

Students' Extracurricular Reading Behavior and the Development of Vocabulary and Reading Comprehension^{1,2}

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Abstract This study investigated the role of extracurricular reading behavior in the development of reading literacy. Whereas previous research has focused mostly on bivariate relations between one or several measures of these two variables, the present study analyzed the role of several reading activities together. Furthermore, it assessed distinct patterns of extracurricular reading behavior composed of traditional print media and new forms of reading on the Internet. Participants were 1,226 secondary school students from the Bamberg BiKS longitudinal study. Results confirmed the importance of traditional book reading for the development of reading comprehension and vocabulary. In contrast, online activities such as e-mail or chatting related negatively to reading achievement. Furthermore, students could be classified to five distinct latent classes in terms of their extracurricular reading behavior. The role of reading traditional print media for students' literacy development as well as possible reasons why it cannot be compensated adequately by online reading activities are discussed critically.

Keywords: *reading literacy development, reading behavior, vocabulary, secondary school, Internet*

1. Introduction

Individual differences in the development of cognitive competencies are the product of a large number of interacting individual and environmental variables (Fraser, Walberg, Welch, & Hattie, 1987; Hattie, 2009; Scarr, 1992). Researchers in educational psychology have tried to separate the causes of these individual differences and to describe their magnitude, mechanisms, as well as their interrelations. When it comes to individual differences in reading literacy, students' reading behavior is a prominent explanatory variable (Cunningham & Stanovich, 2001), and reading behavior is often seen as one cause of low reading literacy (e.g., Watkins & Edwards, 1992). However, most studies have focused on unconditional relationships between a measure of time spent reading and facets of reading literacy, and they have neglected the influence of other important variables or alternative explanations. Consequently, we need to ask whether the sheer amount of time spent reading is important for the acquisition of reading literacy, or whether additional variables are crucial for this relation. For example, does an equal amount of time spent reading newspapers versus reading books exert an equal influence on the development of reading comprehension? What about reading on the Internet with its unique language specifics (cf. Crystal, 2006; Schlobinski, 2006)? And how do these relationships change once important third variables such as the students' familial and social background are controlled?

1.1 Reading Behavior, the Development of Reading Comprehension and Vocabulary, and Matthew effects in Reading

It would seem obvious to assume a relationship between the time individuals spend reading and both their vocabulary and their reading comprehension. Therefore, we shall start with some theoretical arguments on why reading as a practice fosters the development of reading comprehension and vocabulary, before going on to discuss empirical results and the shortcomings of past research on the relationship between reading behavior and competence development.

Several suggestions have been made as to why reading increases reading comprehension (Guthrie, Wigfield, Metsala, & Cox, 1999): First, reading might lead to an increase in prior knowledge because of the gain in information. The more prior knowledge, the more retrieval structures are readily available, and this might support text comprehension (Kintsch & Rawson, 2005). In other words, knowing something about climate change prior to reading a journal article about carbon dioxide and global warming, as well as knowing something about the typical structure of such a text, will facilitate the comprehension of that specific article (Baldwin, Peleg-Bruckner, & McClintock, 1985; Purcell-Gates, Duke, & Martineau, 2007). Additionally, more reading might enhance reading efficiency by increasing the automaticity of the processes needed for comprehension (e.g., decoding skills or practice

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in an effective use of reading strategies may both free resources for higher comprehension processes; Perfetti, Landi, & Oakhill, 2005). A third common explanation is that frequent reading might influence a student's self-concept and self-efficacy beliefs. Individuals who believe that they have the capability and competence to read a certain text are, for example, more likely to persist in reading despite the presence of obstacles or to maximize their cognitive activities in order to understand the text (Guthrie & Wigfield, 2000; Schunk, 1989, 2003). Moreover, students may extend their vocabulary by incidentally learning new word meanings from the reading context (Drum & Konopak, 1987; Jenkins, Stein, & Wysocki, 1984; Saragi, Nation, & Meister, 1978)—a position labeled the *input hypothesis* (Krashen, 1989). Additionally, written language provides particular contact with low-frequency words in comparison to other learning opportunities such as watching television or informal conversation (Hayes & Ahrens, 1988).

A further important concept supporting the assumption that reading experience triggers the development of reading competencies is the idea of Matthew effects or cumulative disadvantages or advantages in reading (Stanovich, 1986, 2000; Walberg & Tsai, 1983): Small initial differences in reading achievement or reading-related skills may well increase over time due to the self-reinforcing mechanisms that drive this developmental pattern. Indeed, exposure to print and self-initiated reading behavior have been stressed as underlying mechanisms of this effect (Aunola, Leskinen, Onatsu-Arviolommi, & Nurmi, 2002; Pfof, Dörfler, & Artelt, 2012; Stanovich, 1986). Free reading, characterized by authentic reading experience (cf. Purcell-Gates, et al., 2007), fosters the development of reading skills, and reading volume further increases as reading becomes more efficient (Harlaar, Dale, & Plomin, 2007; Morgan & Fuchs, 2007; OECD, 2010). We may call this pattern the “virtuous circle of reading” in contrast to the “vicious circle of nonreading.” Taken together, the Matthew effect model in reading highlights a mutual dependency of both cognitive and behavioral measures. Furthermore, due to increasing achievement differences over time, we might expect stronger relations between measures of print exposure and reading skills as students grow older (Mol & Bus, 2011).

1.2 Time Spent Reading, Reading Exposure, and Achievement Growth

Relationships between simple measures of time spent reading or reading exposure and reading comprehension or vocabulary have been studied repeatedly. For example, in their classic analysis of data from 13-year-old students participating in the National Assessment of Educational Progress (NAEP) study, Walberg and Tsai (1984) showed that after controlling for several other indicators, the

frequency of reading for enjoyment was linked positively to a reading achievement score. Furthermore, the data were consistent with a model of diminishing returns over time, which means that the additional competence gain per unit of time spent doing extra reading decreases with the total amount of time spent reading. Smith's (1996) analysis of reading proficiency levels among adults participating in the National Adult Literacy Survey (NALS) revealed a comparable pattern, and Watkins and Edwards (1992) showed that the total time spent reading at home in a sample of 3rd- to 6th-grade students, on average 79 min per month, significantly predicted a reading achievement score, even after taking a prior reading score into account. However, only about 1% of the total variance in reading achievement was explained incrementally by extracurricular reading. Nonetheless, Taylor, Frye, and Maruyama (1990) were unable to confirm these results. Members of their sample of 5th- and 6th-grade students reported reading an average of 15 min per day at home and about 16 min per day during reading class in school. A multiple regression taking prior reading comprehension into account indicated a significantly positive effect of min per day reading in school on reading achievement but a nonsignificant effect of min per day reading at home. Both variables together explained about 2% of the total variance in reading achievement.

Cipielewski and Stanovich (1992) took a different approach to analyze the effect of amount of reading on reading comprehension. Instead of asking directly for time spent reading, the authors developed two measures called the Title Recognition Test (TRT) and the Author Recognition Test (ART). In both tests, students are given a list of authentic and fictitious children's book titles (TRT) or authors (ART), and asked to indicate whether they recognize the title or author. Both tests seem to be valid indicators of print exposure, especially book reading (Allen, Cipielewski, & Stanovich, 1992). Cipielewski and Stanovich (1992) showed that both measures of print exposure significantly predicted different measures of reading comprehension and reading speed. Positive relationships between these measures of print exposure and different linguistic competence measures have been replicated several times. In a recent meta-analysis focusing on print exposure checklists (ARTs, TRTs, and Magazine Recognition Tests [MRT]), Mol and Bus (2011) reported moderate correlations of print exposure to reading comprehension ($r = .36$) and vocabulary/oral language skills ($r = .45$) for school students. Furthermore, correlations between print exposure and vocabulary/oral language skills increased with students' age. This finding can be interpreted as reflecting the reciprocal causal status of reading behavior and reading achievement related to the Matthew effect in reading (Stanovich, 1986). However, reading comprehension revealed stable correlations to print exposure checklists across

different age groups. Finally, print exposure measured by ART was highly related to print exposure measured by MRT. However, ART revealed stronger correlations to almost all reading achievement measures than MRT. In summary, these studies indicate that time spent reading contributes positively to the development of students' reading literacy. However, the reported studies mostly measured overall time spent reading, leaving the question of different influences of different types of reading material unanswered.

1.3 Different Types of Reading Material, Reading Comprehension, and Vocabulary

Different types of reading material or text genres not only reflect characteristic communicative functions that accompany different types of text but also impose unique demands on the reader in order to comprehend the provided text. Expository texts in newspapers or magazines, for example, are often characterized by simple words and short phrases in order to be easy for a large audience to understand, and they try to avoid passive phrase constructions to minimize the distance to the reader. Narrative texts, in contrast, often contain metaphors, explicit and implicit indications, or missing information that the reader has to infer alone (Gehrer & Artelt, 2013). Consequently, it seems worth asking whether the habitual reading of different types of reading material provides equal conditions for improving secondary school students' reading skills.

