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Title: Leisure Reading (But Not Any Kind) and Reading Comprehension Support Each Other : A Longitudinal Study Across Grades 1 and 9

Year: 2020

Version: Accepted version (Final draft)

Please cite the original version:

Torppa, M., Niemi, P., Vasalampi, K., Lerkkanen, M.-K., Tolvanen, A., & Poikkeus, A.-M. (2020). Leisure Reading (But Not Any Kind) and Reading Comprehension Support Each Other : A Longitudinal Study Across Grades 1 and 9. Child Development, 91(3), 876-900. https://doi.org/10.1111/cdev.13241

Leisure Reading (But Not Any Kind) and Reading Comprehension Support Each Other - A Longitudinal Study across Grades 1 and 9

Submitted to Child Development December 2018

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Abstract

This study examines developmental associations between leisure reading and reading skills from Grade 1 to 9. As a step further from traditional cross-lagged analysis, we used a random intercept cross-lagged panel model (RI-CLPM) with latent factors to identify within-person associations in a data of 2,525 students on leisure reading (books, magazines, newspapers, and digital reading), reading fluency, and reading comprehension. In Grades 1 to 3 poorer comprehension and fluency predicted less leisure reading. In later grades more frequent leisure reading, particularly of books, predicted better reading comprehension. Negative associations were found between digital reading and reading skills. The findings specify earlier findings of correlations between individuals by showing that reading comprehension improvement, in particular, is predicted by within-individual increases in book reading.

Keywords: leisure reading, random intercept cross-lagged panel model, reading development

A common belief is that in addition to school-related reading activities, reading for pleasure promotes reading development. The assertion seems plausible as avid readers devote considerable time and effort to reading, and they can receive massive practice for automatization and accumulating lexicon (e.g., a Harry Potter book has as many as 250,000 words). Leisure reading may thus result in practice that easily surpasses the amount of text students read for school (e.g., Anderson, Wilson, & Fielding, 1988). In line with this, consistent evidence points to significant positive correlations between the amount of leisure reading and reading skills (e.g., Mol & Bus, 2011; Schiefele, Schaffner, Möller, & Wigfield, 2012; Stanovich, 1986), suggesting that those who read a lot are better readers than those who are reading less. Evidence further suggests that leisure reading is intrinsically more motivating than reading for school (Cox & Guthrie, 2001; Durik, Vida, & Eccles, 2006; Wang & Guthrie, 2004). Thus, it appears justifiable to conclude that parents and teachers would be well advised to encourage children to become habitual readers.

Although the practical significance of leisure reading appears self-evident, the direction of influence in reported research on the topic is anything but undisputable. This means that the pedagogical measures taken regarding reading also lack true underpinning. Instead of keen reading, the driving force can as well be reading competence itself or this can act in concert with leisure reading. Is the stage set already during the early elementary grades, so that students with a head start in reading skills also develop an interest in voluntary reading? If so, then habitual reading would be established together with good decoding skills which feed into vocabulary and comprehension (e.g., Perfetti & Stafura, 2014). Alternatively, it may be possible to encourage older students to read more than they did before, thereby inducing a virtuous circle that promotes reading competence (e.g., Snowling & Hulme, 2011). Finally, a reciprocal influence is also possible from the very beginning of an individual's reading career (e.g., Leppänen, Aunola, & Nurmi, 2005).

A research setting that could indicate the direction of influence from among these plausible patterns of influence must meet certain conditions. First, because literacy development continues throughout compulsory education (e.g., Eklund, Torppa, Aro, Leppänen, & Lyytinen, 2015), a long-term follow-up is necessary. Second, the sample of voluntary reading materials must be suitably diverse, including digital reading, comics and magazines along with more traditional book reading. Third, the data must include repeated assessments of both leisure reading and reading skills to identify direction of influence (cross-lagged effects) over time while controlling for previous levels of skill/leisure reading (autoregressors). Fourth, most models focus on differences between individuals. We need, instead, analysis methods that focus on how the changes within individuals across time in reading skills are associated with subsequent changes in leisure reading and vice versa, rather than models that focus on differences between individuals. The estimates in traditional cross-lagged panel models mix the variance that represents changes within individuals across time and the variance representing stable differences between them, which in turn causes severe problems in interpreting the results (e.g., Berry & Willoughby, 2017). The present study drawing from a large longitudinal Finnish sample meets all these preconditions.

What Underlies the Correlation between Reading Skills and Leisure Reading?

The well-established correlation between reading skills and the amount of reading at different ages has led to various interpretations (e.g., Mol & Bus, 2011; Schiefele et al., 2012). First, frequent leisure reading can support learning of important prerequisites of fluency and reading comprehension, such as orthographic knowledge and vocabulary. According to Share's (1995) self-teaching hypothesis, experience with decoding words is important for fluent recognition of letter patterns in words. Along with improved automatization and less need for effort and focus on decoding words, beginning readers can allocate more cognitive resources to comprehension processes which will promote reading comprehension (e.g., Mol & Bus,

2011). This suggestion is supported by Perfetti's (1985) verbal efficiency hypothesis (see also LaBerge, & Samuels, 1974) as well as by empirical findings on the association between reading fluency and comprehension (e.g., Florit & Cain, 2011). In addition to providing knowledge of print and promoting more fluent decoding, reading experience can support other important components of proficient reading, such as an array of verbal skills (for reviews, see Florit & Cain, 2011; Mol & Bus, 2011) and content knowledge (e.g., Hirsch, 2003). Written texts can also support vocabulary growth because they provide contextual information which can help the reader to infer meaning for yet unknown words (Nagy, Anderson, & Herman, 1987; Nagy & Herman, 1987).

Second, it is also possible that frequent leisure reading emerges from good skills. Poor reading or problems in the key linguistic skills may act as constraints for leisure reading particularly at the early phases of reading development. This view is supported by evidence showing that reading ability is strongly predicted by cognitive pre-reading skills assessed years before school entry (e.g., Puolakanaho et al., 2007; Whitehurst & Lonigan, 2003). Dysfluent and erroneous reading and/or comprehension problems make reading laborious and hardly enjoyable. What is more, reading situations may become counterproductive if children do not have a feeling of competence or progress (e.g., Becker et al., 2010).

Third, the association between the amount of leisure reading and reading skills may be reciprocal. Over time, the two-way relation can result in cumulative advantages or disadvantages, known as diverging "the rich-get-richer and poor-get-poorer" pathways (Stanovich, 1986). In addition to the quantity as such, the quality of the texts selected for leisure reading may differentiate between good and poor readers. Those with better skills and/or higher reading self-concept may select more difficult texts, thus driving their reading progress further (e.g., Guthrie, Wigfield, Metsala, & Cox, 1999).

Previous Longitudinal Studies on the Association of Leisure Reading and Reading Skills

Most previous studies on the association between reading competence and reading amount have been cross-sectional (see, e.g., Schiefele et al., 2012), resulting in the unfortunate situation that the indicated developmental trends are strained by between-groups variability. The few longitudinal follow-up studies that are available cover only a short period and, in addition, their results concerning the direction of influence are equivocal (Aarnoutse & van Leeuwe, 1998; Harlaar, Deater-Deckard, Thompson, DeThorne, & Petrill, 2011; Leppänen et al., 2005). The only long-term study (Cunningham & Stanovich, 1997) found that Grade 1 reading skills predicted print exposure (title and author recognition) 10 years later, but the sample was small (n = 27), and print exposure was assessed only in Grade 11, while there were no assessments between Grades 1 and 11.

A crucial gap in previous research is that only one longitudinal study has followed the development of both reading ability and reading amount repeatedly over years, reporting longitudinal models with autoregressors (Aarnoutse & van Leeuwe, 1998). Annual assessments of reading comprehension and reading frequency from Grade 2 to Grade 6 suggested that reading amount develops largely independently from reading comprehension. Shorter-term follow-up studies have reported contradictory findings. Leppänen et al. (2005) focused on Grade 1 and Grade 2 reading (using a composite measure of accuracy, fluency, and comprehension). Their models suggested reciprocal associations with stronger cross-lagged paths from reading ability to reading amount. Harlaar et al. (2011) assessed reading amount and reading ability (a composite of accuracy and comprehension) at ages 10 and 11 and showed a significant cross-lagged effect from reading ability to reading amount but not vice versa. Overall, the available cross-lagged longitudinal models have found no effects at all or a somewhat stronger association from skills to leisure reading than the other way around. However, it is possible that the modest findings are due to the shortness of the follow-up and

the focus on young readers (Mol & Bus, 2011), thereby rendering the studies underpowered to detect long-term predictive effects. It is worth noting that no follow-up study has analyzed the effects of leisure reading separately on reading comprehension and decoding.

Do Genres of Leisure Reading Produce Dissimilar Fruit?

Leisure reading genre has been suggested to be a relevant aspect when considering the association of reading frequency and skill development. In particular, fiction reading seems more strongly correlated with comprehension skills than other leisure reading genres are (Spear-Swerling, Brucker, & Alfano, 2010). It has been suggested that while fiction reading is associated with intrinsic motivation, adolescents read informational texts mainly as a response to instructional requests (Guthrie, Klauda, & Morrison, 2012). Consumption of light reading materials such as magazines and comics, on the other hand, emerges mainly from social motives such as sharing with peers and getting recognized by them (McGeown, Osborne, Warhurst, Norgate, & Duncan, 2016). Recently, however, the reading habits of children and adolescents have changed profoundly. The reason is the advent of digital reading, also known as electronic reading activities or digital texts (Huang, Orellana, & Capps, 2016; Hutchison, Woodward, & Colwell, 2016). This form of reading features a wide variety of activities ranging from digital text reading to e-mail and chat exchanges. Importantly, a trend towards increased digital reading along with age has been found (McGeown, Duncan, Griffiths, & Stothard, 2015; McGeown et al., 2016).

Although Salmerón, García, and Vidal-Abarca (2018) suggested that print comprehension skills can be transferred to mastery of Internet reading tasks, other researchers have shown that online and print reading skills may not fully overlap (Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012; Leu et al., 2014). An interesting and hitherto little explored question is the extent to which different genres of digital reading support or do not support the development of traditionally defined reading competence. Unsurprisingly, time

spent on reading fragmented digital information such as e-mails, blogs, online forums, and chats has been found to correlate negatively with print reading comprehension (Pfost, Dörfler, & Artelt, 2013). In fact, digital reading skills and print reading skills seem to be at least partially different skill domains. In their study of seventh graders from socio-economically wealthy and poor areas, Leu et al. (2014) showed that a gap between students from different socioeconomic backgrounds existed in digital reading comprehension even after controlling for print reading comprehension, writing ability and prior knowledge scores. A similar finding has been reported between preselected undergraduates with either good or poor learning ability (Goldman et al., 2012).

It seems justifiable to conclude that time spent on digital reading can be a mixed blessing. Skilled navigation and source evaluation necessarily require good comprehension skills (e.g., Naumann, 2015) but the evidence suggests an asymmetry in that competent reading of linear printed text is a strong facilitator of competent digital reading but not vice versa (Hahnel, Goldhammer, Kröhne, & Naumann, 2018; Hahnel, Goldhammer, Naumann, & Kröhne, 2016; Naumann & Salmerón, 2016). It is plausible that intensive reading of superficial digital material instead of print reading is likely associated with comprehension problems and may even augment them. It can thus be concluded that attention has to be paid to digital reading when studying the effect of leisure reading on reading competence. This element is so far conspicuous by its absence in the relevant research.

