

RUNNING HEAD: RESILIENCE IN READING

**Promotive and Protective Effects of Cognitive, Motivational, and Parental Factors on
Reading Fluency and Reading Comprehension in Grade 9**

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Abstract

Purpose: This study examined resilience mechanisms influencing Grade 9 reading fluency and reading comprehension skills. Performance in reading fluency and comprehension in Grade 1 was considered a risk factor for Grade 9 reading performance. We focused on the potential promotive and protective effects of cognitive skills, motivational and parental factors, and gender on reading. Promotive factors benefit all individuals regardless of their level of risk, while protective factors generate more benefit for individuals at higher risk compared with those at lower risk.

Method: Data from a longitudinal Finnish sample of approximately 2,000 individuals were analyzed. Promotive and protective factors were examined separately for reading fluency and comprehension. Promotive factors were identified as main effects while controlling for Grade 1 performance. Protective factors were identified based on significant interactions with the risk factor, i.e., Grade 1 reading fluency and comprehension skills, and the signaling of gap-closing effects between those at lower and higher risk.

Results: Most examined skills and factors were identified as promotive factors for reading fluency and comprehension. Four protective factors emerged for reading fluency: pre-literacy skills, arithmetic fluency, oral language, and homework persistence. Oral language was identified as a protective factor for reading comprehension. Two additional significant interactions emerged for reading fluency: parental teaching of reading and parental support with reading-related homework, but they did not conform to the classic protective factor model.

Conclusion: This study advances the application of constructs indicating resilience in reading research and sheds light on factors that provide promotive and protective support for early reading skills development.

Keywords: reading fluency, reading comprehension, resilience, promotive, protective

Promotive and Protective Effects of Cognitive, Motivational, and Parental Factors on Reading Fluency and Reading Comprehension in Grade 9

The ability to read fluently and comprehend text is fundamental not only to academic achievement but also to lifelong learning and success. Although numerous studies have analyzed and revealed factors that contribute to difficulties in reading fluency and comprehension (e.g., Caravolas et al., 2019; Hjetland et al., 2020; Lervåg et al., 2018; Psyridou et al., 2021) and provided predictive models for identifying individuals at risk of reading difficulties early on (e.g., Erbeli et al., 2023; Psyridou et al., 2023b), a significant gap prevails with respect to understanding of resilience mechanisms that can protect against these difficulties. In the modern educational landscape where reading fluency and comprehension lay the critical foundation for academic success across various subjects, understanding the underlying factors that promote resilience in literacy development is paramount. The limited existing research on resilience has predominantly centered on children with or at risk for dyslexia, primarily exploring resilience, i.e., promotive and protective factors related to socio-emotional and cognitive factors supporting an individual in a situation of accumulated risks (Aro et al., 2023; Haft et al., 2016; Yu et al., 2018). Nevertheless, despite these efforts, a consensus on these findings remains elusive. In a recent study that sought to examine resilience mechanisms, the focus was solely on cognitive skills, specifically vocabulary, rapid naming, verbal working memory, and processing speed, to determine their potential contribution to resilience in the context of only single-word reading skills (Slomowitz et al., 2021). The present study contributes to this emerging research area and explores whether a longitudinal design encompassing a broader set of cognitive skills, motivational factors, parental factors (parental involvement in reading tasks, parental reading difficulties, socio-economic status [SES]), and gender could inform on the range of underlying resilience mechanisms in the lives of children at an early risk of reading difficulties.

Risk can be conceptualized in various ways, such as a discrete condition or performing at the lower end of a continuous distribution. In the present study, we considered poor reading fluency and comprehension skills in Grade 1 as the initial risk factors, acknowledging the potential long-term consequences these early challenges may have for further skill development. Prior research on the development of reading fluency and reading comprehension, as well as the stability of reading difficulties over time, both in the Finnish context (e.g., Khanolainen et al., 2020; Psyridou et al., 2023a) and in other languages (e.g., Ricketts et al., 2020; Verhoeven & van Leeuwe, 2008), indicates strong correlations and high stability, particularly for reading fluency. However, despite this mean level across-age stability, studies have also documented the existence of varying developmental trajectories and that even individuals who share similar risk factors may exhibit distinct pathways in their reading skills development (e.g., Catts et al., 2012; Psyridou et al., 2020; 2021; Torppa et al., 2015). These findings point to the likelihood of a range of promotive and/or protective factors – in addition to risk factors – contributing to developmental mechanisms, warranting more extensive examination.