The question how different types of reading material influence reading comprehension and vocabulary was first addressed by Anderson, Wilson, and Fielding (1988). Fifth-grade students were motivated to fill out an activity form each school day documenting their out-of-school activities on the previous day for either an 8- or 26-week period. On average, students indicated spending about 10 min each day on reading books, 5 min on reading newspapers and magazines, 2 min on comics, and about 1 min on letter mail. Furthermore, the results indicated a very high variability in time spent reading. For example, students at the 10th percentile rank spent less than 2 min overall on reading each day, whereas students at the 90th percentile rank spent more than 40 min overall on reading. When analyzing the influence of reading activities on reading comprehension status in Grade 5 and reading comprehension development between Grades 2 and 5, results indicated a significant positive effect of book reading on status in Grade 5 as well as on reading achievement development between Grades 2 and 5, and a small but significant negative effect of reading letter mail on reading achievement status. Reading comics and newspapers made no further contribution to the prediction of reading comprehension. With regard to vocabulary, reading books was linked positively and reading letter mail was linked negatively to 5th-grade vocabulary status, but both measures were not linked

to vocabulary development. However, reading comics was linked positively to vocabulary development. In a recent study, Spear-Swerling, Brucker, and Alfano (2010) generally confirmed Anderson et al.'s (1988) and Cipelewski and Stanovich's (1992) results in a sample of 6th-grade students. Reading fiction books as well as scores on an updated ART correlated positively with measures of reading comprehension and vocabulary. Furthermore, reading newspapers related positively to vocabulary in Grade 6. However, reading nonfiction books correlated negatively with reading comprehension. Further analyses indicated that students performing well on measures of reading comprehension tended to voluntarily read longer and more difficult books than their less well performing peers.

Finally, results from the Programme for International Student Assessment (PISA) provide further evidence for the need to take the type of reading material into account when investigating the relationship between reading behavior and reading comprehension. On average, results based on a sample of about 470,000 fifteen-year-old students from the 65 countries participating in PISA 2009 indicated that the amount of fiction reading (novels, narratives, and stories) related highly positively to reading literacy. Reading nonfiction, magazines, and newspapers also generally related somewhat less positively to reading literacy, whereas reading comics related negatively to reading literacy. However, these effects were of very modest size (OECD, 2010). Online reading also related positively to reading literacy, but effects were once again very modest. Kirsch et al. (2002) applied another approach to the relationship between reading behavior and reading literacy by using cluster analysis to identify profiles of readers in a reanalysis of data from the PISA 2000 study. They found that a four-cluster solution seemed appropriate for describing students' reading habits. Students in the first cluster were called the *least diversified readers*, because they reported only occasionally reading magazines. Students in this cluster were also the lowest performing students on the PISA reading proficiency scale. The second, *moderate diversified reading cluster* contained students who reported frequently reading magazines and newspapers. On average, these students performed better than those in Cluster 1. Students in Cluster 3 reported frequently reading magazines, newspapers, and comics as well as sometimes (but less frequently) reading fiction and nonfiction. These students were called *diversified readers of short texts*, and, on average, their reading literacy was better than that of students in Clusters 1 and 2. Members of the last Cluster 4 were called *diversified readers of long and complex texts* because they reported frequently reading magazines, newspapers, fiction and nonfiction books, but not comics. In comparison to the other clusters, students in Cluster 4 showed the

highest reading literacy scores. However, the PISA design is cross-sectional and may not describe developmental differences linked to differences in students' out-of-school reading habits. Furthermore, students are increasingly getting in contact with written text by consuming online media. However, online reading may be quite different from reading more traditional print media, as discussed in the next paragraph.

1.4 Internet Use and Academic Achievement

The Internet and information technology have changed the world tremendously. Whereas home computers were available for only a minority of students in the 1990s, almost every student in OECD countries now has a computer at home and also access to the Internet (U.S. Census Bureau, 2009; OECD, 2011). Furthermore, social disparities in access to computers have declined in the last decade, although there is still a small socioeconomic gap in the availability of the Internet at home. Regarding home use of computers, more than 80% of students across the OECD countries report frequently browsing on the Internet for fun; 75%, chatting online at least once a week; and 68%, frequently using e-mail.

However, little is known about how Internet use relates to the development of academic achievement. According to the results of the latest PISA study, students who are highly engaged in online reading activities such as reading e-mails, chatting on line, reading online news, using an online dictionary or encyclopedia, or taking part in online group discussions or forums are more proficient readers than students who engage in less online reading. This pattern was found in all PISA participating countries except Liechtenstein (OECD, 2010). Jackson et al. (2006) provide further empirical support for the assumption that a high level of online activities relates positively to reading achievement. They analyzed how the temporal length and frequency of Internet use related to the development of academic achievement in a sample of school students from low-income families. Higher Internet use had a positive influence on students' grade-point averages as well as on the development of their reading comprehension. Mathematics achievement, however, did not relate to Internet use. The authors interpreted their findings by stating that webpages are text based, and therefore more Internet use leads to more reading practice, and this improves students' reading skills. In a second study, Jackson, von Eye, Witt, Zhao, and Fitzgerald (2011) provided further evidence from a broader sample for a positive relationship between the amount of Internet use and reading achievement. However, this positive relationship was significant only for readers with below-average or average reading skills.

Studies focusing on the use of specific websites such

as Facebook® report different results of extensive habitual engagement in online activities (cf. Junco & Cotten, 2011 for instant messaging). Kirschner and Karpinski (2010) found lower academic performance in university students using Facebook in comparison to nonusers. Furthermore, Facebook users reported spending fewer hours per week studying. Junco (2012), however, found that time spent on Facebook related more strongly to lower academic achievement than the frequency of simply checking Facebook. Additionally, time spent on Facebook related negatively to time spent preparing for class. So taken together, empirical results analyzing the role of online media use for the development of measures of academic performance, including reading achievement, are not very clear. A high amount of online reading activity may, comparable to traditional print media, improve vocabulary and foster comprehension skills, but it may also have detrimental effects on reading achievement by, for example, preventing other, more traditional reading activities.

1.5 Aims of the Present Study

Theoretical assumptions and empirical results converge to show that time spent reading is an important variable in the development of reading comprehension and vocabulary. Furthermore, most studies support the conclusion that reading (fiction) books is particularly important for the development of reading literacy. However, the use of online media, also called *new media*, and especially the relationship between using new media and classical print media, has been broadly neglected despite the widespread use of the new media by so many young people. In Germany, for example, about 95% of 15-year-old students indicated having access to and also using a computer as well as the Internet in 2009 (Hertel, Jude, & Naumann, 2010; cf., U.S. Census Bureau, 2009, for related statistics). Finally, most studies in the current literature have also paid insufficient attention to the use of different types of reading materials, especially in terms of their internal structure.

Our study addressed the limitations of research in the field with the following research questions: First, we asked how both the amount and type of out-of-school reading behavior in secondary schools students relates to the development of reading comprehension and vocabulary. Although, theoretically, one could at least expect that the more time students spend reading, the higher their achievement gains, we did not formulate any specific expectations regarding the different types of reading materials. Second, we wanted to know what effect reading exerts on reading comprehension and vocabulary development independent of potential confounding third variables. In other words, we wanted to be able to reject alternative explanations for the relationship between extracurricular reading behavior and reading literacy development by

controlling their influence. Popular factors that have often been found to relate to the development of reading literacy are, for example, students' initial reading literacy level (Kempe, Eriksson-Gustavsson, & Samuelsson, 2011; Pfof, et al., 2012; Stanovich, 2000), students' gender (Lietz, 2006; Logan & Johnston, 2009), the type of school or school track (Hallinan & Kubitschek, 1999; Pfof, Karing, Lorenz, & Artelt, 2010), or students' social and ethnic-cultural backgrounds (Caro, McDonald, & Willms, 2009; Marks, 2005; Reardon, 2003; Sirin, 2005). Thus, higher growth rates in reading literacy were expected for good readers, students attending an upper academic track, students without immigration background as well as students from families with a high education level. Finally, an advantage for female students was expected. As we assumed substantial effects of extracurricular reading on reading literacy, we hypothesized that influences of extracurricular reading on the development of reading comprehension and vocabulary development could still be demonstrated even after taking this broad set of potential confounding variables into account. Finally, we asked how different facets of extracurricular reading relate to each other. In other words, we examined whether we could differentiate characteristic reading profiles of secondary school students based on their use of classical print text media and new forms of online media and then relate these profiles to reading achievement.