Do Traditional Cross-Lagged Models Miss the Target?

Cross-lagged models are the most common analysis methods in longitudinal studies focusing on developmental associations of two or more constructs. However, important problems with these models have been identified (e.g., Berry & Willoughby, 2017; Curran, Howard, Bainter, Lane, & McGinley, 2014; Hamaker, Kuiper, & Grasman, 2015; McArdle, 2009). The key limitation of traditional cross-lagged panel models is that cross-lagged estimates represent

two sources of variance which cannot be teased apart: changes within individuals and differences between individuals. As a consequence, the match between developmental theories and model results becomes spurious. This is a major concern because in theoretical models of development and the inferences based on them, the between-person differences and within-person processes occurring in time are typically separated. Regarding the present research focus, the across-time, across-domain correlations may suggest that "better readers read more" (here the focus is on differences between individuals: *between-person inferences*). However, we often make *within-person inferences* such as "the more you read, the better your skills become". In other words, we expect that if someone becomes a more active reader we will, in time, see an improvement in that person's reading skills. Importantly, traditional cross-lagged models do not separate these effects even though we often make such inferences based on them.

We argue that the within-person inferences are of key interest in the study of reading competence and leisure reading for both theory building and educational practice. Hence, there is a clear need for models that can analyze the within-person level variance when between-person variation is controlled. This call has recently been met by Berry and Willoughby (2017), Curran et al. (2014), Hamaker et al. (2015), and Seppälä et al. (2015). Our modeling builds on their suggestions.

The Present Study

The present study adds to the previous literature on the role of leisure reading in reading development by applying a long-term longitudinal design, comprehensive assessment of the key measures, and a sophisticated analysis method for developmental data. We use a large longitudinal sample (n = 2,525) with frequent assessments (Grade 1, 2, 3, 4, 6, 7, and 9, that is, from 7 to 16 years of age) of both leisure reading and reading competence. We include measures of both reading fluency and reading comprehension and assess their development

separately because, based on previous research (e.g., Cain, Oakhill, & Bryant, 2004; Catts, Adlof, & Weismer, 2006; Nation, Clarke, Marshall, & Durand, 2004; Torppa et al., 2007), we know that they form separate skill constructs, and their association with leisure reading may thus be different. After Grade 4, we also separately analyze different types of reading material to better tap the diversity of leisure reading.

The research questions are the following:

1. Are the development of reading skills (fluency and comprehension) and the amount of leisure reading of different genres (books, newspapers, comics, magazines, and digital texts) associated at the *between-person level*? That is, do better readers also read more than poorer readers do from Grade 1 to Grade 9?
2. Do reading skills (fluency and comprehension) and leisure reading of different genres (books, newspapers, comics, magazines and digital texts) predict one another at the *within-person level*? That is, does increased leisure reading amount predict increased reading fluency and/or better comprehension at the subsequent time-point and vice versa?

Method

Participants

The participants (n = 2,525) were born in 2000 and followed from Kindergarten to Grade 9. In this study we include data from Grade 1 to Grade 9. In Finland, children enter school in August of the year they turn seven. The data are a part of a larger longitudinal follow-up (AUTHORS) from four municipalities of different size and located in different parts of Finland. Three of them include the whole age cohort and one municipality targets half of the age cohort. Parental education levels in the data set are close to the Finnish national average (Eurostat, 2013). Informed consent for participation was collected from each participant and

their parents. The study has been reviewed and approved by the Ethical Board of the University of xxx (hidden for reviewing purposes) in 2006.

Measures

Leisure reading. In Grades 1 to 4, parents reported their child's leisure time reading activity with four items assessing frequency of (1) browsing books or magazines, (2) reading magazines, (3) reading novels, and (4) reading books with informational content. We employed questions based on those used previously by Sénéchal, LeFevre, Thomas, and Daley (1998). Ratings were given on a 5-point Likert scale (1 = not at all or rarely…5 = several times a day). Cronbach's alpha coefficients indicating internal consistency were as follows: .81 in Grade 1, .79 in Grade 2, .79 in Grade 3, .75 in Grade 4.

In Grades 6, 7, and 9, reading frequency was assessed via self-report with items tapping reading frequency of different reading materials based on a survey of adolescents' reading materials (Luukka et al., 2008). In each grade, 15 items were repeated, tapping reading of books, newspapers, magazines, comics, and digital texts such as e-mails, blogs and so on. Ratings were given on a 5-point Likert scale (1 = never…5 = daily). One item tapped the amount of reading (How many books have you read during this school year?), using a 6-point Likert scale (1 = none…6 = more than 20). To form composite scores, we conducted explorative factor analyses in SPSS 24 for each grade (6, 7, and 9) separately. Factor analyses (using principal axis factoring, varimax rotation) revealed that four items had very low communalities and incoherent loadings, and these four items were omitted from the analysis. The remaining 12 items had the same clear factor structure with four factors for each grade. In Grade 6, the factor model explained 37.26% of the variance, in Grade 7 it explained 39.57%, and in Grade 9, 39.09%. In factor one, named 'Book reading', two items were loaded: Number of books read in one's free time and book reading frequency. In factor two, named 'News and comics', four items were loaded: reading frequency of newspapers, comic books,

non-fiction and interest related books, and tabloids. In factor three, named 'Magazines', two items were loaded: reading frequency of 1) magazines and 2) magazines for adolescents. In factor four, named 'Digital texts', four items were loaded: reading frequency of 1) e-mails, 2) messages and Internet conversations, 3) Facebook, and 4) blogs. The Cronbach's alphas indicating internal consistency for the factors were as follows: for Book reading; .73 in Grade 6, .80 in Grade 7, and .82 in Grade 9; for News and comics; .51 in Grade 6, .56 in Grade 7, and .55 in Grade 9; for Magazines; .53 in Grade 6, .61 in Grade 7, and .63 in Grade 9; and for Digital texts; .53 in Grade 6, .52 in Grade 7, and .46 in Grade 9.

Reading fluency. Three group-administered tests were used to assess reading fluency: a sentence reading task, a word-reading fluency task, and a word-chain task. The word-reading fluency task is a subtest of the nationally normed reading test battery (ALLU; Lindeman, 2000). Each of the 80 items consisted of a picture with four phonologically similar words attached to it. The child silently read the four words and then drew a line connecting the picture with the word, semantically matching it. The words and pictures were easy and frequently used words familiar to very young children. The score was the number of correct answers within a two-minute time limit. In our sample, the Pearson correlation coefficients between subsequent time-points varied between .62 (Grade 4 and 6) and .73 (Grade 3 and 4). The Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgesen, Rashotte, & Pearson, 2010; Finnish version by Lerkkanen & Poikkeus, & Ketonen, 2008) was also used to assess silent reading efficiency in Grades 1 to 4. Respondents were given three minutes to read 60 sentences (e.g., *Strawberries are blue*) and verify the truthfulness of as many sentences as possible. In Grade 6, a similar task was used, called the Salzburger Lese-Screening Test (SLS; Mayringer & Wimmer, 2003) which is similar to the Woodcock-Johnson sentence verification task (Woodcock, McGrew, & Mather, 2001). Respondents were given two minutes to read 69 sentences and verify the truthfulness of as many sentences as

possible. In Grades 7 and 9, a standardized Finnish reading test for lower secondary school sentence reading task with similar but different items and the same instruction (YKÄ; Lerkkanen, Eklund, Löytynoja, Aro, & Poikkeus, 2018) was used. Respondents were given two minutes to read 70 sentences and verify the truthfulness of as many sentences as possible. The outcome score in all tasks was the amount of correct answers given within the time limit. All three tests had the same aim and same instruction but although similar, different items and different number of items. Correlations between different tests were very similar to the stability correlates within tests suggesting that the same skill was assessed despite changes in test items. In Grades 1 to 4 the stability correlations were between .60 (between Grades 1 and 4) and .73 (between Grades 3 and 4) and between Grades 7 and 9 the stability correlation was .69. Between the Grade 4 TOSREC and Grade 6 Salzburg test, the correlation was .68, and between the Grade 4 TOSREC and Grade 7 YKÄ test, the correlation was .62. The correlation between the Grade 6 Salzburg test and Grade 7 YKÄ test correlation was also .62. The word-chain task (Nevala & Lyytinen, 2000) was a timed test that required participants to indicate as many word boundaries as they could in a given time-limit. There were 10 rows of word chains in a paper that comprised from 4 to 6 words written together. The task was to silently read the word chains and, while reading them, indicate the word boundaries by drawing a division line in between them. The score was the number of correct responses (max. = 40) within the time limit (1 minute 25 seconds in Grades 1 and 2, 1 minute 20 seconds in Grade 3, 1 minute 5 seconds in Grade 4, 1 minute in Grades 6 and 7, and 1 minute 30 seconds in Grade 9). In our sample, the Pearson correlation coefficients between subsequent time-points varied between .51 (Grade 1 and 2) and .71 (Grade 7 and 9). The Cronbach's alphas for the reading fluency composite were .81 for Grade 1, .78 for Grade 2, .79 for Grade 3, .80 for Grade 4, .77 for Grade 6, .84 for Grade 7, and .82 for Grade 9.

Reading comprehension. A group-administered subtest of the nationally normed reading test battery (ALLU; Lindeman, 2000) was used to assess reading comprehension in Grades 1 to 6. The participants silently read a fiction story and then answered 11 multiple-choice questions and one question in which they had to arrange five statements in the correct sequence based on the information gathered from the text. One point for each correct answer was allotted (max. 12). In Grades 7 and 9 a similar standardized reading comprehension test developed for lower secondary grade levels was used (YKÄ; Lerkkanen, et al., 2018). All tests had the same aim and same instruction as well as the same number of multiple tasks but different texts and items. Each participant completed the task at his or her own pace, but the maximum time allotted was 45 minutes. Cronbach alphas were .69 in Grade 1, .75 in Grade 2, .66 in Grade 3, .67 in Grade 4, .66 in Grade 6, .68 in Grade 7 and .63 in Grade 9.

Statistical analysis

Prior to modeling, variable distributions were examined. Although distributions approached normality, only reading fluency measures from Grade 3 onwards fulfilled the criteria according to the Kolmogorov-Smirnov test statistics. However, all distributions resembled normal distribution and both skewness and kurtosis values were low (all < 2). All models were estimated with within age standardized values (mean = 0, sd = 1). The SEM modeling was carried out using the Mplus statistical package (version 7.3; Muthén & Muthén, 1998–2014). The parameters of the models were estimated by using full information maximum likelihood estimation with robust standard errors (MLR), which is considered robust to non-normality (Muthén & Muthén, 1998–2014).

The modeling strategy chosen follows from the concern that the traditional cross-lagged model does not yield interpretable estimates due to the mixing of between-person variance (stable differences between individuals across time) and within-person

variance (fluctuations around the stable level at each time-point; e.g., Berry & Willoughby, 2017; Curran et al., 2014; Hamaker et al., 2015). We apply models based on the Random Intercepts Cross-Lagged Panel Model (RI-CLPM) as suggested by Hamaker et al. (2015). We make, however, an important addition to the model by using latent factors in order to handle measurement error in line with a model recently utilized by Seppälä et al. (2015). The inclusion of several indicators for reading fluency and leisure reading allowed us to build latent factors and thus omit measurement error. In this paper, we refer to the models as RI-CLPM models.