Using a longitudinal design, which allows for analysis of a range of cognitive, motivational, and parental factors known to impact reading skills development, we seek to deepen our understanding of resilience mechanisms in early literacy and identify key promotive and protective factors that contribute to early literacy development. Understanding these factors holds the potential to pinpoint key areas where interventions and support can yield the most significant benefits. Ultimately, this endeavor holds the promise of advancing understanding of the mechanisms of resilience in early literacy learning and guiding the development of evidence-based interventions to enhance the academic achievements of children at risk of reading difficulties.

Resilience Through the Lens of Developmental Psychopathology

Research on resilience has recently called for a developmental systems approach (Masten, 2011). In accordance with the developmental psychopathology perspective, resilience refers to achieving outcomes that surpass expectations despite the presence of risk (Masten & Kalstabakken, 2018). Thus, risk is a fundamental prerequisite for resilience (Masten, 2001). Within the context of child maltreatment and psychopathology (Masten & Wright, 1998), it has been shown that there are individuals who, despite sharing similar risk factors, often exhibit divergent outcomes. Some individuals demonstrate resilience, even in the face of the strongest risk factors, while others do not. This resilience typically arises from the presence of promotive and protective factors within either the individual or their environment.

Promotive factors enhance outcomes for individuals across the risk spectrum, regardless of whether they face high or low levels of risk (Masten & Barnes, 2018; Masten & Reed, 2009; Wright et al., 2013). These factors have a positive influence on outcomes for all individuals and are identified by main effects in linear models (Wright et al., 2013). Promotive factors foster resilience when they manifest within a high-risk context; in low-risk contexts, they are not considered resilience factors, as there is no risk to be surmounted (Wright et al., 2013).

By contrast, protective factors mitigate the adverse effects of risk, leading to outcomes that surpass expectations for individuals at higher risk compared to those at lower risk, although individuals at lower risk may still perform better than those at higher risk (Masten & Reed, 2009). Protective factors are identified through interactions in linear models and exert their greatest influence in high-risk contexts, where they generate more robust buffering effects for individuals at high risk (Masten, 2001; Masten & Barnes, 2018; Wright et al., 2013). Therefore, the identification of protective factors necessitates, in addition to the significant interaction effect, examination of the presence of gap-closing effects between those at high and low risk.

Distinguishing between the different types of resilience mechanisms is essential because protective factors reduce disparities by offering more benefits to higher risk groups, thereby narrowing gaps (Masten & Reed, 2009; Wright et al., 2013). It is also important to note that one factor may serve dual roles as both promotive and protective; for instance, effective parenting may act as a promotive factor by improving outcomes across risk levels while also serving as a protective factor by exerting the most substantial impact on those at high risk (Masten & Barnes, 2018). Analysis helping to disentangle these different mechanisms of resilience is essential for enhancing conceptual clarity within the field of reading and for understanding forms of prevention and compensation with respect to reading difficulties.

Promotive and Protective Factors for Reading Fluency and Reading Comprehension

When attempting to incorporate the developmental psychopathology viewpoint into reading studies, two problems may surface. While over the past few decades, numerous studies have explored the factors signifying risk of reading fluency and reading comprehension difficulties and predicting early on those at risk of facing reading difficulties, considerably less focus has been given to the identification of resilience mechanisms that can protect against them. Therefore, when a linear association has been identified between certain measures and reading fluency or reading comprehension, these measures have typically been labeled as risk factors. The higher end of these linear associations, commonly referred to as promotive factors, has frequently been neglected in the interpretation of findings. Essentially, promotive factors often represent opposing ends of the same linear distribution as risk factors, rendering the observations concerning promotive factors a matter of terminology differentiation rather than a novel empirical discovery (Masten, 2001). The second challenge faced is the unclear distinction between promotive and protective factors. Frequently, the term “protective factors” is used in a general sense to refer to both kinds of effects. This issue goes beyond simple terminology, as identifying promotive and protective factors requires different methodological