2. Method

2.1 Design and Participants

Data were collected within the framework of two longitudinal studies conducted by the BiKS research group (Bildungsprozesse, Kompetenzentwicklung und Formation von Selektionsentscheidungen im Vor-/ Schulalter [educational processes, competence development, and selection decisions in pre-, elementary-, and secondary-school-aged children]). The interdisciplinary BiKS research group contains researchers from psychology, sociology, and educational sciences who have been collecting data regularly from students, teachers, and parents in southern and central Germany since 2006. In these regions, secondary school comprises 5 (lower track), 6 (middle track), or 8 (higher track) years of education and starts after 4 years of elementary school when children are about 10 years old. Our analyses focused on data from the sixth wave of measurement assessing 7th-grade secondary school students in 2010. In addition, data from the fourth wave of measurement of the same students in Grade 5 were considered for our longitudinal questions. In total, we analyzed data from 1,226 students (68.1% of the original secondary school sample) from 55 secondary schools participating in the seventh wave of measurement. Due to the need for active informed

parental consent for students participating in the BiKS study, we could not rule out a bias due to self-selectivity of the sample (cf. Bergstrom, et al., 2009; Esbensen, et al., 1996). The students' mean age was 11.4 years ($SD = 0.46$) in Grade 5 and 13.4 years in Grade 7. The majority (816, 66.6%) were attending higher track schools; 236 (19.2%), middle track schools; and 174 (14.2%), lower track schools. Furthermore, 13.9% of the sample were living in households with an immigrant background. Regarding educational background, 56.0% of the students lived in households in which at least one parent had a higher school-leaving certificate permitting university entrance. The sample contained approximately equal numbers of girls (52.7%) and boys (47.3%).

2.2 Measures

Students, teachers, and parents were tested once a year on a wide range of measures. The current analysis addressed the following measures:

2.2.1 Reading behavior

Students' extracurricular reading behavior was assessed with seven items from the student questionnaire in Grade 7. Students were given the question "Outside school, how often do you read . . . ?" followed by seven types of reading material: magazines or newspapers; comics; novels, stories or tales; nonfiction books (e.g., technical or science); e-mails; online encyclopedias (e.g., Wikipedia); and online forums or chats. The students rated the frequency of their own reading behavior on a 4-point scale with the response options 1 (*almost never or never*), 2 (*several times a month*), 3 (*several times a week*), and 4 (*several times a day*).

2.2.2 Reading comprehension

In Grade 5, reading comprehension was measured with five short texts and a total of 43 multiple-choice items developed by the BiKS research group. The length of each text ranged between 48 and 278 words. In Grade 6, three texts with a total of 31 multiple-choice items were used. Text length ranged from 217 to 443 words. In Grade 7, three (two expository and one narrative) texts with altogether 26 multiple-choice items were used. Text length ranged from 440 to 456 words. The texts were chosen with an age-appropriate level of difficulty. In the reading comprehension test, students had to read a given text, search for relevant information, and generate more or less high inferences from the text to answer the given items. The reading comprehension measures were constructed in close communication with reading experts from the German PISA consortium. Although only the reading comprehension measures given to Grades 5 and 7 were used for the current analysis, data on Grade 6 was also used for the scaling procedure. For the three waves of measurement, a common item design with nonequivalent groups/ an anchor-item

test design was applied (Holland, Dorans, & Peterson, 2007; Kolen & Brennan, 2004). This allowed us to estimate students' reading comprehension on a common metric within an IRT framework. In a first run, we used the ConQuest software package (Wu, Adams, Wilson, & Haldane, 2007) to estimate the item-difficulty parameters for all items of the reading comprehension tests with a three-dimensional one-parameter Rasch model. A design matrix was specified, and the item difficulty parameters of the three waves of measurement were estimated in a single simultaneous run (concurrent estimation). Item difficulty parameters for the same items across different waves of measurement were set as equal. In a second run, we estimated individual students' abilities with weighted likelihood estimates (WLEs) for every wave of measurement using the item difficulty parameters of the first run. This two-step procedure was necessary due to student dropout and missing data. In a final step, we *T*-standardized ($M = 50$, $SD = 10$) the estimated individual ability scores based on Grade 5. The reliabilities (WLE reliability) of the reading comprehension measures were satisfactory for all waves of measurement ($R_{Grade\ 5} = .78$, $R_{Grade\ 6} = .77$, $R_{Grade\ 7} = .76$).

2.2.3 Vocabulary

We measured students' vocabulary with a set of 35 items from the subscale V1 (Vocabulary) of a cognitive ability test called the *Kognitiver Fähigkeitstest für 4. bis 12. Klassen, Revision* (KFT 4-12 + R; Heller & Perleth, 2000). Five additional vocabulary items used in Grade 7 were discarded in the present analysis in order to keep the metric constant. For every item, a target word (e.g., *to throw*) as well as a selection of five additional words (e.g., *to drink*, *to jump*, *to collect*, *to toss*, and *to drop*) was presented for reading. Students had to indicate which word was closest in meaning to the target word. Students' vocabulary was estimated by summing the number of correct answers. For ease of interpretation, students' vocabulary scores were also *T*-standardized ($M = 50$, $SD = 10$) based on Grade 5 using a linear transformation. The internal consistency (Cronbach's α) of the vocabulary test was satisfactory for both waves of measurement ($\alpha_{Grade\ 5} = .78$, $\alpha_{Grade\ 7} = .78$).

2.2.4 Auxiliary variables

2.2.4.1 Reading enjoyment.

On the Grade 7 questionnaire, students were asked to indicate how much they enjoy reading on a 4-item scale. The items were selected from the scale *Leselust* of the PISA 2000 study (Kunter, et al., 2002). Due to psychometric properties four items out of the original 9-item scale were chosen for the BiKS student questionnaire. Every item consisted of a statement (e.g., "Reading is one of my favorite hobbies") that had to be rated on a 4-point scale

ranging from 1 (I disagree) to 4 (I agree) (Cronbach's $\alpha = .90$).

2.2.4.2 Sociodemographic background.

This was assessed in a highly standardized parental telephone interview. Parents were asked about their cultural origins, and students were classified as having an immigrant background when at least one parent was born in a foreign country. Furthermore, parents were asked about their educational as well as occupational status. This information was used to determine the parents' highest ISEI (International Socio-economic Index of Occupational Status; Ganzeboom, De Graaf, & Treiman, 1992).

2.3 Analysis Strategy

First, we regressed student's 7th-grade reading comprehension and vocabulary scores on student's extracurricular reading behavior. All types of reading material were taken into account concurrently in order to determine the unique contribution of each type of text. Second, we further controlled for student's 5th-grade reading comprehension or vocabulary. This enabled us to interpret relations between extracurricular reading behavior and either reading comprehension or vocabulary as differences in the developmental trend between Grades 5 and 7. Finally, in order to control for further confounding factors and to strengthen the interpretability of the effect of extracurricular reading behavior, we added the following covariates to the model: student's sex (dummy coded; 1 = male, 0 = female) and immigrant background (dummy coded; 1 = immigrant background, 0 = no immigrant background), the parental school leaving certificate (dummy coded; 1 = completed upper academic track, 0 = other) parent's highest ISEI, and the type of school track the student was attending (dummy coded; 1 = middle/upper track, 0 = lower track). All regression analyses were run with *Mplus* 6.11 (Muthén & Muthén, 1998-2010). Standard errors of the estimates were controlled for the nesting of students within schools. Missing values were treated by applying multiple imputation methods ($m = 5$). The amount of missing data ranged between 1.1% and 0.5% for the reading behavior measures, between 7.9% and 0.0% for the competence measures, and between 11.7% and 0.0% for the covariates.

We examined the second research question by formulating a latent class analysis (LCA) model with binary latent class indicators and ordered categorical (ordinal) dependent variables (Muthén & Muthén, 1998-2010). In general, LCA tries to reduce the response patterns of a sample of persons into a few latent classes. Interindividual differences in response patterns are explained by membership of latent classes with class-specific response profiles (Geiser, 2010; Rost, 2004). As the number of latent classes is not a parameter that is estimated automatically, different models with different numbers of classes were estimated and compared to each other. We

applied three information criteria—the Akaike (AIC), the Bayesian information criterion (BIC), and the sample-size adjusted BIC—to compare the different models: the lower the values of these criteria, the better the model. We also examined the entropy of these models. High entropy (close to 1) reflects a highly reliable classification, whereas low entropy (close to 0) reflects an unreliable classification. Finally, we considered the interpretability of the models, giving preference to a solution delivering easy-to-interpret classes. Eid, Langeheine, and Diener (2003) or Geiser, Lehmann, and Eid (2006) report examples of this procedure. Drawing on the results of Kirsch et al. (2002), we expected about four to five latent classes. We did not apply statistical tests evaluating the overall model fit due to the problem of sparse tables. This means that in an analysis based on seven items with four categories, $4^7 = 16,384$ possible response patterns exist, whereas only 1,226 students were observed. This results in contingency tables with many small and zero-observed frequencies leading to the problem of potentially misleading χ^2 statistics because they might not follow a χ^2 distribution (Eid, et al., 2003). For our latent class analysis, we used 500 random sets of starting values in the initial stage and 50 optimizations in the final stage. Additionally, the maximum number of iterations allowed in the initial stage was increased from the default of 10 to 50 iterations. Convergence was set at 0.000001. Furthermore, missing values were treated by applying a Full Information Maximum Likelihood (FIML) estimator. After deciding on a solution with five latent classes, we tried to characterize these classes with regard to the mean reading behavior profiles of students in each class. Students were assigned to the latent classes according to their most likely latent class membership. Additional measures were also considered to assess relationships of the latent classes to other characteristics such as type of school.

