive value for reading self-concept, SES has not. This may imply an urge to be wary of prejudices about children coming from low SES families. Having a low SES does not automatically increase the risk on having a low reading

self-concept or weak reading comprehension skills, whereas the HLE does have predictive value in this. The present study thus shows that for the domain of reading, and more specifically reading comprehension, one should look at domain-specific predictors. At a distal level, HLE is a meaningful predictor of reading comprehension, and at a more proximal level, reading self-concept is predictive for reading comprehension as well.

Strength, limitations and directions for future research

The present study contributes to the understanding of possible causal relationships between HLE, reading self-concept and reading comprehension. It has been proven that HLE still influences reading comprehension in fourth grade, over and above the more general influences of SES. The inclusion of both environmental (HLE) and psychosocial (reading self-concept) factors in one model provide a valuable explanation of reading comprehension scores. Furthermore, evidence was found for partial mediation of the relation between HLE and reading comprehension through reading self-concept. This has, as far as known, never been studied before. The present study is powerful because of the large sample used. The sample of 2214 Dutch fourth grade children, combined with the carefully computed student weight factors, makes it a well representative of the Dutch student population. Therefore, findings of the present study are highly generalizable for all fourth grade children in the Netherlands.

However, some drawbacks come from the used dataset as well. Instead of computing a single individual reading comprehension score, PIRLS makes use of plausible values for estimating reading achievement. Although these plausible values provide accurate estimates of achievement, data analysis becomes more complicated and is not possible with regular statistical software. IEA IDB Analyzer was developed to make proper use of the plausible values when conducting analyses, so the results of the regression analyses in the current study can be perceived as reliable and valid. However, the options for analyses within the analyzer

were quite limited. Therefore it was not possible to perform bias-corrected bootstrap methods for estimating the indirect effect of HLE on reading comprehension through reading self-concept. These methods are nowadays viewed as being the most powerful and reliable test of the indirect effect (Preacher & Hayes, 2008). The Monte Carlo interval method was used as a convenient alternative, and although this method does not perform as well as original bootstrapping, it is not expected that conclusions would have been different, since the indirect effect was quite clear.

Another limitation was formed by the used measurement scale of literacy activities at home, one of the components of HLE. PIRLS measured the early literacy activities parents did with their children before they went to primary school. It would have been preferable if current formal and informal literacy activities of the families had been measured. This would possibly result in a higher reliability for the scale, since it is easier to make an estimate of current literacy activities, instead of making retrospective judgements. But even more importantly, it could give insight into the importance of doing literacy activities at home with older children for their reading achievement. Boerma et al. (2018) already studied the effect of home literacy activities in higher grades, but they focused on the effect on reading interest, and not reading self-concept or reading comprehension. Future studies could investigate which kind of literacy activities impact reading comprehension skills most.

In the present study design, a model was tested in which reading self-concept was assumed to have a direct influence on reading comprehension. However, reverse causal effects of reading comprehension on reading self-concept could not be tested within this design. Within earlier studies, evidence has already been found for bidirectional associations between reading self-concept and reading comprehension (Crampton & Hall, 2017; Retelsdorf et al., 2014). Future studies could further examine these reciprocal effects, and specifically what the place of HLE is in this chain of effects.

Another recommendation for future research would be to further clarify the construct of reading self-concept. In the current study, a focus on self-perceptions of competence in reading was chosen, but some scholars also plead for the inclusion of affect in the conceptualization of reading self-concept (e.g., Chapman & Tunmer, 1995). The inconsistency within the literature is problematic for comparability between studies on reading self-concept. It is therefore necessary to work towards a common understanding of the notion of reading self-concept.

All in all, despite the mentioned limitations, the evidence from this study definitely contributes to the theoretical knowledge on predictors of reading comprehension. HLE and reading self-concept appeared to be both predictors of reading comprehension within older primary school children, above influences of SES. Moreover, a partial mediation of reading self-concept in the relation between HLE and reading comprehension has been demonstrated. These results may have implications for policy makers, school leaders and teachers in primary education. First of all, the results imply that SES should not be overly judged when determining the risk of low levels of reading comprehension. HLE is a more valuable predictor for both reading comprehension and reading self-concept. Therefore, teachers should be aware of the impact of HLE. Within the initial stages of reading development, schools generally strongly encourage parents to be involved with their children's reading: they are asked to read books, to help their child practicing reading, and to create a positive atmosphere around reading. This often declines as children grow older (Boerma et al., 2018). However, the current study revealed that HLE still has an impact on children's reading comprehension. Therefore, it is important to increase parents' awareness of their impact on both the reading self-concept and reading comprehension skills of their child. Parents should be given access to practical tools to create a positive and rich literacy environment at home. This could foster children's reading self-concept and reading comprehension, which can

create more optimal opportunities for children to be successful in school and in their later

career.

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Appendix A: student questionnaire reading self-concept

Reading self-concept was measured with the 'Confident in Reading' scale from PIRLS

2016 (Martin et al., 2017). The questionnaire has been administered in Dutch.

How well do you read? Tell how much you agree with each of these statements.

Answer options: *agree a lot*, *agree a little*, *disagree a little*, and *disagree a lot*,

1. I usually do well in reading
2. Reading is easy for me
3. I have trouble reading stories with difficult words*
4. Reading is harder for me than for many of my classmates*
5. Reading is harder for me than any other subject*
6. I am just not good at reading*

Appendix B: parental questionnaire home literacy environment

Home literacy environment was measured with three different scales from the PIRLS

2016 home questionnaire.

The *physical literacy environment* was measured by two items from the 'Home

Resources for Learning' scale.

About how many books are there in your home? (Do not count ebooks, magazines, newspapers, or children's books.)

Answer options: *0 – 10, 11 – 25, 26 – 100, 101 – 200, more than 200.*

About how many <u>children's</u> books are there in your home? (Do not count children's ebooks, magazines, or school books.)

Answer options: *0 – 10, 11 – 25, 26 – 50, 51 – 200, more than 100.*

The *home literacy activities* were measured with the 'Early Literacy Activities Before

Beginning Primary School' scale.

Before your child began primary/elementary school, how often did you or someone else in your home do the following activities with him or her?

Answer options: *often*, *sometimes*, and *never or almost never*.

1. Read books
2. Tell stories
3. Sing songs
4. Play with alphabet toys (e.g., blocks with letters of the alphabet)
5. Talk about things you had done
6. Talk about what you had read
7. Play word games
8. Write letters or words
9. Read aloud signs and labels

Parent's attitudes toward reading were measured with the 'Parents Like Reading' scale.

Please indicate how much you agree with the following statements about reading.

Answer options: agree a lot, agree a little, disagree a little, disagree a lot.

1. I only read if I have to
2. I like talking about what I read with other people
3. I like to spend my spare time on reading
4. I read only if I need information
5. Reading is an important activity in my home
6. I would like to have more time for reading
7. I enjoy reading
8. Reading is one of my favorite hobbies

When you are at home, how often do you read for your enjoyment?

Answer options: *every day or almost every day, once or twice a week, once or twice a month, never or almost never*.