strategies (that is, analyzing main effects versus interaction effects) and influences the disparity in outcomes between higher and lower risk groups in distinct ways. These challenges guided the methodological approach of the current study.

Specifying Risk for Reading Fluency and Reading Comprehension Difficulties for the Analysis of Resilience Factors

Protective factors are characterized by their capacity to lessen the impact of risk factors, which points to the need to analyze their effects longitudinally. Given that reading fluency skills are closely associated across time, as are reading comprehension skills, difficulties in the early grades can serve as indicators of potential difficulties that may persist into later grades (Khanolainen et al., 2020; Psyridou et al., 2023a; Ricketts et al., 2020; Verhoeven & van Leeuwe, 2008). Considering the high stability of reading skills, especially for reading fluency, as observed in previous studies using the same sample (Khanolainen et al., 2020; Psyridou et al., 2023a), in the present study, we determined the primary risk factor to be the initial level of reading fluency and reading comprehension skills observed at the onset of primary school (Grade 1). A study using the same sample reported high stability of both reading fluency and reading comprehension skills across Grades 1 to 9 (Khanolainen et al., 2020). Latent variables were constructed for reading fluency and reading comprehension skills for Grades 1–2, 3–4, and 7–9 and showed that for reading fluency, 76%–85% of the latent factor variance was explained by the previous assessment, while for reading comprehension, 72%–86% of the latent factor variance was explained by the previous assessment. Hence, while not perfectly predictive, early reading fluency and reading comprehension skills are strongly related to future reading skills. Moreover, despite the presence of other significant factors influencing the manifestation of reading difficulties, our study concentrated on a single primary risk variable to simplify demonstration of the developmental psychopathology analytical framework. Furthermore, by choosing reading fluency and reading comprehension skills in Grade 1 as the

primary risk variable, we leverage our dataset to examine how other factors previously identified by research as related to reading fluency or reading comprehension difficulties might serve as potential protective factors. This focused approach allowed us to delve into the role of early cognitive skills, for example, and how they contribute to resilience in reading skills development.

Research in the field of developmental psychopathology rests typically on categorical evaluation of risk/protective factors and outcomes (e.g., exposure to trauma and recovery or bouncing back). However, in the realm of reading research, the differentiation between high-risk and low-risk groups is typically made through arbitrary cut-offs within a continuous distribution. This strategy, although useful for the identification of difficulties, introduces several problems. The arbitrary selection of cut-offs, which vary across different studies, affects the consistency of findings. Additionally, reliance on such cut-offs introduces ambiguity into research findings due to measurement errors (Branum-Martin et al., 2013; Francis et al., 2005; Psyridou et al. 2020; Schatschneider et al., 2016), loss of information on individual differences, and loss of effect size and potential spurious statistical significance (MacCallun et al., 2002). This method also fails to capture the gradual nature of skill development, especially for those individuals who marginally surpass the selected cut-off at one time point, and can affect the longitudinal stability of difficulties, leading to false or biased estimations of the prevalence of each group (Psyridou et al., 2020). Individuals who marginally surpass the cut-off can still experience considerable difficulties, suggesting that a binary classification system could miss subtle, yet significant, variations in skill levels. In response to these challenges, the present study utilized a dimensional perspective, treating reading skills and the potential promotive and protective factors on a continuum ranging from very low to very high. This approach more accurately captures the complexity and diversity of reading skills, offering a nuanced risk assessment that recognizes differences in intensity across individuals. By moving

beyond the simplistic division into “at risk” and “not at risk” categories, our approach was intended to provide a representation that more closely aligns with the diverse skill range observed in real-world settings, thus avoiding the oversimplification that often accompanies binary categorizations.