Finally, we once again formulated linear regression models to predict students' 7th-grade reading comprehension and vocabulary. The procedure was similar to that described above, exception that instead of using straight measures of reading material, we entered the latent classes of students' reading behavior as predictor variables. The categorical latent class variable was dummy coded. The most frequently occupied class was used as reference category. In a last regression model, the facets of extracurricular reading behavior that emerged as predictors of the development of reading comprehension or vocabulary in the first regression models were controlled further in order to determine whether the reading profiles still predicted unique parts of the variance in the outcome variable.

3. Results

3.1 Descriptive Statistics

Table 1 presents the frequencies of the reading behavior measures as well as means and standard deviations for reading comprehension and vocabulary for the whole sample. The intercorrelations are presented in Table 2. When considering students' extracurricular reading behavior, we see clear differences in the preferred types of reading material in this sample. Within the classic types of reading material, students in general read mostly magazines or newspapers followed immediately by novels, stories, or tales. The least read type of text was nonfiction books. Almost two-thirds of the students indicated that they never or hardly ever read nonfiction books. With regard to reading so-called new media, online forums and chats as well as e-mails were very popular among the tested students. On average, they indicated using both media several times a week. Looking at the interrelations of the seven reading behavior measures depicted in Table 2, we found—with some exceptions—relatively low correlations among the reading behavior measures. For classical print media, correlations ranged between .07 and .22. All these correlations were statistically significant. For the new media category, correlations were higher, ranging from .18 to .52. Furthermore, reading in online forums and chats showed a significant negative association with reading comics; novels, stories, or tales; and nonfiction books. Reading nonfiction books, in contrast, showed a significant positive relation to reading online encyclopedias. Finally, reading comprehension showed a weak positive correlation with reading magazines or newspapers and nonfiction books alongside a strongly positive link to the reported amount of reading novels, stories, or tales. The frequency of using e-mails as well as online forums and chats related negatively to reading comprehension. Equivalent relations were found for vocabulary.

Correlations of covariates, Grade 7 reading achievement measures and reading behavior are depicted in Table 3. Grade 7 reading comprehension and vocabulary were positively related to Grade 5 measures of reading comprehension and vocabulary, parents' educational and socioeconomic background and the attendance of an upper academic track. Immigrant background was negatively related to reading comprehension and vocabulary measures. The dummy variable indicating the attendance of a middle academic track in comparison to the attendance of an upper or lower academic track was negatively related to reading achievement and vocabulary. Concerning students' reading behavior, a number of significant relations to the variables used were found, although mostly of moderate size.

Table 1: Cell Frequencies, Means, and Standard Deviations of Reading Behavior, Reading Comprehension, and Vocabulary

	1= never or hardly ever	2 = several times a month	3 = several times a week	4 = several times a day	M (SD)	N
Comics	59.4 %	21.0 %	12.8 %	6.7 %	1.67 (0.94)	1215
Magazines or newspapers	19.1 %	30.4 %	39.3 %	11.2 %	2.43 (0.92)	1216
Novels, stories, or tales	30.3 %	22.8 %	26.4 %	20.5 %	2.37 (1.12)	1213
Nonfiction books	61.6 %	25.1 %	9.9 %	3.4 %	1.55 (0.81)	1218
Online encyclopedias	34.6 %	38.1 %	21.4 %	5.9 %	1.99 (0.89)	1216
E-mails	15.8 %	22.2 %	35.4 %	26.5 %	2.73 (1.02)	1213
Online forums or chats	20.2 %	11.2 %	28.6 %	40.0 %	2.88 (1.14)	1220
Reading comprehension						
Grade 5 ^a					50.0 (10.0)	1129
Grade 7					56.1 (15.3)	1224
Vocabulary						
Grade 5 ^a					50.0 (10.0)	1129
Grade 7					57.8 (9.6)	1226

^aT-metric.

Table 2: Intercorrelations Between Reading Behavior, Reading Comprehension, and Vocabulary

	1	2	3	4	5	6	7	8
1 Comics								
2 Magazines or newspapers	.15 **							
3 Novels, stories, or tales	.07 *	.15 **						
4 Nonfiction books	.22 **	.16 **	.21 **					
5 Online encyclopedias	.09 **	.18 **	.10 **	.24 **				
6 E-mails	-.04	.14 **	-.04	.02	.31 **			
7 Online forums or chats	-.07 *	.09 **	-.18 **	-.17 **	.18 **	.52 **		
8 Reading comprehension Grade 7	.04	.09 **	.42 **	.09 **	.05	-.17 **	-.23 **	
9 Vocabulary Grade 7	.06 *	.08 **	.34 **	.08 **	.06 *	-.14 **	-.15 **	.62 **

Note. All correlations except that between reading comprehension and vocabulary are nonparametric.

** $p < .01$.

* $p < .05$.

Table 3: Intercorrelations between the used covariates, reading behavior and reading achievement

Covariates	Outcomes				Reading behavior				
	Reading comprehension Grade 7	Vocabulary Grade 7	Comics	Journals or newspapers	Novels, stories, or tales	Nonfiction books	Online encyclopedias	E-mails	Online forums or chats
Reading comprehension Grade 5	.54**	.51**	.04	.08**	.34**	.01	.08**	-.08**	-.07*
Vocabulary Grade 5	.56**	.65**	.08*	.08**	.29**	.11**	.08*	-.09**	-.11**
Sex	-.14**	-.05	.28**	-.09**	-.31**	.22**	-.01	-.04	-.05
Parental school leaving certificate	.28**	.29**	.14**	.04	.22**	.07*	.03	-.06	-.11**
Immigrant background	-.09**	-.09**	-.02	-.06	-.04	.01	.07*	.08*	.09**
HISEI	.23**	.28**	.08*	.07*	.19**	.06	.00	-.06	-.10**
Middle academic track	-.19**	-.23**	-.02	-.02	-.15**	-.05	-.07*	.00	.03
Upper academic track	.45**	.50**	.02	.07*	.32**	.05	.13**	-.02	-.07*

Note. All correlations except that between reading comprehension, vocabulary and HISEI are nonparametric. The following variables were dummy coded: sex (1 = male); parental school leaving certificate (1 = completed upper academic track); immigrant background (1 = immigrant background); school track (1 = attending middle/upper academic track).

** $p < .01$.

* $p < .05$.

3.2 Predicting Reading Comprehension and Vocabulary by Extracurricular Reading Behavior

Students' 7th-grade reading comprehension and vocabulary scores were regressed on measures of extracurricular reading behavior. All facets of students' extracurricular reading behavior were taken into account concurrently in order to estimate the unique influence of every facet after controlling for all other types of reading materials. A second step added students' 5th-grade reading comprehension or vocabulary. Finally, the last step controlled type of school, student's sex, and socioeconomic background measures. The estimated results are presented in Table 4 for reading comprehension and in Table 5 for vocabulary.

Reading comprehension (Table 4, Model 1) showed significant positive relationships with reading magazines or newspapers ($b = 1.036$, $SE = 0.419$, $p < .05$) as well as novels, stories, or tales ($b = 5.132$, $SE = 0.472$, $p < .01$). Frequent use of e-mails ($b = -1.723$, $SE = 0.469$, $p < .01$) and online forums or chats ($b = -1.604$, $SE = 0.457$, $p < .01$) related negatively to 7th-grade reading comprehension. Reading comics ($b = -0.191$, $SE = 0.508$, ns), nonfiction books ($b = -0.815$, $SE = 0.666$, ns), and online encyclopedias ($b = 0.732$, $SE = 0.549$, ns) did not relate significantly to reading comprehension. After controlling for differences in students' 5th-grade reading comprehension, the effect of reading novels, stories, or tales still related positively to 7th-grade reading comprehension ($b = 3.206$, $SE = 0.331$, $p < .01$), whereas a high engagement in e-mails ($b = -0.988$, $SE = 0.416$, $p < .05$) and online-forums or chats ($b = -1.663$, $SE = 0.437$, $p < .01$) still related negatively to reading comprehension (Model 2). Reading magazines or newspapers no longer related to the development of reading

comprehension between Grades 5 and 7 ($b = 0.724$, $SE = 0.374$, ns). Finally, after controlling for further covariates (Model 3), the effects of reading novels, stories, or tales; e-mails; and online-forums or chats was still stable.