The modeling had three major stages: (1) factor models for each construct at each time point, (2) longitudinal factor models for each construct, and (3) the random intercept cross-lagged panel models (RI-CLPM). At the first stage the separate confirmatory factor models were built for leisure reading and reading fluency at each time point. The latent factors for leisure reading in Grades 6 to 9 were built based on exploratory factor analyses (see more details in the leisure reading measure description). For reading comprehension, we had only one indicator and the reading comprehension error term was fixed to zero and loading to reading comprehension latent factor was fixed to 1. At the second stage, longitudinal models were estimated for each construct across time. At the third stage, the reading skill and leisure reading models were combined and the final RI-CLPM models were estimated (Figures 1–8). There are four models for reading fluency (Figures 1–4) and four for reading comprehension (Figures 5–8) because there were four different leisure reading genres assessed in Grades 6 to 9.

The RI-CLPM models include three stable between-person latent factors: reading skill across time, leisure reading in Grades 1 to 4 (parental report), and leisure reading in Grades 6 to 9 (self-report). In these between-person factors all loadings across time were fixed to be equal. These between-person factors represent the stable inter-individual

differences over the whole assessment period. In addition, there are seven latent change factors for each construct, one for each time-point. These factors represent the within-person changes around the overall level. In these models all stability and cross-lagged paths were included. In addition, correlations between T1 measures and correlations between the unexplained variances of the within-person factors within each time point were estimated in all models. The goodness-of-fit of the estimated models was evaluated using four indicators: χ^2-test, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Good model fit is indicated by a small, preferably non-significant χ^2, CFI > .95, RMSEA < .06, and SRMR < .08 (Hu & Bentler, 1999). As the final step of the analysis, we compared differences of the cross-lagged path estimates from leisure reading to reading skills and vice versa. In the analysis we first ran Wald test for all six pairs of estimates in each model, and, second, we used the model constraint option to compare each pair separately in the cases where the Wald test was significant. Because of running multiple tests, we applied the Bonferroni correction by dividing p-level .05 by eight for the Wald test as there were eight models, and by dividing p-level by 48 for the comparisons of the cross-lagged path estimates for individual time-points (eight models each with six comparisons). Applying these criteria for correction we ended up by using the cut-offs of p-level of .006 being significant for the Wald tests, and .001 for the paired tests.

Results

Descriptive Statistics

Table 1 reports descriptive statistics. Note that mean values of standardized scores for reading fluency are reported as the three tests had different scales. Note also that the outcome reading comprehension was based on different, age-level matched tests in different grades and

therefore the raw scores cannot be directly compared across time. Appendix Table 1 reports correlations for the composite measures.

The Longitudinal RI-CLPM **Models for Reading Fluency and Leisure Reading**

There are four models for reading fluency (Table 2, Figure 1, and Appendix Figures 1–3) because separate models were built for the different Grade 6–9 leisure reading measures (books, magazines, newspapers & comics, and digital texts). In all these models, Grade 1–4 measures of reading fluency and leisure reading were the same. The model fits were reasonable considering the large sample size (χ^2-tests are very sensitive to the sample size) and models with multiple components over time. Because allowing more error covariances between observed leisure reading measures had no or very small impact on the main interest estimates (correlations between the between-person factors and cross-lagged paths between the within-person factors), we only allowed the largest error covariances (those between the same items across time for reading fluency and for magazine reading). The fit statistics were for model 1 (Figure 1): $\chi^2(767) = 4142.32$, $p < .001$, RMSEA = .04, CFI = .93, SRMR = .09 (the model with leisure reading assessed with book reading in Grades 6–9), for model 2 (Appendix figure 1): $\chi^2(765) = 4010.78$, $p < .001$, RMSEA = .04, CFI = .93, SRMR = .09 (the model with leisure reading assessed with magazine reading in Grades 6–9), for model 3 (Appendix Figure 2): $\chi^2(1034) = 5298.78$, $p < .001$, RMSEA = .04, CFI = .91, SRMR = .09 (the model with leisure reading assessed with newspapers and comics reading in Grades 6–9), and for model 4 (Appendix Figure 3): $\chi^2(1034) = 4779.10$, $p < .001$, RMSEA = .04, CFI = .92, SRMR = .08 (the model with leisure reading assessed with digital texts in Grades 6-9).

In all four models for reading fluency (Figure 1 and Appendix Figures 1-3), there are three between-person factors that represent stable differences between individuals (denoted with BRF for reading fluency, $BLR_{1–4}$ for Grade 1–4 leisure reading, and for Grade 6–9 leisure reading of books $BLR_{B6–9}$, of magazines $BLR_{M6–9}$, of newspapers & comics

$BLR_{N6–9}$, and of digital texts $BLR_{D6–9}$) were significantly correlated. In all models there was a positive significant correlation between BRF and $BLR_{1–4}$. The correlations for the between-person factors of leisure reading between Grade 1–4 and Grade 6–9 measures were all significant but lower for magazine reading (.14) and digital texts (.18) than book reading (.41) as well as for newspapers and comics reading (.33). The correlations between the between-person factors of the Grade 6–9 leisure reading and reading fluency were significant and of rather similar magnitude for books (.44), newspapers and comics (.30), and digital texts (.38) but lower and non-significant for magazines (.09).

The within-person factors represent the individual fluctuations around their overall level, denoted as WRF_1–WRF_9 for reading fluency, WLR_1–WLR_4 for leisure reading in Grades 1 to 4, and WLR_{6B}–WLR_{9B} for book reading, WLR_{6M}–WLR_{9M} for magazine reading, WLR_{6N}–WLR_{9N} for newspapers and comics reading, and WLR_{6D}–WLR_{9D} for digital texts in Grades 6 to 9. The positive autoregressive effects suggested that fluctuation from overall level was predicted by a similar difference from the overall level at previous time-point. The Grade 1 within-person factors WRF_1 and WLR_1 were correlated showing a significant positive association between reading fluency and leisure reading already in Grade 1. Furthermore, the cross-lagged relations across time suggested that in Grade 1 and Grade 3, reading fluency predicted subsequent leisure reading change positively. During Grades 1 to 4 the within-person leisure reading factors were not significantly predictive of the within-person reading fluency factors. Note that although the same factors of reading fluency and leisure reading are included in all four models, there are slight differences in the estimates because all models are estimated separately and fitted to the data as a whole. The differences in estimates are small, however.

In Grades 6 to 9, book reading in Grade 7 was a significant positive albeit very weak (.08) predictor of Grade 9 reading fluency change whereas Grade 6 digital texts was a

significant negative predictor (-.11) of Grade 7 reading fluency change. Finally, Grade 6 reading fluency predicted positively magazine reading change in Grade 7 (.15). Overall, the cross-lagged path estimates between any leisure reading within-person factor and reading fluency were quite low and barely significant.

The examination of whether the cross-lagged paths from leisure reading to reading fluency were statistically different from the cross-lagged paths from reading fluency to leisure reading suggested no significant differences between any time-points in any of the models.

The results can be summarized so that in Grades 6 to 9, fluency no longer plays a role in reading development and reading activities. Hence, the stage is set for the interplay at the level of comprehension. Choices between different kinds of leisure reading reflect variation in motivation and individual values. Can their traces be seen in the development of reading comprehension?

The Longitudinal RI-CLPM **Models for Reading Comprehension**

There are four models for reading comprehension (Table 3, Figure 2, and Appendix Figures 4–6) because, again, separate models were built for the different Grade 6–9 leisure reading measures (books, magazines, newspapers and comics, and digital texts). The model fits were reasonable considering the large sample size and models with multiple components over time. As with reading fluency models, we decided not to start improving model fit by allowing more error covariances between observed leisure reading measures (error covariances across time were allowed for the same magazine reading items across time). The model fit statistics were model 5 (Figure 2): $\chi^2(342) = 2339.42$, $p < .001$, RMSEA = .05, CFI = .91, SRMR = .08 (the model with leisure reading assessed with book reading in Grades 6–9), model 6 (Appendix Figure 4): $\chi^2(340) = 2322.76$, $p < .001$, RMSEA = .05, CFI = .90, SRMR = .07 (the model with leisure reading assessed with magazine reading in Grades

6–9), model 7 (Appendix Figure 5): $\chi^2(525) = 3517.40$, $p < .001$, RMSEA = .05, CFI = .87, SRMR = .08 (the model with leisure reading assessed with newspapers and comics reading in Grades 6–9), and model 8 (Appendix Figure 6): $\chi^2(525) = 2988.57$, $p < .001$, RMSEA = .04, CFI = .88, SRMR = .07 (the model with leisure reading assessed with digital texts).

In all four models for reading comprehension (Figure 2 and Appendix Figures 4–6), there are three between-person factors that represent stable differences between individuals (denoted with BRC for reading comprehension, $BLR_{1–4}$ for Grade 1–4 leisure reading, and for Grade 6–9 leisure reading of books $BLR_{B6–9}$, of magazines $BLR_{M6–9}$, of newspapers and comics $BLR_{N6–9}$, and of digital texts $BLR_{D6–9}$). Similar to the reading fluency models, in all models there was a positive significant correlation between BRC and BLR_{1-4}. The between-person factor correlations of leisure reading between Grade 1–4 and Grade 6–9 measures were also very similar to the reading fluency models. The correlations between the between-person factors of the Grade 6–9 leisure reading and reading comprehension were all significant but varied in magnitude, being .53 for books, .14 for magazines, .21 for newspapers and comics, and .31 for digital texts.

The within-person factors represent the individual fluctuations around their overall level denoted as WRC_1–WRC_9 for reading comprehension, WLR_1–WLR_4 for leisure reading in Grades 1 to 4, and WLR_{6B}–WLR_{9B} for book reading, WLR_{6M}–WLR_{9M} for magazine reading, WLR_{6N}–WLR_{9N} for newspapers and comics reading, and WLR_{6D}–WLR_{9D} for digital texts in Grades 6 to 9. The positive autoregressive effects suggested that fluctuation from overall level was predicted by a similar fluctuation from the overall level at a previous time-point. The Grade 1 within-person factors WRC_1 and WLR_1 were correlated showing a significant positive association between reading comprehension and leisure reading already in Grade 1. Furthermore, there were many significant cross-lagged relations across time between the within-person factors. First, there were reciprocal associations between the Grade 1–4

leisure reading and reading comprehension within-person factors. The within-person factors of leisure reading were significant predictors of the subsequent reading comprehension within-person change in Grades 1, 3, and 4. The Grade 1 and Grade 2 reading comprehension within-person factors were significant predictors of Grade 2 and Grade 3 leisure reading within-person change.

Second, the reading comprehension and book reading within-person factors were reciprocally linked in Grades 6 to 9. Change in the Grade 6 and Grade 7 book reading within-person factors were predicted by reading comprehension within-person factors in Grade 4 and Grade 6, respectively. On the other hand, the Grade 7 and Grade 9 reading comprehension within-person factor change were predicted by book reading within-person factors in Grade 6 and Grade 7, respectively. Third, there were no significant cross-lagged paths between the reading comprehension and newspapers and comics reading or magazine reading within-person factors. Fourth, there were significant negative cross-lagged paths between the within-person factors of Grade 6 digital texts and Grade 7 reading comprehension as well as between reading comprehension in Grade 4 and digital texts in Grade 6.