Potential Promotive and/or Protective Factors in Reading Development

Variability in the development of reading fluency and reading comprehension skills during the school years can be attributed to a multitude of factors, some of which may promote reading development for all children or protect children at risk against reading difficulties. In the present study, our focus was centered on examining cognitive, motivational, and parental factors that have previously demonstrated associations with reading fluency and reading comprehension performance. Given the limited attention devoted to protective factors in previous research, the inclusion of potential protective factors in our study was guided by theoretical frameworks and empirical evidence related to risk and promotive factors in reading skills development.

Cognitive skills represent an extensively researched domain when it comes to understanding the variations in reading skills among individuals. Previous studies have consistently highlighted the significance of cognitive skills as predictive markers for the subsequent development of reading fluency and reading comprehension, as well as the probability of manifesting reading difficulties. The cognitive skills examined in the present study as candidates supporting children’s reading skills development included rapid automatized naming (RAN) (Clayton et al., 2020; Hoff et al., 2023; Landerl et al., 2019), pre-literacy skills such as phoneme awareness, letter knowledge and word reading (e.g., Caravolas et al., 2012; Lervåg et al., 2009; Melby-Lervåg et al., 2012), counting (Bernabini et al., 2021; Koponen et al., 2016; Psyridou et al., 2021), and oral language (Hjetland et al., 2018; Hulme et al., 2015; Psyridou et al., 2018, 2021; Schatschneider et al., 2004). Additionally, early

arithmetic fluency skills have been shown to have a close association with literacy development (Balhinez & Shaul, 2019; Georgiou et al., 2021; Koponen et al., 2016; Landerl & Moll, 2010). There is significant overlap in cognitive processes involved in both reading and arithmetic, such as nonverbal reasoning, working memory, processing speed, RAN, and serial retrieval fluency (Fuchs et al., 2016; Koponen et al., 2019; Spencer et al., 2022), and a substantial proportion of individuals with reading fluency difficulties also struggle with difficulties in arithmetic fluency (Khanolainen et al., 2023; Moll et al., 2019).

Beyond cognitive skills, motivational factors such as task persistence, interest in literacy, the perceived importance and utility of literacy, and self-concept of reading ability have also demonstrated links to reading performance. For instance, several studies have suggested a positive link between academic achievement and task-persistent learning behavior (or a negative link between academic achievement and task avoidance; e.g., Georgiou et al., 2013; Hirvonen et al., 2010) while performance in literacy has been positively associated with interest in literacy (e.g., Ecalle et al., 2006; Viljaranta et al., 2009) and self-concept of ability in literacy (i.e., students' beliefs about their competence in different domains) (Vasalampi et al., 2020).

In addition to cognitive skills and motivational factors, various parental factors may serve as promoting or protective factors in literacy learning. In addition to obvious genetic influences (e.g., Snowling & Melby-Lervåg, 2016; van Bergen et al., 2014), the home environment also plays an important role in the development of reading skills (e.g., Barger et al., 2019; Boonk et al., 2018; Noble et al., 2019). Studies examining the association between parental involvement in learning, such as parental teaching of reading at home or parental support with reading-related homework, and reading performance have demonstrated, however, mixed results (Dumont et al., 2012; Hill & Tyson, 2009; Silinskas et al., 2022; Wilder, 2014). Even when parents aim to support their children's skills, motivation, or

engagement, their efforts may not yield the intended results. Moreover, due to gene–environment interactions (Hart et al., 2021), reading difficulties in parents and their children may affect the home environment or moderate the associations between the home environment and reading development. Finally, SES, most commonly defined by measures such as parental education and family income, has often been identified as an important indicator influencing children’s reading outcomes (Dilnot et al., 2016; Guzmán-Simón et al., 2020; Khanolainen et al., 2020; Psyridou et al., 2021), with lower SES being associated with lower reading performance. However, the relationship between SES and children’s reading skills may reflect multiple factors, including both genetic and environmental effects.