Regressing students' extracurricular reading behavior on measures of vocabulary (Table 5, Model 1) revealed a significant positive relationship between reading novels, stories, or tales ($b = 2.712$, $SE = 0.363$, $p < .01$) and students' 7th-grade vocabulary scores. The frequency of using e-mails related negatively to 7th-grade vocabulary ($b = -1.242$, $SE = 0.333$, $p < .01$). All other measures of extracurricular reading did not relate substantially to vocabulary. After controlling for students' vocabulary in Grade 5 (Model 2) as well as further covariates (Model 3), the positive effect of reading novels, stories, or tales diminished but remained significant (Model 2: $b = 1.402$, $SE = 0.242$, $p < .01$; Model 3: $b = 0.835$, $SE = 0.237$, $p < .01$). Comparable findings were found for the negative effect of frequently using e-mails for vocabulary development between Grades 5 and 7 (Model 2: $b = -0.646$, $SE = 0.261$, $p < .05$; Model 3: $b = -0.657$, $SE = 0.243$, $p < .01$). In summary, a high engagement with different types of reading material made a variety of unique contributions to the prediction of students' reading comprehension and vocabulary. However, because the different measures of students' reading behavior were not independent from each other (see Table 2), it seemed worth seeing whether we could also find prototypical profiles of extracurricular reading behavior. Therefore we asked whether we can subdivide secondary school students into more or less homogeneous groups according to their reading habits and whether group membership has an effect on literacy development.

3.3 Reading Behavior Profiles

We looked for reading behavior profiles with a latent class analysis. To decide on the number of latent classes, we applied a set of criteria to evaluate the appropriateness of the different latent class models. Table 6 presents an overview of the evaluation criteria for a two- to seven-class solution. According to the BIC, a four-class solution was appropriate; whereas the sample-size adjusted BIC favored a five-class solution, and the AIC, a solution with more than seven classes. However, the AIC mostly overestimates the number of classes (Nylund, Asparouhov, & Muthén, 2007). Entropy was quite good for a five- and six-latent-class solution. In the end, and by taking the interpretability of the model into account, we decided on a 5-class solution. Alternatively, the first latent class would have collapsed into the second and third classes in a 4-class solution, and the fourth latent class would have split up into two quite comparable classes in a 6-class solution. The item profiles of the five latent classes are presented in Figure 1. The corresponding results are presented in Table 7 that also relates a selection of students' sociodemographic characteristics to their most likely latent class

membership.

The first class consisted of 44 students (3.6%) who could be characterized by their extensive reading of a broad variety of texts. With regard to their extracurricular reading behavior, we called these students *highly engaged readers* because they indicated reading all kinds of texts in a quantitatively high manner from mostly several times a week to several times a day. Interestingly, this group of students not only indicated that they use so-called classic written media such as fiction and nonfiction books, magazines, or newspapers, but also indicated spending time regularly reading online encyclopedias, chats, and e-mails. Additional statistics on this class of students indicated a slightly, but in comparison to all other students nonsignificantly, higher score on the reading comprehension test ($d = 0.16$) as well as a higher vocabulary score ($d = 0.08$). Furthermore, in comparison to all other students, boys were overrepresented ($d = 0.48$), and students in this class enjoyed reading more ($d = 0.53$) than the rest of the sample.

Table 4: Linear Regression Analysis Predicting Students' 7th-Grade Reading Comprehension by Extracurricular Reading Behavior

Parameter	Model 1		Model 2		Model 3	
	b (SE)	β	b (SE)	β	b (SE)	β
Intercept	56.075** (0.839)	3.671	56.075** (0.517)	3.671	50.988** (1.100)	3.338
Reading behavior						
Comics	-0.191 (0.508)	-0.012	-0.186 (0.425)	-0.011	0.097 (0.407)	0.006
Magazines or newspapers	1.036* (0.419)	0.063	0.724 (0.374)	0.044	0.467 (0.360)	0.028
Novels, stories, or tales	5.132** (0.472)	0.375	3.206** (0.331)	0.234	2.261** (0.357)	0.165
Nonfiction books	-0.815 (0.666)	-0.043	-0.161 (0.582)	-0.009	0.323 (0.579)	0.017
Online encyclopedias	0.732 (0.549)	0.043	0.057 (0.513)	0.003	-0.182 (0.486)	-0.011
E-mails	-1.723** (0.469)	-0.115	-0.988* (0.416)	-0.066	-0.996* (0.393)	-0.067
Online forums or chats	-1.604** (0.457)	-0.120	-1.663** (0.437)	-0.124	-1.519** (0.413)	-0.114
Covariates						
Grade 5 reading comprehension			0.692** (0.039)	0.457	0.555** (0.039)	0.367
Sex					-2.230* (0.870)	-0.073
Parental school leaving certificate					1.283 (0.975)	0.042
Immigrant background					-3.444** (1.066)	-0.080
HISEI					-0.021 (0.028)	-0.022
Middle academic track					3.028* (1.250)	0.078
Upper academic track					8.058** (1.255)	0.249
Total R^2	0.201		0.386		0.427	

Note. b = unstandardized regression parameter. β = standardized regression parameter. The following variables were dummy coded: sex (1 = male); parental school leaving certificate (1 = completed academic track); immigrant background (1 = immigrant background); school track (1 = attending middle/upper academic track). All predictors except dummy-coded variables were centered on the grand mean. Missing data were multiple imputed ($m = 5$).

** $p < .01$.

* $p < .05$.

Table 5: Linear Regression Analysis Predicting Students' 7th-Grade Vocabulary by Extracurricular Reading Behavior

Parameter	Model 1		Model 2		Model 3	
	b (SE)	β	b (SE)	β	b (SE)	β
Intercept	57.778** (0.658)	6.048	57.778** (0.321)	6.048	53.867** (0.881)	5.639
Reading behavior						
Comics	-0.027 (0.298)	-0.003	-0.131 (0.264)	-0.013	0.023 (0.259)	0.002
Magazines or newspapers	0.417 (0.270)	0.040	0.191 (0.213)	0.018	0.047 (0.196)	0.004
Novels, stories, or tales	2.712** (0.363)	0.317	1.402** (0.242)	0.164	0.835** (0.237)	0.098
Nonfiction books	-0.380 (0.389)	-0.032	-0.486 (0.290)	-0.041	-0.152 (0.278)	-0.013
Online encyclopedias	0.660 (0.360)	0.062	0.403 (0.254)	0.038	0.190 (0.259)	0.018
E-mails	-1.242** (0.333)	-0.133	-0.646* (0.261)	-0.069	-0.657** (0.243)	-0.070
Online forums or chats	-0.316 (0.319)	-0.038	-0.252 (0.265)	-0.030	-0.165 (0.258)	-0.020
Covariates						
Grade 5 vocabulary			0.565** (0.030)	0.600	0.450** (0.026)	0.478
Sex					-0.822 (0.469)	-0.043
Parental school-leaving certificate					-0.042 (0.478)	-0.002
Immigrant background					-1.477* (0.584)	-0.055
HISEI					0.025 (0.017)	0.043
Middle academic track					2.745* (1.168)	0.113
Upper academic track					6.024** (0.857)	0.298
Total R^2	0.133		0.461		0.506	

Note. b = unstandardized regression parameter. β = standardized regression parameter. The following variables were dummy coded: sex (1 = male); parental school leaving certificate (1 = completed upper academic track); immigrant background (1 = immigrant background); school track (1 = attending middle/upper academic track). All predictors except dummy-coded variables were centered on the grand mean. Missing data were multiple imputed ($m = 5$).

** $p < .01$.

* $p < .05$.

We classified 227 (18.5%) students into the fourth latent class. Students in Class 4 could be characterized by a moderate to highly pronounced reading of fiction and nonfiction books and comics, but a less pronounced reading of newspapers. Interestingly, students in this class indicated, in comparison to all other classes, a very minor use of all forms of new media, especially e-mails and weblogs or chats. A total of 64.6% of these students indicated never or almost never reading online encyclopedias; 59.9%, never or almost never reading e-mails; and finally, 80.6%, of never or hardly ever reading weblogs or engaging in chatting. Consequently, we named students with this reading profile *traditional print readers*. Looking at the other measures, students in Class 4 showed a higher reading comprehension ($d = 0.39$) and vocabulary ($d = 0.22$) score than all other students. Male students ($d = 0.17$) were overrepresented, and students' parents had a higher school leaving certificate ($d = 0.24$). Finally, the mean HISEI of these students was higher ($d = 0.26$), and students indicated that they enjoyed reading more ($d = 0.49$).