Overall, there were significant positive cross-lagged path estimates between within-person factors of reading comprehension and leisure reading in Grades 1 to 4 and between reading comprehension and leisure book reading in Grades 6 to 9. On the other hand, no significant paths were found for newspapers and comics reading or magazine reading and there were significant negative paths between reading comprehension and digital texts.

The examination of whether the cross-lagged paths from leisure reading to reading comprehension were statistically different from the cross-lagged paths from reading comprehension to leisure reading suggested significant differences in all four models. Wald test statistics were the following for the four respective models: book reading $\chi^2(6)=54.06$, p

< .001, newspapers and comics reading χ^2 (6)=18.60, p < .005, magazine reading χ^2 (6)=21.16, p < .002, and digital texts χ^2 (6)=28.58, p < .001 For all models there was a difference in the cross-lagged estimates from grade 3 to grade 4 suggesting that increased leisure reading was a stronger predictor of increases in reading comprehension than the other way around. This was the only significant difference in the cross-lagged paths in the model for magazine and for the newspapers and comics reading. In the model for the digital texts, cross-lagged path estimates were significantly different also from grade 4 to 6 and from grade 6 to 7. Finally in the model for book reading the cross-lagged path estimates were significantly different from grade 4 to 6, from grade 6 to 7 and from grade 7 to 9 suggesting stronger prediction from increased leisure reading to reading comprehension than the other way around.

In sum, after grade 3 the comparison of the cross-lagged paths in the reading comprehension models suggested stronger paths from leisure reading to comprehension than the other way around, and the effects were positive for parental evaluation of leisure reading and book reading but negative for digital reading. The pattern underscores the critical role of book reading for the development of reading for meaning. This is also the main finding of the present study.

Discussion

The present study examined the interplay between leisure reading and reading competence from Grade 1 to Grade 9. This is the first study to report such a long follow-up including both reading comprehension and fluency as well as leisure reading of various genres. In addition, the analysis method was chosen to separate within-person and between-person variance in order to overcome the problems of the traditional cross-lagged models. Overall, the results suggested positive associations between leisure reading and reading competence. Importantly, however, the relationship varied as a function of time, leisure

reading genre, and reading competence measure, that is, fluency as opposed to comprehension. An overarching theme in the present results was the mutual positive association between reading comprehension and voluntary book reading. In contrast, digital reading showed a simultaneous negative association. If replicable, the finding has considerable pedagogical relevance not least because the two genres are justifiably depicted as rivals. No consistent pattern was found for consumption of magazines and comic books. Moreover, associations between leisure reading and reading fluency were weak although in lower grades, fluency assumed an instrumental character being a constraint for learning from texts.

With regard to our first research question whether good readers read more than poor readers do (between-person correlations), the models suggested that both fluent reading and good comprehension are positively associated with leisure reading, which supports previous studies (for reviews, see Mol & Bus, 2011; Schiefele et al., 2012). Both slow readers and poor comprehenders read all types of leisure reading genres less than fluent readers and good comprehenders did. Of interest is that this also encompassed digital reading, which has become a highly relevant topic because of its recent explosive growth. There was variation in the strength of the associations, however. The strongest correlation was found between Grade 6–9 reading of books and reading comprehension, and the lowest was found between Grade 6–9 reading of magazines and reading fluency (the only non-significant correlation). The finding that the strongest effects were found for book reading is in line with previous studies (Pfost et al., 2013; Spear-Swerling et al., 2010). Our results add to the previous, mostly cross-sectional, findings of the association between leisure reading and reading skills by showing that the association exists (a) across nine grades from age 7 to 16, (b) for various leisure reading genres, (c) for both parent- and self-reported leisure reading, and for reading fluency

as the cognitively constructed basis for comprehension, but even more strongly in the later years for reading comprehension.

The main focus of the present study was not, however, the between-person correlations but the cross-lagged within-person effects across time. More precisely, we investigated if reading development is the driving force for leisure reading or if increased leisure reading promotes reading skills. In addition, the models controlled for previous levels of the skill and leisure reading (autoregressive effects) whereby the significant cross-lagged paths suggest effects on changes in time. Overall, the cross-lagged paths suggested that during the early grades the predictive cross-lagged paths run from reading fluency and comprehension to leisure reading and not from leisure reading to reading competence. In the later grades, however, active book reading in particular was reciprocally associated with reading comprehension but not with reading fluency. It thus seems that leisure reading does not promote reading fluency but that reading fluency can act as a constraint on leisure reading during the early school years. Skilled reading comprehension, on the other hand, promoted leisure reading in Grades 1 to 9. Importantly, in later grades the relationship was found to be reciprocal and the effects of leisure reading on reading comprehension were stronger than the other way around. The stronger positive effect from leisure reading to reading comprehension was significant across several grade levels for book reading only indicating the that reading comprehension is promoted more strongly by leisure reading of books than other reading materials. It should be noted that the reciprocal mechanism for leisure reading and reading comprehension contradicts the findings of Aarnoutse and van Leeuwe (1998) that reading frequency develops largely independent from reading comprehension in Grades 2 to 6. It is difficult to state the reason for these mixed findings because there are many differences between the studies, extending from age and language context to assessments and analysis methods.

The finding that reading skills predicted the amount of leisure reading supports previous findings (Harlaar et al., 2011; Leppänen et al., 2005; van Bergen et al., 2018), but it further suggests that the effect of reading fluency on leisure reading is limited to the early grades. In addition, the present findings suggest that the predictive association is found even for the within-person variance. That is, we can infer that if a child, irrespective of his/her skill level, develops in reading fluency (during the early grades) or in reading comprehension, it predicts more leisure reading, particularly of books. It seems that during the early primary school grades slow reading can act as a constraint for leisure reading most probably because slow reading hampers comprehension (e.g., Florit & Cain, 2011) and can also impair reading motivation because slow readers may not get experiences of enjoyment or competence from reading (e.g., Becker et al., 2010). Once reading becomes fluent enough, children can become more interested in leisure reading and, possibly, choose more advanced texts. Therefore, the impact of reading fluency on leisure reading should decrease, and so it did in the present study when the initially significant effect of reading fluency on leisure reading disappeared after Grade 4. Interestingly, unlike reading fluency, reading comprehension continued to be a significant promoter of leisure book reading still in junior secondary grades. Functioning reading comprehension is based on meaning-making. Therefore, it can also act as a driver when more advanced leisure reading material is chosen by the student.

Leisure reading did not promote reading fluency at any time point although fast readers on average read more. This is in line with previous longitudinal studies of leisure reading and reading development that have used composite scores of reading competence instead of reading fluency (Harlaar et al., 2011; Leppänen et al., 2005) in the shorter follow-ups. It is important to note, however, that this finding does not refute the idea that reading automatization is promoted by reading more. Leisure reading is not the only context where reading is practiced. Particularly during the early grades when decoding and fluency develop,

reading instruction focuses heavily on teaching of basic reading skills and children who are not keen on leisure reading also get plenty of daily practice.

If avid reading does not appreciably improve reading fluency, is it justifiable to conclude that recommendations for outside-school reading are ill-founded from the perspective of skills? The answer is definitively no. The evidence is clear that other skills, with the exception of decoding, may benefit from frequent leisure reading, such as vocabulary, syntax, or background knowledge (e.g., Hirsch, 2003; Mol & Bus, 2011; Nagy & Herman, 1987). These skills are particularly important for reading comprehension development (e.g., Florit & Cain, 2011). In support of this, we found that most cross-lagged paths from leisure reading (parental reports and self-reported book reading) to subsequent reading comprehension were significant and positive. These paths suggest that leisure reading (of books in particular) supports reading comprehension. As we did not find associations from leisure reading to reading fluency, it is likely that leisure reading was not affecting reading comprehension via the improvement of reading fluency or reading automatization through more frequent encounters with words (e.g., Share, 1995) but rather via the improvement of other skills and knowledge needed in reading comprehension, such as increased vocabulary or syntax knowledge. The finding is also in line with studies that have focused on the effects of print exposure of younger children via parent–child shared reading (e.g., Sénéchal & LeFevre, 2002; Torppa, Poikkeus, Laakso, Eklund, & Lyytinen, 2006; Torppa et al., 2007). These studies have shown that linguistic skills such as vocabulary and listening comprehension are supported by book reading whereas code-related skills are supported more by direct teaching.

Not all types of reading materials were as important for reading comprehension, however. Unlike book reading, newspapers and comics reading as well as magazine reading did not promote it. Furthermore, the consumption of digital texts (Grade 6) even had a negative path to reading comprehension (Grade 7), suggesting that more frequent reading of

digital texts in Grade 6 predicts weaker reading comprehension in Grade 7. A similar finding was reported by Pfost et al. (2013) among German students in Grade 5 and Grade 7. In our sample, the negative association also emerged for reading fluency. However, drawing strong conclusions from the obtained negative correlation must be done with a caveat in mind because we assessed print reading competence and it has been suggested that online and print reading skills may not overlap (Goldman et al., 2012; Leu et al., 2014). Research on digital reading is constantly developing and future studies may be able to examine in more detail the associations between leisure reading genres and both digital and print reading skills. For example, a focus on information content as opposed to social participation likely results in different reading strategies (Naumann, 2015). In sum, our results suggest that for comprehension of continuous printed text, book reading was a superior predictor while the early onset of digital text consumption (possibly at the expense of print reading) had a negative association with print reading skills.

While adding to the current research on leisure reading and reading development, our study has several limitations that future studies should address. First, even though they are based on a longitudinal sample and RI-CLPM modeling, our findings can only suggest causal effects, not prove them. There could be third factors not included in the models which may have affected the results. In an ideal world, well-controlled and sufficiently long interventions would give more definitive answers. So far, no such study exists. Even in the present non-invasive setting, controlling for third factors is extremely difficult because of the required length of the follow-up.

Second, the assessment of leisure reading was based on parental reports and self-reports. The change in informant and scale in the middle of the follow-up was unfortunate and limits the inferences we can make about developmental changes. Our decision was based on the view that parents are better evaluators of children's reading amount

in the early grades while children themselves do a better job during the later grades. Despite the change of questionnaire items and respondent, the models showed good stability from the early grades (1–4) to the later grades (6–9) in leisure reading. Stability was strongest for the self-reported book reading and newspapers and comics reading, which is understandable because these items were similar in parental reports and self-reports. Had we had the same items across time, the correlations might have been stronger. Correlations might have been stronger also if we had had higher reliability for the leisure reading constructs. The internal consistency estimates (Cronbach alphas) were weak particularly for magazines, newspapers, and digital reading. Assessment of leisure reading is, however, challenging. Both parental and self-reports have been criticized for being biased towards social desirability (e.g., Sénéchal, LeFevre, Hudson, & Lawson, 1996; Stanovich & West, 1989). In their meta-analysis, Mol and Bus (2011) were able to compare studies of school-aged children and college students who had completed both checklists and self-reports, and found that the two measures produced overlapping results. It appears that the risk of bias is accentuated when parents report their literacy activities with pre-readers by answering a single question. There are also problems with the recognition lists because children and youth often read books representing a certain genre (e.g., fantasy, romance or sports) and despite being an active reader, the respondent may not know titles or authors of books from other genres. A further issue is that identification of names from foils requires linguistic skills that also differentiate poor and skilled readers. Therefore, the task may not only tap print exposure but also linguistic skills, memory skills, and reading skills.