Finally, a significant body of research has indicated that females tend to excel over males in reading proficiency (e.g., Clinton et al., 2014; Quinn & Wagner, 2015), as has been reported for the present sample (e.g., Manu et al., 2021; Psyridou et al., 2021). At the individual level, a potential factor contributing to this gender disparity in reading skills could be the variation in cognitive abilities: girls are reported to have an advantage in essential pre-reading skills such as phonological awareness, letter recognition, rapid naming, vocabulary, and listening comprehension (Lange et al., 2016; Palejwala & Fine, 2015). However, this was not found in the present sample (Manu et al., 2021). Another possibility may be related to motivational factors, as girls tend to be more interested in literacy activities (e.g., Marsh & Yeung, 1998; Ulvinen, 2024; Viljaranta et al., 2016).

The Present Study

The present study was designed to explore whether early cognitive skills, motivational factors, parental factors, and gender can act as promotive factors (exhibiting positive effects for all children) and/or protective factors (demonstrating stronger positive effects for children with weaker reading skills in Grade 1) for reading fluency and comprehension skills in Grade 9. The cognitive skills considered to be potential promotive and protective factors were

phonological awareness, letter knowledge, word reading, RAN, counting, arithmetic fluency, vocabulary, listening comprehension, and nonverbal reasoning. In terms of motivational factors, the present study examined self-concept for literacy, task value for literacy, and homework persistence. The parental factors encompassed teaching reading at home, support with reading-related homework, parental reading difficulties, and SES. Grade 9 was chosen as the endpoint, as it marks the end of comprehensive school. Drawing upon prior research, especially from previous studies using the same sample, we expected that most of the cognitive skills and motivational factors selected for investigation, along with the absence of parental reading difficulties, would support the literacy development of all children and thus serve as promotive factors (e.g., Caravolas et al., 2019; Clayton et al., 2020; Hoff et al., 2023; Manu et al., 2021; Psyridou et al., 2021; Silinskas et al., 2022; Ulvinen et al., 2024). We also hypothesized that girls would perform better than boys (e.g., Clinton et al., 2014; Manu et al., 2021; Psyridou et al., 2021; Quinn & Wagner, 2015). Since previous research on resilience has primarily focused on children with or at risk for dyslexia (Haft et al., 2016; Yu et al., 2018) or on single-word reading skills in the context of low phonological awareness (Slomowitz et al., 2021), and these studies have yielded inconsistent findings, we refrained from forming a priori hypotheses regarding potential protective factors.

Methods

Participants

The present study was part of a Finnish longitudinal study [“Name of the study” removed for review] that includes data from approximately 2,000 children from kindergarten to Grade 9 (AUTHORS, removed for review). Children’s cognitive skills were assessed in the fall and/or spring of kindergarten (i.e., age 6–7 years); nonverbal reasoning was assessed in the spring of Grade 3 (i.e., age 9–10 years), while their self-concept and task value for literacy were assessed in Grades 6, 7, and 9. In addition, children’s homework persistence, parental

teaching of reading at home, and parental support with reading-related homework were assessed from Grade 1 to Grade 9 (i.e., age 7 to age 16 years). The sample was drawn from four municipalities: two in central, one in western, and one in eastern Finland. One municipality was mainly urban, one mainly rural, and two included both urban and semi-rural environments. In three of the municipalities, the participants formed the entire age cohort of children, and in the fourth, the participating children comprised about half the age cohort. Of the parents who were contacted, 78%–89% agreed to participate in the study – depending on the town or municipality. Ethnically and culturally, the sample was very homogeneous and representative of the Finnish population, and parental education levels were very close to the national distribution of Finland (Statistics Finland, 2007). The university of [“Name of the University” removed for review] ethics committee approved the study in 2006, and all participants provided informed written consent.