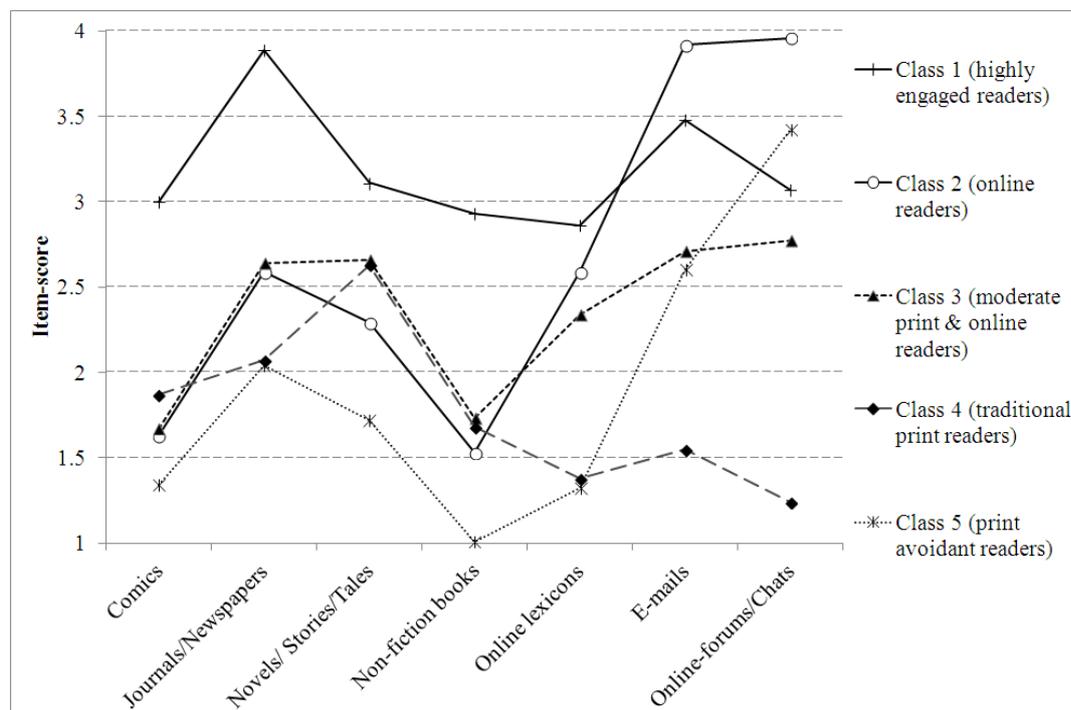
The fifth latent class of 295 students (24.1%) could be characterized as incorporating students with the lowest reading intensity profile. Especially with regard to all classical print media, students in this class indicated, on average, the least intense reading behavior. With regard to new media, they indicated a below-average frequency of reading online encyclopedias and e-mails but an above-average reading of weblogs and chats, which these students indicated using from several times a week up to several times a day. Therefore, we named these students *print-avoidant readers*. Furthermore the academic and sociodemographic characteristics of this class of students were quite distinct from the members of all other classes. These students performed worse on measures of reading comprehension ($d = -0.44$) and vocabulary ($d = -0.38$), were underrepresented in higher track schools ($d = -0.36$), had parents with a lower school leaving certificate ($d = -0.37$), had parents with a below-average HISEI ($d = -0.16$), and a lower reading enjoyment ($d = -0.72$) compared to students in the rest of the sample.

Table 6: Goodness of Fit for the Different Latent Class Solutions

	AIC	BIC	aBic	Entropy
2-class solution	20,552.240	20,772.035	20,635.449	0.644
3-class solution	20,350.992	20,683.240	20,476.773	0.652
4-class solution	20,185.272	20,629.974	20,353.625	0.679
5-class solution	20,131.357	20,688.512	20,342.282	0.707
6-class solution	20,095.021	20,764.629	20,348.517	0.711
7-class solution	20,066.557	20,848.618	20,362.625	0.706

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = sample-size adjusted BIC.

Figure 1. Extracurricular reading behavior of students by associated latent class.



3.4 Reading Behavior Profiles and Competence Development

Finally, reading behavior profiles were related to students' reading comprehension and vocabulary. First, we regressed the measures of 7th-grade reading comprehension and vocabulary on the latent reading classes. Because results indicated five latent classes, we computed four dummy indicators. The third latent class was chosen as a reference category due to its high frequency. More than one-third of all students showed a profile of extracurricular reading behavior labeled as moderate print and online reading (Class 3). The next step added the students' 5th-grade reading comprehension or vocabulary scores. Finally, results were controlled for further covariates. The estimated results are presented in Table 8 for reading comprehension and in Table 9 for vocabulary.

Results of the regression analyses indicated significantly lower reading comprehension scores for online readers (Class 2; $b = -7.725$, $SE = 1.192$, $p < .01$) and print-avoidant readers (Class 5; $b = -8.231$, $SE = 1.243$, $p < .01$) compared to moderate print and online readers (Class 3; Table 8, Model 1). Although traditional print readers (Class 4) showed slightly higher comprehension scores in Grade 7 ($b = 1.639$, $SE = 1.336$, ns), and highly engaged readers (Class 1) showed slightly lower reading comprehension scores ($b = -1.344$, $SE = 1.634$, ns), the estimated differences compared to students in the third latent class did not attain significance. When controlling for 5th-grade reading comprehension (Model 2) as well as further covariates (Model 3), the estimated differences between students in either Class 2 or Class 5 and students in Class 3 were still significant. Finally, we also controlled reading of novels, stories, or tales; e-mails; and online forums

or chats in order to check whether the profiles still predicted unique variance in reading comprehension (Model 4). Findings indicated that a profile avoiding traditional print reading materials (Class 5) was still related to lower reading comprehension in Grade 7 ($b = -1.914$, $SE = 0.805$, $p < .05$). A profile preferring online reading (Class 2) was related to lower reading comprehension in a similar way, although this relation missed the significance level marginally ($b = -2.088$, $SE = 1.063$, $p < .06$).

Students' vocabulary revealed comparable results (Table 9). Both online readers (Class 2; $b = -3.962$, $SE = 0.843$, $p < .01$) and print-avoidant readers (Class 5; $b = -4.759$, $SE = 0.864$, $p < .01$) had significantly lower 7th-grade vocabulary scores than moderate print and online readers (Class 3; Model 1). However, highly engaged readers (Class 1; $b = -1.237$, $SE = 1.627$, ns) and traditional print readers (Class 4; $b = -0.310$, $SE = 0.755$, ns) did not differ significantly from moderate print and online readers. After taking students' prior vocabulary score (Model

2) and further covariates (Model 3) into account, differences in students' vocabulary decreased but remained substantial. Finally, we once again added the significant predictors of extracurricular reading behavior; reading novels, stories, or tales; and e-mails to the model (Model 4). There was no longer a significant negative effect for the online reading profile (Class 2; $b = -0.416$, $SE = 0.724$, ns). Avoiding reading traditional print media (Class 5) nevertheless still related negatively to vocabulary in Grade 7 ($b = -1.269$, $SE = 0.614$, $p < .05$).

In summary, reading behavior profiles related strongly to measures of reading comprehension and vocabulary. Thereby, reading behavior profiles characterized by high engagement in online activities (Class 2) or by an exceptionally low engagement in reading traditional print media (Class 5) still related to lower achievement scores even after controlling for a broad set of confounding variables.