The third limitation is that we could use only one reading comprehension task and thus we were unable to eliminate measurement error from the analyses. Unfortunately, in a frequently repeated data collection on around 2,000 children it was not possible to include more tasks. In addition, data were not available for two grade levels, 5th and 8th, which

causes a longer time interval between some assessments. It is possible that stronger associations could have been found during the later grades had we had these time-points included. Future studies should address this issue to achieve a better reliability of reading comprehension assessment. With the short scale and only one text at each age, our models are likely showing weaker associations between measures and lower fit estimates than what could be found with stronger measures. It would also be important to use something other than print comprehension as the reading comprehension material. The present correlations with printed book reading might be inflated because book reading and our reading comprehension texts resemble each other.

Fourth, the present study was conducted in Finnish and should be replicated in other linguistic contexts. The transparency of Finnish orthography makes learning to read relatively easy and supports fast reading acquisition featuring very accurate decoding and reasonably good fluency from Grade 2 onwards (e.g., Seymour, Aro, & Erskine, 2003). In other orthographies the associations between reading skills and amount may differ, with reading skills, for example, acting as a constraint for leisure reading for a longer time.

In conclusion, the present study contributes to knowledge of the role leisure reading plays in the development of reading fluency and reading comprehension skills. The findings related to reading fluency development and leisure reading frequency fitted best with the idea that the effects run from reading fluency to leisure reading, but only during the early grades when decoding ability can still act as a constraint. The findings for reading comprehension, on the other hand, suggested reciprocal associations over time (e.g., Mol & Bus, 2011). The reciprocal interpretation makes it possible to envisage that over time the so-called rich-get-richer and poor-get-poorer pathways, or Matthew effects (Stanovich, 1986), can emerge. This means that as the poor comprehenders read less, their skills increasingly lag behind those of good comprehenders. Once in progress, such a development has long-

reaching effects on school achievement and later vocational choices. Importantly, because the cross-lagged effects were found at the within-person level the findings are not due to differences between individuals but due to changes in time within each child. That is, irrespective of the individual's overall level in leisure reading, increased leisure reading consumption can promote reading comprehension. These findings underline the importance of leisure reading for reading comprehension development and suggest that we should pay close attention to the development of reading interest from early grades onwards. This is particularly important for the poorest readers who are at particular risk for not developing a positive attitude to reading when poor skills hamper the interest in leisure reading during the early grades. Based on our findings, it is justifiable to conclude that parents and teachers would be advised to see fostering early reading interest as an ally of teaching reading skills, not as a rival.

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Table 1

Descriptive Statistics for Leisure Reading, Reading Fluency, and Reading Comprehension Measures Across Time

	n	Min	Max	M	sd	Skewness	Kurtosis
Reading fluency composite							
Grade 1	2052	-2.11	3.48	0.00	0.86	0.62	0.44
Grade 2	2006	-2.47	3.31	0.00	0.85	0.26	0.23
Grade 3	1995	-3.82	2.75	0.00	0.86	-0.04	0.43
Grade 4	1954	-4.01	2.39	0.00	0.87	-0.17	0.30
Grade 6	1822	-3.00	2.74	0.00	0.84	0.12	-0.07
Grade 7	1770	-3.66	2.65	0.00	0.87	-0.07	0.00
Grade 9	1721	-2.60	2.60	0.00	0.87	-0.09	-0.14
Reading comprehension							
Grade 1	2035	0	12	5.50	3.18	0.00	-0.96
Grade 2	1974	0	12	8.52	2.71	-0.73	-0.20
Grade 3	1988	0	12	9.09	2.17	-1.17	1.72
Grade 4	1950	0	12	8.10	2.52	-0.47	-0.34
Grade 6	1821	0	12	7.15	2.55	-0.20	-0.59
Grade 7	1758	0	12	6.59	2.54	0.05	-0.64
Grade 9	1702	0	12	7.02	2.43	-0.15	-0.57
Leisure reading composite							

Grade 1	1484	1	5	2.62	0.86	0.39	-0.34
Grade 2	1459	1	5	2.83	0.89	0.09	-0.58
Grade 3	1365	1	5	2.91	0.89	0.03	-0.52
Grade 4	1288	1	5	2.98	0.88	-0.09	-0.53
Book reading							
Grade 6	1816	1	5	2.57	1.17	0.57	-0.61
Grade 7	1762	1	5	2.22	1.14	1.02	0.10
Grade 9	1710	1	5.5	1.95	1.06	1.50	1.88
Magazine reading							
Grade 6	1810	1	5	1.77	0.87	1.17	0.85
Grade 7	1737	1	5	1.72	0.84	1.30	1.46
Grade 9	1706	1	5	1.47	0.69	1.95	4.45
Newspapers and comics reading							
Grade 6	1813	1	5	2.27	0.79	0.44	-0.27
Grade 7	1737	1	5	2.28	0.83	0.38	-0.49
Grade 9	1706	1	5	2.06	0.77	0.53	-0.22
Digital texts							
Grade 6	1813	1	5	2.60	0.97	0.28	-0.63
Grade 7	1738	1	5	2.44	0.89	0.48	-0.25
Grade 9	1706	1	5	2.42	0.84	0.31	-0.38

Note that the measures for reading fluency and leisure reading composites were calculated as averages of the measures except for reading comprehension.
Note that reading fluency measures are within-age standardized scores.

Table 2

Standardized Model Estimates for Reading Fluency (Models 1-4): Between-Person Correlations, Within- Person Cross-lagged Estimates and Grade 1 Within-Person Correlation

	Model 1: Grade 6-9 Books	Model 2: Grade 6-9 Magazines	Model 3: Grade 6-9 Newspapers & comics	Model 4: Grade 6-9 Digital texts
Between – person correlations				
Leisure reading Grade 1-4 x Leisure reading Grade 6-9	.41***	.14*	.33***	.18**
Leisure reading Grade 1-4 x Reading skill level	.46***	.45***	.45***	.46***
Leisure reading Grade 6-9 x Reading skill level	.44***	.09	.30***	.38***
Within- person correlation Grade 1	.53***	.45***	.45***	.44***
Within- person cross-lagged paths from skill to leisure reading				
Grade 1_{RF} → Grade 2_{PE}	.21*	.18*	.17*	.16*
Grade 2_{RF} → Grade 3_{PE}	.01	-.03	-.03	-.03
Grade 3_{RF} → Grade 4_{PE}	.20**	.18**	.17*	.16*
Grade 4_{RF} → Grade 6_{SE}	-.03	.14	-.06	.10
Grade 6_{RF} → Grade 7_{SE}	.01	.15*	-.03	-.07
Grade 7_{RF} → Grade 9_{SE}	-.01	.19	-.02	.12
Within- person cross-lagged paths from leisure reading to skill				

Grade 1_{PE} → Grade 2_{RF}	-.01	-.03	-.03	-.03
Grade 2_{PE} → Grade 3_{RF}	.03	.04	.03	.03
Grade 3_{PE} → Grade 4_{RF}	.06	.06	.07	.06
Grade 4_{PE} → Grade 6_{RF}	.07	.07	.06	.05
Grade 6_{SE} → Grade 7_{RF}	.06	.05	-.03	-.11*
Grade 7_{SE} → Grade 9_{RF}	.08*	.04	.02	.04

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

PE= Parent evaluation(same items across Grade 1-4) , SE= Self-evaluated (differs in the models), RF= Reading fluency

Table 3

Standardized Model Estimates for Reading Comprehension (Models 5-8): Between-Person Correlations, Within-Person Cross-lagged Estimates and Grade 1 Within-Person Correlation

	Model 5: Grade 6-9 Books	Model 6: Grade 6-9 Magazines	Model 7: Grade 6-9 Newspapers & comics	Model 8: Grade 6-9 Digital texts
Between –person correlations				
Leisure reading Grade 1-4 x Leisure reading Grade 6-9	.37***	.19**	.32***	.18**
Leisure reading Grade 1-4 x Reading skill level	.40***	.45***	.46***	.43***
Leisure reading Grade 6-9 x Reading skill level	.53***	.14*	.21***	.31***
Within-person correlation Grade 1	.36***	.32***	.31***	.32***
Within-person cross-lagged paths from skill to leisure reading				
Grade 1_{RC} → Grade 2_{PE}	.17***	.17***	.16***	.17***
Grade 2_{RC} → Grade 3_{PE}	.14**	.11**	.10*	.13**
Grade 3_{RC} → Grade 4_{PE}	-.01	-.03	-.03	-.02
Grade 4_{RC} → Grade 6_{SE}	.10*	-.04	-.07	-.21***
Grade 6_{RC} → Grade 7_{SE}	.12**	.07	-.05	-.01
Grade 7_{RC} → Grade 9_{SE}	.05	-.05	.06	.10

Within person cross-lagged paths from leisure reading to skill				
Grade 1_{PE} → Grade 2_{RC}	.15*	.10	.09	.12*
Grade 2_{PE} → Grade 3_{RC}	.08	.01	.01	.03
Grade 3_{PE} → Grade 4_{RC}	.34***	.26***	.25***	.28***
Grade 4_{PE} → Grade 6_{RC}	.23***	.16**	.15*	.17**
Grade 6_{SE} → Grade 7_{RC}	.28***	.00	.04	-.17**
Grade 7_{SE} → Grade 9_{RC}	.27***	-.05	-.06	.04

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

PE= Parent evaluation (same items across Grade 1-4) , SE= Self-evaluated (differs in the models), RC= Reading comprehension