Measures

The children were assessed longitudinally, starting in kindergarten (5–6 years old; fall 2006 and/or spring 2007) and continuing through Grade 9 (spring 2016). Mothers and fathers independently completed questionnaires regarding their education level during each assessment year. The highest education level reported by both parents within each family was retained. Family income information was obtained for the years when their children were in Grades 4, 6, 7, and 9. Furthermore, during Grades 1, 2, 3, 4, 6, 7, and 9, parents answered questions about their child’s persistence when doing homework, frequency of teaching reading to their child, and frequency of supporting their child with reading-related homework. The responses from both parents were combined, considering the following approach: if only the mother or father responded, their respective answer was retained; if both parents responded, the mean of their responses was calculated. By adopting this method, the measures employed

in this study incorporated information from both parents. All measures are described in Table 1.

Statistical Analysis

Promotive and protective factors were identified separately for Grade 9 reading fluency and reading comprehension using multiple regression models. For reading fluency, the outcome variable was reading fluency in Grade 9, represented as a latent factor constructed from the three reading fluency tasks. Grade 1 reading fluency performance was considered the risk factor for later reading fluency development. Grade 1 reading fluency skills were modeled as a latent factor comprising the three reading fluency tasks. For reading comprehension, the outcome variable was Grade 9 reading comprehension, represented as a latent factor constructed from the two reading comprehension tasks in Grade 9 (the nationally normed reading test battery and the task from the Programme for International Student Assessment [PISA]). Similar to the approach for reading fluency, Grade 1 reading comprehension performance was considered the risk factor for later reading comprehension development. Grade 1 reading comprehension skills were modeled as an observed variable.

Main effects and Risk \times “Testing variable” interactions were used to test for promotive and protective factors, respectively (see Figure 1 for moderation graph). The “Testing variable” encompassed pre-literacy, counting, RAN, oral language, arithmetic fluency, nonverbal reasoning, self-concept for literacy, task value for literacy, homework persistence, teaching reading at home, parental support with reading-related homework, parental reading difficulties, SES, and gender in 14 separate models. To explore the direction of significant interaction effects and their potential contribution to gap-closing effects, we also conducted a simple slopes analysis (Aiken & West, 1991).

Except for parental reading difficulties and gender, which were entered as binary variables into the multiple regression models, cognitive skills, motivational factors, and

parental factors (i.e., the testing variables) were all entered as continuous variables. For the testing variables, we opted for latent factors whenever feasible. A detailed overview of the 14 models, specifying whether observed or latent variables were employed for the testing variables, can be found in Table 2. Utilizing latent factors allowed the mitigation of the effect of measurement error. Furthermore, constructing latent factors that integrate data from earlier grades, rather than solely focusing on Grade 9, enabled us to capture the cumulative effect of this factor over time, offering a more robust representation of its promotive or protective effects on Grade 9 reading fluency and reading comprehension skills. Thus, this approach yielded a more comprehensive analysis of the potential promotive and protective effects of various factors on Grade 9 reading fluency and reading comprehension skills. Factor loadings for all latent factors can be found in Appendix B.

Given the examination of multiple models in this study, we applied a Bonferroni-adjusted alpha level separately for each group of similar covariates, namely cognitive skills, parental factors, and motivation, separately for the analysis of reading fluency and reading comprehension. Specifically, in the six models assessing whether cognitive skills serve as promotive or protective factors (pre-literacy, RAN, counting, early arithmetic skills, oral language, Raven), we set the Bonferroni-adjusted significance value at .0042 (.05/12). In the three models investigating motivation factors as promotive or protective factors (self-concept of literacy, task value for literacy, homework persistence), we utilized a Bonferroni-adjusted significance value of .0083 (.05/6). For the four models exploring the role of parental factors as promotive or protective factors (teaching reading at home, parental support with reading-related homework, SES, parental reading difficulties), we applied a Bonferroni-adjusted significance value of .0063 (.05/8). This correction is considered conservative due to its method and the presence of correlations among factors under investigation (see Appendix D).