Table 7: Students' Reading Behavior, Competences, and Additional Background Characteristics by Associated Latent Class

	Class 1 M (SD)	Class 2 M (SD)	Class 3 M (SD)	Class 4 M (SD)	Class 5 M (SD)	F (df)
Comics	3.00 (1.28)	1.63 (0.90)	1.67 (0.86)	1.87 (1.03)	1.34 (0.71)	37.58 (4, 1210)**
Magazines or newspapers	3.89 (0.32)	2.59 (0.91)	2.64 (0.67)	2.07 (1.02)	2.04 (0.88)	68.36 (4, 1211)**
Novels, stories, or tales	3.11 (0.97)	2.29 (1.08)	2.66 (1.00)	2.63 (1.13)	1.72 (1.02)	45.54 (4, 1208)**
Nonfiction books	2.93 (1.27)	1.53 (0.80)	1.73 (0.75)	1.68 (0.82)	1.01 (0.10)	93.56 (4, 1213)**
Online encyclopedias	2.86 (0.98)	2.59 (0.98)	2.34 (0.61)	1.38 (0.54)	1.32 (0.59)	197.33 (4, 1211)**
E-mails	3.48 (0.82)	3.92 (0.36)	2.71 (0.68)	1.55 (0.78)	2.60 (0.84)	344.47 (4, 1208)**
Online forums or chats	3.07 (0.97)	3.96 (0.28)	2.77 (0.93)	1.24 (0.52)	3.42 (0.66)	487.64 (4, 1215)**
Reading comprehension Grade 7	58.4 (13.1)	51.6 (14.6)	59.3 (14.6)	60.9 (15.6)	51.0 (14.4)	25.82 (4, 1219)**
Vocabulary Grade 7	58.6 (10.4)	55.8 (10.4)	59.8 (8.1)	59.5 (9.3)	55.0 (9.9)	15.85 (4, 1221)**
Higher track	.75 (0.44)	.66 (0.48)	.74 (0.44)	.68 (0.47)	.54 (0.50)	9.21 (4, 1221)**
Sex (1 = male)	.70 (0.46)	.40 (0.49)	.43 (0.50)	.54 (0.50)	.51 (0.50)	5.98 (4, 1221)**
Parents school-leaving certificate (1 = higher track)	.61 (0.50)	.54 (0.50)	.61 (0.49)	.66 (0.48)	.42 (0.49)	8.57 (4, 1083)**
Immigrant background	.11 (0.32)	.22 (0.41)	.11 (0.32)	.12 (0.32)	.14 (0.35)	3.51 (4, 1084)**
HISEI	54.3 (16.8)	53.9 (15.0)	55.0 (16.0)	58.3 (16.2)	52.9 (16.2)	3.58 (4, 1077)**
Reading enjoyment	3.18 (0.83)	2.47 (0.97)	2.89 (0.88)	3.06 (0.91)	2.13 (0.95)	47.84 (4, 1218)**

Note. $F = F$ value for the test of equal means between all latent classes.

** $p < .01$.

Table 8: Linear Regression Analysis Predicting Students' 7th-Grade Reading Comprehension by Latent Class

Parameter	Model 1		Model 2		Model 3		Model 4	
	b (SE)	β						
Intercept	59.300** (1.122)	3.883	58.220** (0.733)	3.812	52.590** (1.083)	3.443	52.079** (1.083)	3.410
Latent class ^a								
Class 1 (highly engaged readers)	-1.344 (1.634)	-0.016	-0.347 (1.346)	-0.004	0.304 (1.433)	0.004	-0.181 (1.568)	-0.002
Class 2 (online readers)	-7.725** (1.192)	-0.200	-5.724** (1.053)	-0.148	-5.026** (0.936)	-0.130	-2.088 (1.063)	-0.054
Class 4 (traditional print readers)	1.639 (1.336)	0.042	1.874 (1.102)	0.048	2.721* (1.099)	0.069	-0.159 (1.110)	-0.004
Class 5 (print avoidant readers)	-8.231** (1.243)	-0.230	-5.686** (0.886)	-0.159	-4.135** (0.823)	-0.116	-1.914* (0.805)	-0.054
Covariates								
Grade 5 reading comprehension			0.785** (0.043)	0.519	0.595** (0.043)	0.393	0.554** (0.039)	0.366
Sex					-3.573** (0.929)	-0.117	-2.162* (0.864)	-0.071
Parental school-leaving certificate					1.363 (0.939)	0.044	1.175 (0.975)	0.038
Immigrant background					-3.723** (1.051)	-0.086	-3.422** (1.067)	-0.079
HISEI					-0.011 (0.028)	-0.012	-0.016 (0.028)	-0.017
Middle academic track					3.022* (1.208)	0.078	2.869* (1.232)	0.074
Upper academic track					8.791** (1.141)	0.272	7.855** (1.239)	0.243
Reading behavior								
Novels, stories, or tales							2.199** (0.337)	0.161
E-mails							-0.812 (0.461)	-0.054
Online forums or chats							-1.166** (0.407)	-0.087
Total R ²	0.077		0.341		0.405		0.428	

Note. *b* = unstandardized regression parameter. β = standardized regression parameter. The following variables were dummy coded: sex (1 = male); parental school leaving certificate (1 = completed upper academic track); immigrant background (1 = immigrant background); school track (1 = attending middle/upper academic track). All predictors except binary variables were centered on the grand mean. Missing data were multiple imputed ($m = 5$).

^a Latent class membership was dummy coded; Latent class 3 (moderate print- and online readers) was taken as reference category.

** $p < .01$. * $p < .05$.

Table 9: Linear Regression Analysis Predicting Students' 7th-Grade Vocabulary by Latent Class

Parameter	Model 1		Model 2		Model 3		Model 4	
	b (SE)	β						
Intercept	59.794** (0.705)	6.259	58.762** (0.362)	6.151	54.558** (0.859)	5.711	54.438** (0.884)	5.699
Latent class ^a								
Class 1 (highly engaged readers)	-1.237 (1.627)	-0.024	-1.190 (1.276)	-0.023	-0.916 (1.272)	-0.018	-0.819 (1.283)	-0.016
Class 2 (online readers)	-3.962** (0.843)	-0.164	-1.766** (0.601)	-0.073	-1.498* (0.589)	-0.062	-0.416 (0.724)	-0.017
Class 4 (traditional print readers)	-0.310 (0.755)	-0.013	-0.035 (0.511)	-0.001	0.341 (0.502)	0.014	-0.592 (0.624)	-0.024
Class 5 (print avoidant readers)	-4.759** (0.864)	-0.213	-2.462** (0.612)	-0.110	-1.703** (0.610)	-0.076	-1.269* (0.614)	-0.057
Covariates								
Grade 5 vocabulary			0.598** (0.032)	0.635	0.463** (0.027)	0.492	0.448** (0.026)	0.476
Sex					-1.355** (0.426)	-0.071	-0.840 (0.443)	-0.044
Parental school-leaving certificate					-0.037 (0.472)	-0.002	-0.120 (0.464)	-0.006
Immigrant background					-1.508* (0.599)	-0.056	-1.460* (0.595)	-0.054
HISEI					0.029 (0.018)	0.049	0.028 (0.017)	0.047
Middle academic track					2.856* (1.173)	0.118	2.759* (1.189)	0.114
Upper academic track					6.343** (0.848)	0.313	6.025** (0.869)	0.298
Reading behavior								
Novels, stories, or tales							0.740** (0.223)	0.086
E-mails							-0.755** (0.285)	-0.081
Total R ²	0.049		0.440		0.500		0.508	

Note. *b* = unstandardized regression parameter. β = standardized regression parameter. The following variables were dummy coded: sex (1 = male); parental school leaving certificate (1 = completed upper academic track); immigrant background (1 = immigrant background); school track (1 = attending middle/upper academic track). All predictors except binary variables were centered on the grand mean. Missing data were multiple imputed ($m = 5$).

^a Latent class membership was dummy coded; Latent class 3 (moderate print- and online readers) was taken as reference category.

** $p < .01$. * $p < .05$.

4. Discussion

The main interest of our study was to describe relationships between extracurricular reading behavior and the development of reading comprehension and vocabulary. In line with the prevalent literature (e.g. Anderson, et al., 1988; Cipelewski & Stanovich, 1992; OECD, 2010; Spear-Swerling, et al., 2010; Walberg & Tsai, 1984; Watkins & Edwards, 1992), we anticipated a positive link between the total amount of time spent reading and competence development. However, we had less clear expectations regarding the specific effects of different reading materials on the development of reading competencies, especially when taking into account the new media as a potentially important source of reading experience (cf. OECD, 2011). Based on our results, we can first state that extracurricular reading behavior is an important factor in explaining individual differences in students' literacy development. However, our study indicates the inadequacy of considering only one single or global indicator of the amount of time students spend on reading outside of school when studying the influence of extracurricular reading behavior on the development of measures of reading achievement. In other words, there does not seem to be a uniform influence of all types of reading materials on reading achievement.

With regard to reading classical print media, time spent reading narrative texts or books was the most influential predictor for the development of reading comprehension and vocabulary. Furthermore, the relationship between time spent reading narrative texts and reading comprehension as well as vocabulary remained significantly positive even after controlling for several covariates or third variables, including prior achievement level. Therefore, although any statements on causality are only preliminary, it seems highly plausible that reading fiction books positively influences the development of reading achievement. This result is consistent with the prevalent literature, especially the meta-analytic findings reported by Mol and Bus (2011) who found relatively strong correlations between measures of print exposure (ART, TRT) and reading achievement. Contrary to reading narrative texts, however, the amount of reading of newspapers and magazines, comics, and nonfiction books was of only minor importance for the development of reading comprehension and vocabulary. It seems that narrative texts, possibly due to their language specifics (Gehrer & Artelt, 2013; Graesser, McNamara, & Louwrese, 2003), provide different, unique learning conditions not found in reading newspaper, comics, and nonfiction books. Therefore, our results once more confirm the exceptional status narrative texts have for the development of students' reading competencies (cf., Anderson, et al., 1988; Spear-Swerling, et al., 2010).