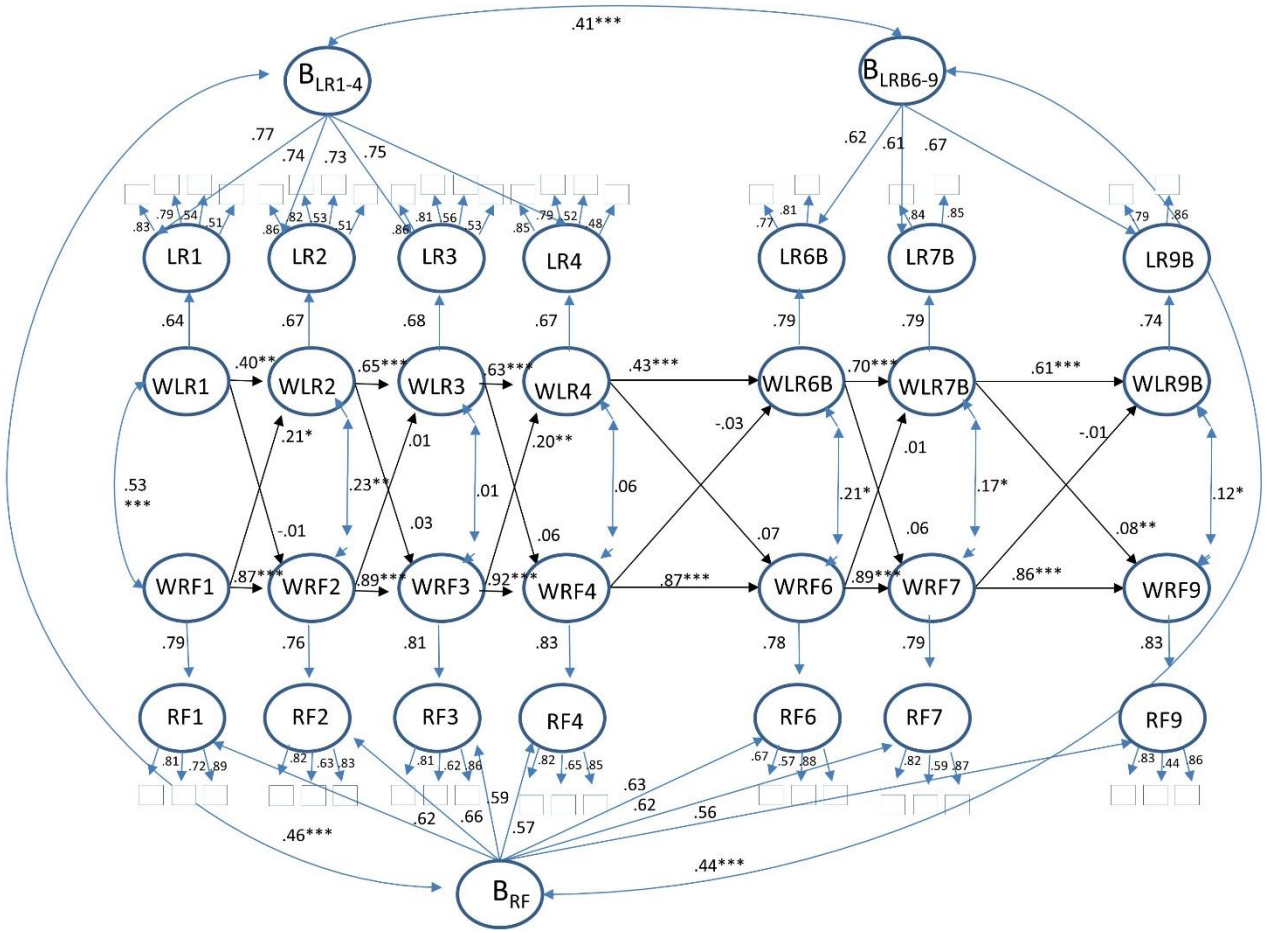

Figure 1

Model for the developmental relations of reading fluency and leisure reading of books (Model 1)

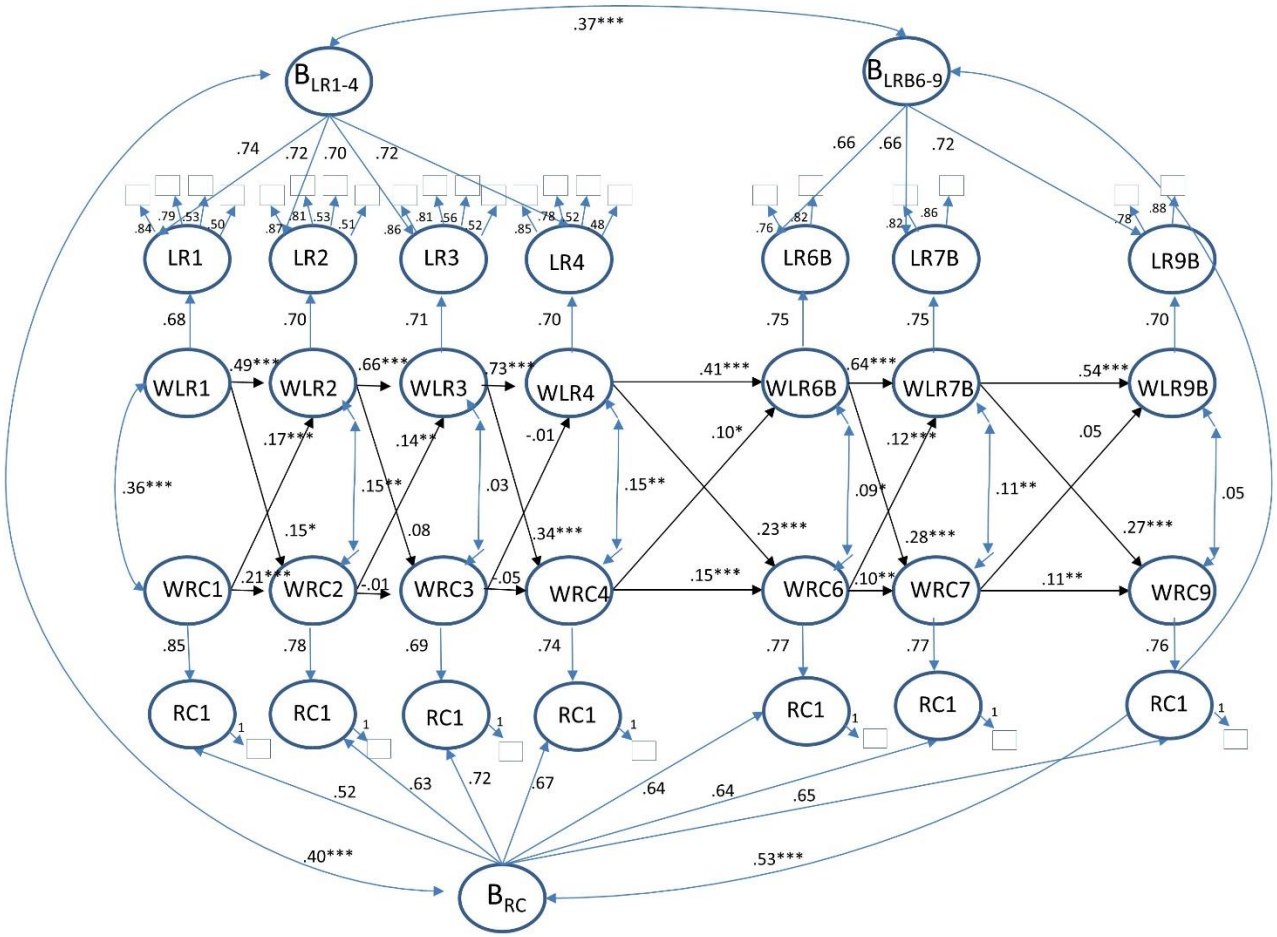

Figure 2

Model for the developmental relations of reading comprehension and leisure reading of books (Model 5)

Appendix

Appendix Table 1

Pearson Correlation Coefficients for the Composite Measures

		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Reading fluency																														
1	Grade 1	.80	.75	.71	.67	.61	.58	.63	.48	.33	.38	.31	.26	.29	.41	.36	.29	.30	.20	.19	.17	.12	.09	.09	.15	.11	.11	.13	.12	.14
2	Grade 2	1	.82	.79	.73	.67	.64	.60	.49	.35	.39	.34	.30	.32	.38	.38	.30	.33	.22	.20	.18	.10	.09	.08	.13	.09	.10	.11	.10	.13
3	Grade 3		1	.85	.78	.71	.67	.55	.47	.34	.40	.31	.26	.28	.36	.36	.28	.32	.20	.18	.14	.12	.11	.10	.13	.10	.11	.12	.11	.14
4	Grade 4			1	.81	.75	.72	.56	.47	.37	.41	.35	.30	.30	.35	.37	.30	.33	.21	.20	.16	.12	.13	.08	.12	.10	.09	.11	.09	.13
5	Grade 6				1	.79	.77	.50	.46	.34	.38	.36	.31	.30	.31	.34	.32	.32	.24	.22	.19	.16	.16	.11	.12	.08	.07	.11	.09	.10
6	Grade 7					1	.81	.47	.43	.34	.41	.39	.37	.36	.32	.35	.36	.35	.26	.27	.23	.17	.19	.14	.15	.14	.13	.07	.08	.13
7	Grade 9						1	.45	.43	.36	.39	.38	.39	.40	.30	.33	.33	.36	.29	.28	.25	.20	.19	.14	.12	.11	.12	.08	.09	.15
Reading comprehension																														
8	Grade 1							1	.53	.39	.44	.42	.36	.37	.36	.36	.31	.32	.25	.23	.20	.06	.03	.05	.11	.09	.12	.03	.08	.15
9	Grade 2								1	.48	.55	.49	.46	.43	.27	.33	.33	.33	.28	.28	.23	.03	.01	.03	.09	.11	.09	-.04	.08	.12
10	Grade 3									1	.47	.42	.40	.36	.21	.27	.24	.26	.24	.23	.19	.09	.08	.08	.06	.08	.10	.03	.04	.12
11	Grade 4										1	.57	.51	.44	.26	.34	.36	.38	.32	.31	.30	.06	.07	.08	.08	.09	.15	-.08	.04	.15
12	Grade 6											1	.49	.47	.19	.27	.32	.30	.30	.32	.25	.02	.06	.05	.11	.09	.15	-.06	.04	.13
13	Grade 7												1	.51	.20	.27	.27	.31	.33	.34	.30	.06	.04	.03	.09	.09	.13	-.06	.04	.14
14	Grade 9													1	.17	.21	.26	.27	.33	.36	.32	.05	.03	.05	.05	.04	.13	-.06	.05	.14
Leisure reading																														
15	Grade 1														1	.70	.59	.58	.23	.21	.20	.14	.09	.07	.18	.16	.13	.03	.06	.09
16	Grade 2															1	.73	.68	.29	.24	.22	.14	.13	.07	.24	.19	.12	.02	.05	.09
17	Grade 3																1	.75	.34	.33	.25	.11	.10	.08	.25	.24	.18	.00	.08	.10
18	Grade 4																	1	.38	.35	.29	.15	.15	.11	.23	.22	.17	-.01	.08	.10
Book reading																														
19	Grade 6																		1	.66	.52	.28	.23	.18	.19	.11	.13	.00	.11	.14

20	Grade 7	1	.65	.19	.22	.19	.13	.16	.16	-.07	.09	.15
21	Grade 9		1	.23	.21	.29	.08	.08	.22	-.04	.08	.18
Magazine reading												
22	Grade 6			1	.59	.44	.15	.05	.04	.32	.24	.17
23	Grade 7				1	.48	.09	.20	.09	.27	.32	.18
24	Grade 9					1	.02	.06	.21	.17	.18	.25
Newspapers and comics reading												
25	Grade 6						1	.59	.47	.06	.07	.10
26	Grade 7							1	.55	-.03	.12	.09
27	Grade 9								1	-.04	.05	.24
Digital texts												
28	Grade 6									1	.45	.23
29	Grade 7										1	.40
30	Grade 9											1