Nevertheless, the effects of online media consumption on the development of reading comprehension and vocabulary reveal quite a different story. In addition,

effects seem to differ within online media. We found that the amount of time spent reading e-mails, weblogs, online forums, and chats had a negative influence on the development of reading comprehension and, at least partially, of vocabulary. The use of online encyclopedias was not related to either reading comprehension or vocabulary. These results are, nevertheless, consistent with the PISA 2009 findings: Whereas online reading activities in general were associated with better reading performance in all PISA participating countries (OECD, 2010), analyses focusing on the relationship of online social activities and digital reading performance report an inverted U-shaped dose-effect curve: Students who frequently read e-mails and chatted online performed worse than students who engaged only moderately in these online social activities (OECD, 2011).

4.1 Reading Behavior Profiles

In addition to the reported bivariate relations between different facets of extracurricular reading behavior and measures of reading achievement, a second set of analyses was needed to explain individual differences in the development of reading comprehension and vocabulary. Because reading different types of materials were not independent of each other (see Table 2), we further asked whether characteristic patterns of extracurricular reading behavior could be found, and whether these patterns related to the development of reading achievement. LCA illustrates that the assumption of a single population of students who do not differ substantially in their extracurricular reading behavior is neither maintainable nor—in our case—adequate (cf. Kirsch, et al., 2002). Our analyses showed that a division of the analyzed sample into five distinct classes of students seemed to be an adequate solution for studying differences in extracurricular reading behavior. The following labels were used to describe the five different profiles of extracurricular reading behavior: highly engaged readers (Class 1), online readers (Class 2), moderate print and online readers (Class 3), traditional print readers (Class 4) and print-avoidant readers (Class 5).

Relating the different reading behavior profiles to student's reading comprehension and vocabulary scores revealed that profiles characterized by a high degree of online reading (Class 2) or by a very low amount of traditional print media reading (Class 5) had a less positive influence on the development of reading comprehension and vocabulary in comparison to all other reading behavior profiles. Furthermore, reading behavior profiles still predicted students' 7th-grade reading comprehension and vocabulary even after controlling for the amount of time spent reading narrative texts and e-mails, as well as online forums or chats (only reading comprehension). Therefore, although reading further materials (nonfiction books, newspapers, etc.) seemed of negligible importance when taken separately, reading profiles remained predictive of students' reading comprehension and

vocabulary development.

4.2 Social Online Media

Although our findings support the general results reported by Junco (2012) or Kirschner and Karpinski (2010) who found negative correlations between Facebook usage (which is one specific type of social online media) and academic achievement, our results are not consistent with their second hypothesis. Especially Kirschner and Karpinski (2010) hypothesized that Facebook or social online media have a negative effect on academic achievement by reducing the time spent on other learning activities. Our findings, however, do not support this assumption for extracurricular reading behavior: The effect of time spent reading e-mails or weblogs remained significant for reading achievement after controlling for the time spent reading books (cf. Tables 4 and 5). Furthermore, students classified as online readers (Class 2) performed worse than traditional print readers (Class 4) or moderate print- and online readers (Class 3; cf. Tables 8 and 9). All three classes of readers indicated substantial traditional print media reading including narrative texts. The major difference, however, was in the amount of time spent on online activities. Online readers indicated a very high level of engagement in online activities compared to moderate print and online readers or traditional print readers. Therefore, another explanation is needed to account for these achievement differences.

In our opinion, there are several explanations for why reading online media may have a negative effect on the development of reading comprehension and vocabulary. The first concerns our reading comprehension and vocabulary measures. Both tests possibly better capture demands linked inherently to reading classical print media than to reading online materials. Therefore, the measures we used to assess reading comprehension and vocabulary may not be adequate for assessing the effects of reading online materials or for making these competence gains visible. The second explanation focuses on the content or quality of the text students are confronted with when reading e-mails or attending online forums. For example, the vocabulary found on the German Internet is characterized by a large number of anglicisms and abbreviations (Stenschke, 2006). E-mails and weblogs often have a conversational character and are written in an informal ductus, for example, by using words typically found in oral but not in written language (Dürscheid, 2006). In this way, Crystal (2006) even claims that *Netspeak* is a genuine “third medium” that combines speech, writing, and electronically mediated properties. However, we have to repeat our first argument: Our reading comprehension and vocabulary measures perhaps do not adequately account for the content and style of what students often read when they use online media. But another aspect may also be true: that using online media does not provide the necessary features for positive reading comprehension and vocabulary development, or even worse, that it

interferes with the positive effects we would expect when reading traditional print media (although this does not seem to be the case for mobile text messaging behavior; cf. Coe & Oakhill, 2011; Wood, Jackson, Hart, Plester, & Wilde, 2011).

A further interesting finding is that students in Class 1 (the highly engaged readers) do not outperform students in Class 3 (the moderate print and online readers) or Class 4 (the traditional print readers) on reading comprehension and vocabulary development. Students in the first latent class indicated the highest reading activity for all classical types of reading materials and also indicated a very frequent usage of online media. Therefore, according to the simple time-spent-reading hypothesis, we would expect students in this class to show the best reading comprehension and vocabulary development of all classes. However, this was not the case. We can see three explanations for our results: First, the frequent use of online media with its language specifics counteracts the positive effects we would expect from reading fiction and nonfiction books or newspapers. Second, according to findings on diminishing returns of time (Anderson, et al., 1988; Smith, 1996; Walberg & Tsai, 1984), students in Classes 3 and 4 had already reached a level of time spent reading at which an extra investment in reading time is no longer accompanied by positive effects on reading literacy. And finally, the number of students who were grouped together in the first class was relatively small. Therefore, sampling error may be high enough to overlap possible true effects.

In summary, our results show that extracurricular reading behavior is an important factor for the explanation of differences in reading competencies. Furthermore, the effects of time spent on extracurricular reading on the development of reading competencies seem to be moderated by the type of reading material. Whereas we would expect positive effects from the reading of traditional print media such as (fiction) books, we cannot expect comparable results when reading texts provided by new media such as e-mails, chats, or weblogs. The underlying cause of this difference, however, still remains unclear.

4.3 Limitations of the Study

The current study also has several limitations. First, it is very exploratory, because the results of latent class analysis may depend on the variables included in the model, and the number of classes in latent class analysis is not a precise finding but tends to depend on decisions made by the researcher. However, our focus was not on defining a general valid solution delivering exact numbers of different types of reading behavior within a representative sample of individuals, but on analyzing the effects of different reading patterns on students' reading comprehension and vocabulary development. Second, we are cautious about making causal inferences from our analysis. As in most studies in the social sciences, individuals are observable only within one certain condition, and we

are unable to observe outcomes in another condition (Holland, 1986). Furthermore, it is difficult in theory to define reading behavior as a treatment that is distinct from students' reading comprehension and vocabulary because of its reciprocal relation (cf., Morgan & Fuchs, 2007; Stanovich, 1986, 2000). Third, the perhaps most significant threat to a causal interpretation of the results is that reading behavior in this study was measured in 7th grade and not in earlier grades. Although our questionnaire asked for a retrospective estimation of students' own reading behavior, and therefore might be a good indicator of reading behavior in Grade 7, it might not be the best indicator of reading behavior in preceding grades. Unfortunately, extracurricular reading behavior was not tapped in such detail in Grade 6, so we were unable to examine relationships between different facets of students' extracurricular reading behavior in foregoing grades and the development of reading comprehension and vocabulary or reading behavior itself. Finally, social desirability might well have influenced the reading behavior measures, because we asked for retrospective estimations of student's own behavior.

4.4 Conclusion and Implications for Further Research

We can conclude that reading outside school matters for the development of reading comprehension and, although to a lesser degree, also for vocabulary. Furthermore, looking at students' reading behavior not only as a single measure in time but also as a mixture of the quantity and type of reading material delivers further insights into the relationship between reading behavior and reading comprehension and vocabulary. However, several problems remain unresolved. First, our measures of students' reading behavior are still relatively superficial. In particular, there is still a lot of additional heterogeneity within every category. For example, books summarized in one category differ in their reading difficulty, and this may be decisive when explaining interindividual differences in reading literacy (e.g. Carver & Leibert, 1995). A comparable argument can be formulated for the book's genre. Furthermore, the outcome measures used in the present study are only a selection of additional potential outcome measures (cf., OECD, 2011). Finally, the reading behavior of students changes in interaction with technological development. Web applications such as Facebook or Twitter and an increasing dissemination of smartphones, e-readers, and e-books (cf., Grimshaw, Dungworth, McKnight, & Morris, 2007) may dramatically change our reading habits and have far-ranging consequences for human cognitive development.

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