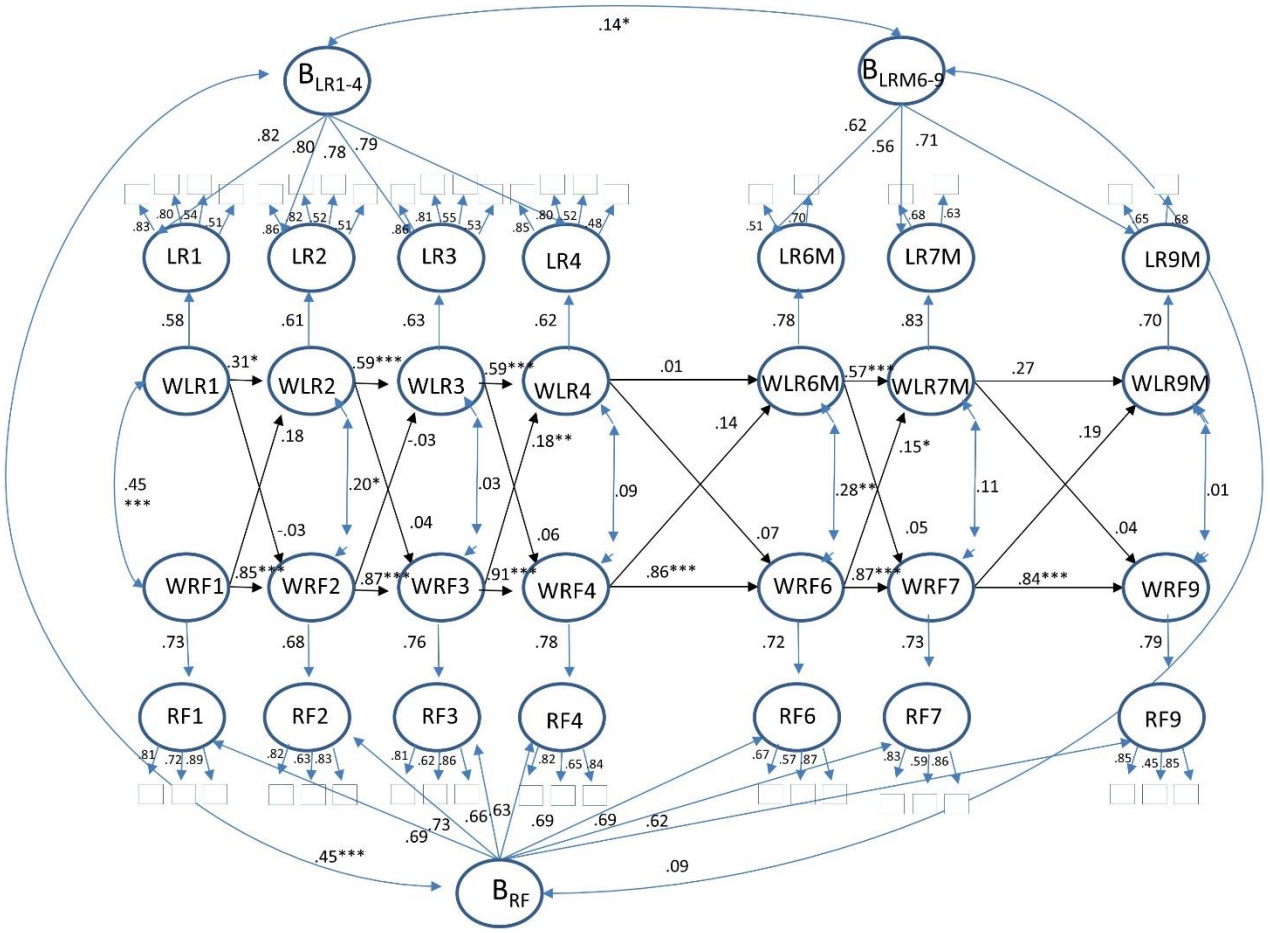

Figure 1 APPENDIX

Model for the developmental relations of reading fluency and leisure reading of magazines (Model 2)

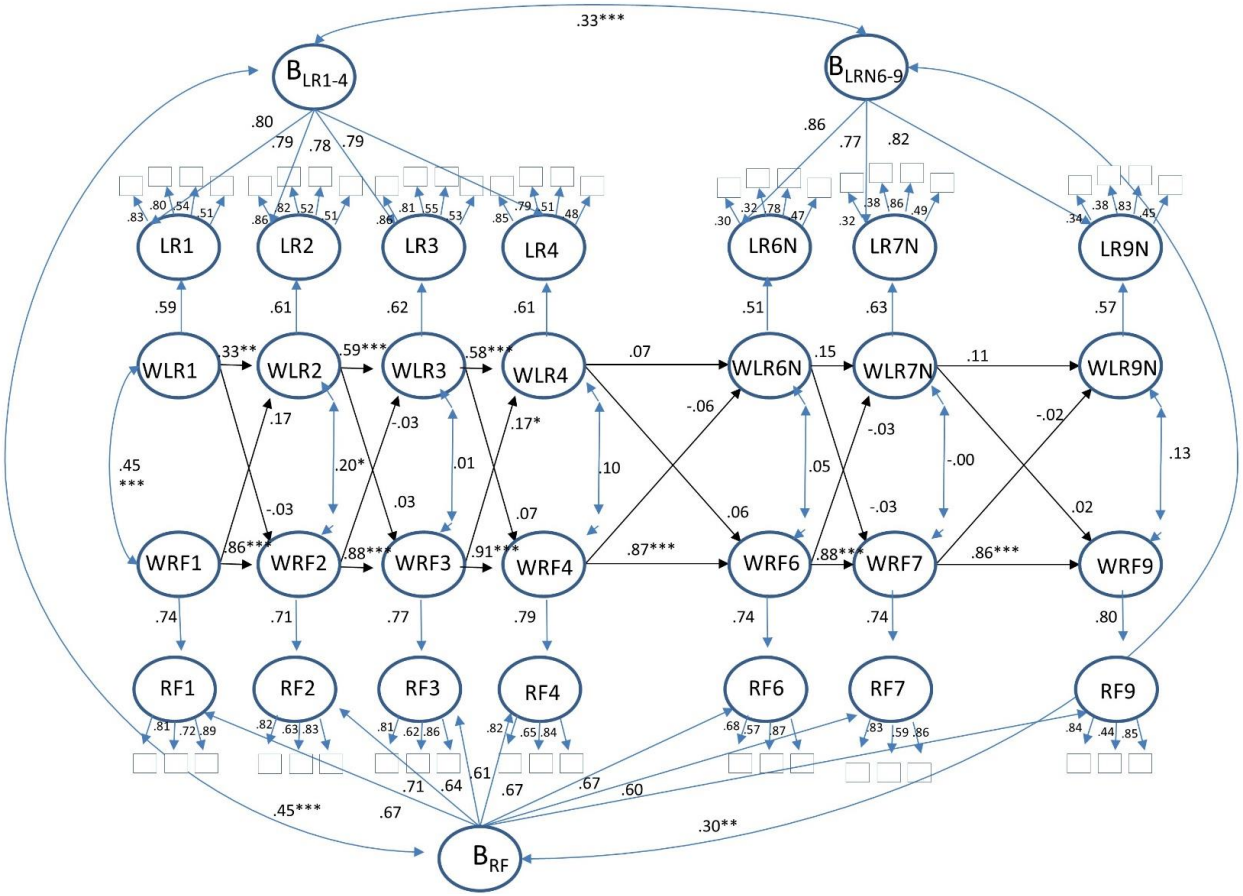

Figure 2 APPENDIX

Model for the developmental relations of reading fluency and leisure reading of newspapers and comics (Model 3)

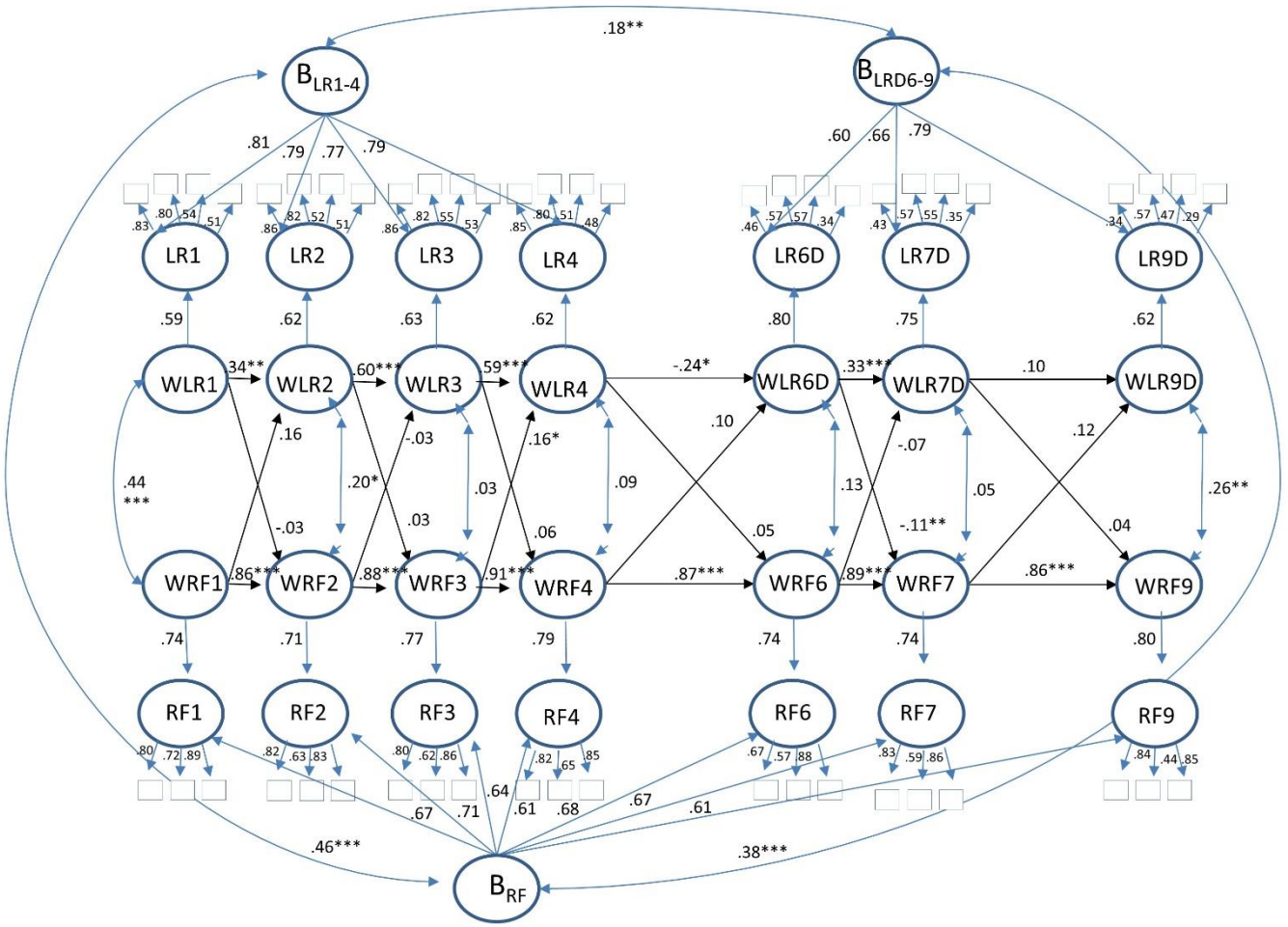

Figure 3 APPENDIX

Model for the developmental relations of reading fluency and leisure reading of digital texts (Model 4)

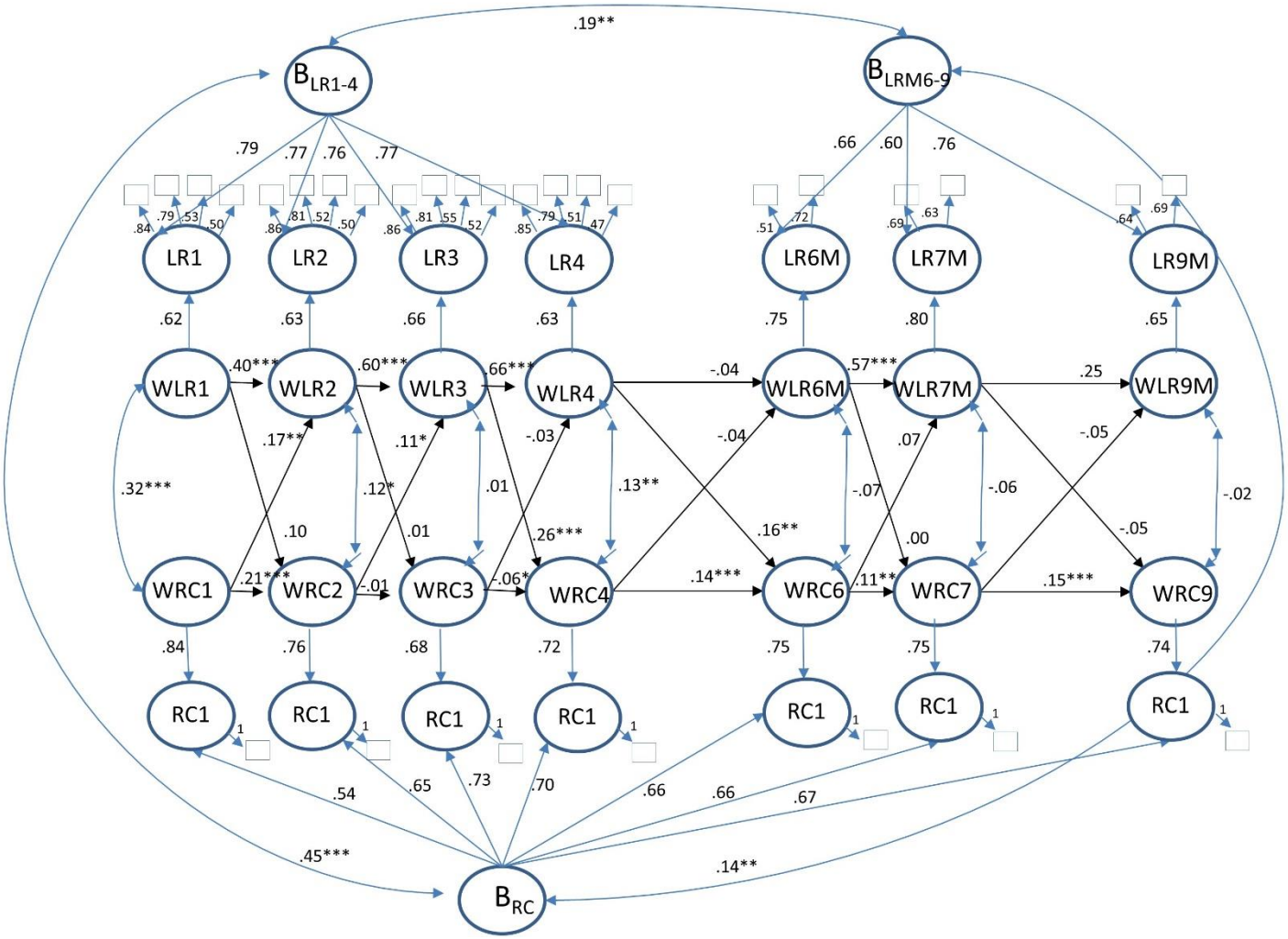

Figure 4 APPENDIX

Model for the developmental relations of reading comprehension and leisure reading of magazines (Model 6)

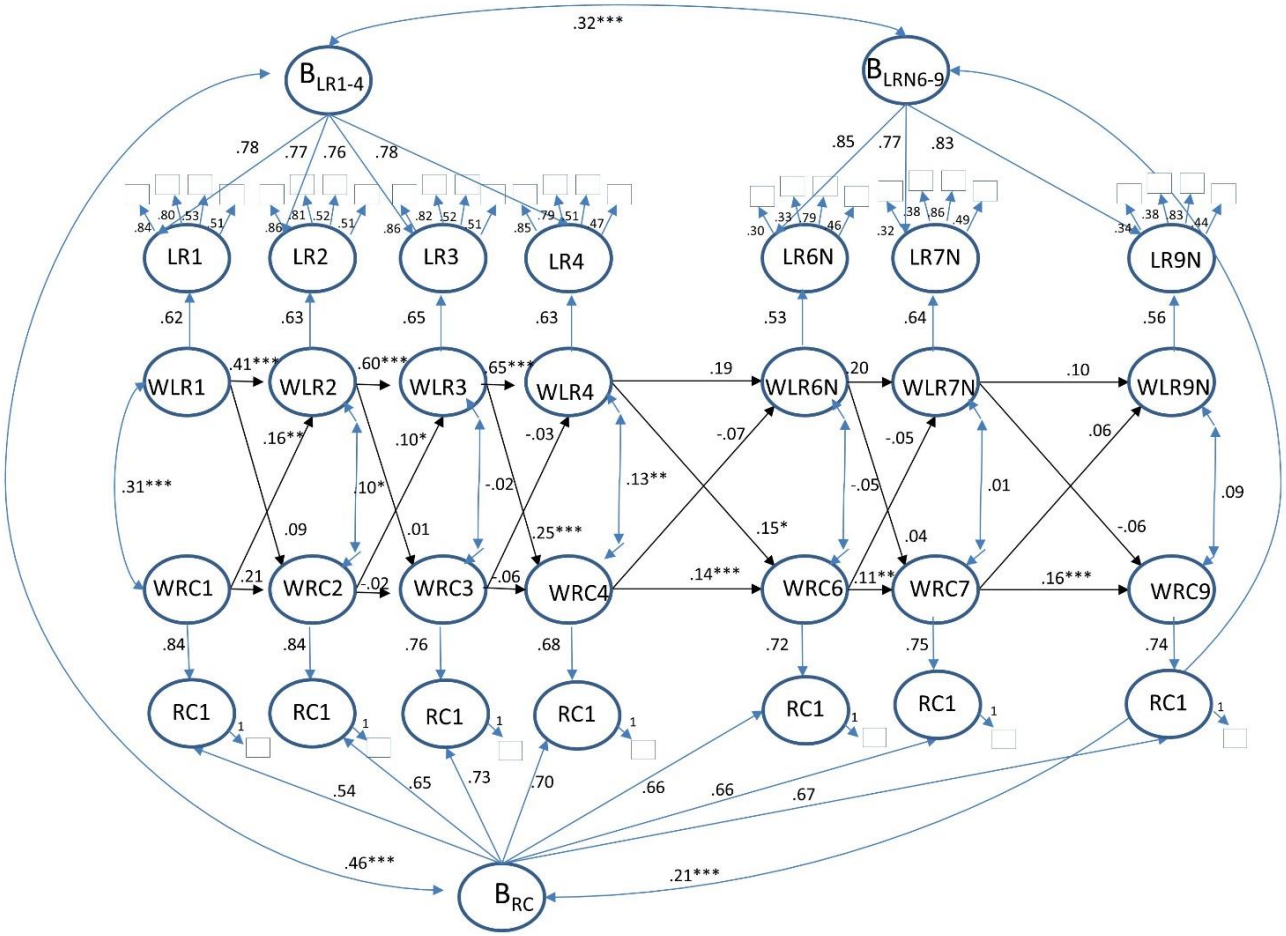

Figure 5 APPENDIX

Model for the developmental relations of reading comprehension and leisure reading of newspapers and comics (Model 7)

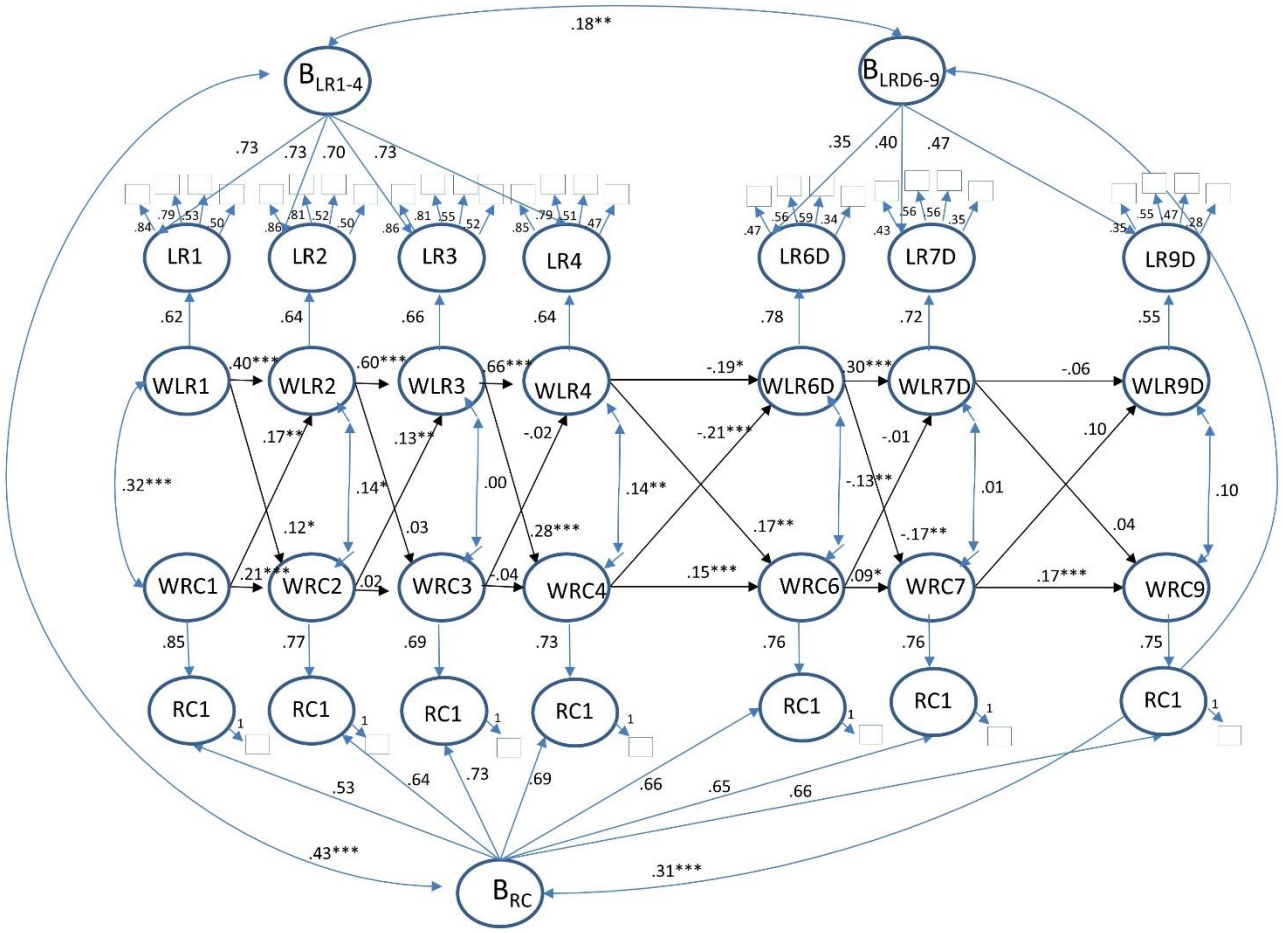

Figure 6 APPENDIX

Model for the developmental relations of reading comprehension and leisure reading of digital texts (Model 8)