The Mplus statistical package (Version 8.7; Muthén & Muthén, 1998–2021) was used for the statistical analyses for the identification of promotive and protective factors. We assumed that the data were missing-at-random (MAR) and opted for a full information maximum likelihood (FIML) data analysis approach that utilizes all available data for the model estimation without imputing missing values. Given the skewness in the distributions of some variables (see Table 3), maximum likelihood estimation with robust standard errors (MLR) was preferred as an estimator for the analysis. The data that support the findings of this study, materials, and analysis code are available on request from the authors. This study was not preregistered.

Results

Descriptive Statistics

Table 3 provides descriptive statistics for the potential promotive and/or protective variables, along with the reading fluency and reading comprehension tasks in Grades 1 (Risk variable) and 9 (Outcome). Appendix A presents correlation coefficients (Pearson or Spearman) between all potential promotive and/or protective variables and the reading fluency and comprehension tasks in both Grades 1 and 9. Appendix D presents the correlations between all potential promotive and/or protective factors. The specific components that constitute each scale are outlined in both the descriptive statistics table and the correlation table, as they were used to construct the latent factors utilized in subsequent analyses. Factor loadings for each latent factor are provided in Appendix B.

Promotive Factors

Reading Fluency

As shown in Tables 4 (cognitive skills), 5 (motivation factors), 6 (parental factors), and 7 (gender), 10 of the 14 estimated regression models revealed significant promotive factors. RAN, oral language, nonverbal reasoning, self-concept for literacy, task value for literacy,

homework persistence, teaching reading at home, support with reading-related homework, parental reading difficulties, and gender significantly predicted reading fluency skills in Grade 9 while controlling for reading fluency skills in Grade 1. Beta coefficients were positive for all measures except for teaching reading at home, support with reading-related homework, parental reading difficulties, and gender, suggesting that less teaching of reading at home, less support with reading-related homework, absence of parental reading difficulties, and being female predicted better reading fluency skills in Grade 9 over and above reading fluency skills in Grade 1. Pre-literacy skills, counting, arithmetic fluency, and SES all had nonsignificant betas.

Reading Comprehension

All 14 models suggested significant promotive factors (Tables 4, 5, 6, and 7). Beta coefficients were positive for all measures except for teaching reading at home, support with reading-related homework, parental reading difficulties, and gender, suggesting that less teaching of reading at home, less support with reading-related homework, absence of parental reading difficulties, and being female predicted better reading comprehension skills in Grade 9 over and above reading comprehension skills in Grade 1. Better pre-literacy skills, RAN, counting, arithmetic fluency, oral language, nonverbal reasoning, self-concept for literacy, task value for literacy, homework persistence, and SES significantly predicted better reading comprehension skills in Grade 9 while controlling for reading comprehension skills in Grade 1.

Protective Factors

Interaction terms were used to test protective effects, with each one included in a separate model that also accounted for the main effects.

Reading Fluency

Six significant interactions were observed for pre-literacy, arithmetic fluency, oral language, homework persistence, parental teaching of reading at home, and parental support with reading-related homework. To explore the direction of the significant interaction effects, a simple slopes analysis was performed. Figure 2 illustrates the significant interaction effects as follows: (a) Risk \times Pre-literacy, (b) Risk \times Arithmetic, (c) Risk \times Oral language, (d) Risk \times Persistence, (e) Risk \times Teaching reading, and (f) Risk \times Support in homework. Figures (a), (b), (c), and (d) revealed that when Grade 1 students have lower reading fluency scores (represented as higher risk on the x-axis), the impact of each specific factor becomes more pronounced. This is evident in the wider gap between the green and red regression lines, with green indicating high levels and red indicating low levels of these factors within the sample. That is, individuals with lower reading fluency skills in Grade 1 benefited more from stronger pre-literacy, arithmetic fluency, and oral language skills, as well as greater homework persistence, compared to individuals with better reading fluency skills in Grade 1, concerning their reading fluency skills in Grade 9. These patterns align with classical protective effects. Conversely, the figures for parental teaching of reading at home and parental support with reading-related homework suggested that individuals with lower reading fluency skills derived fewer benefits from increased parental involvement in reading instruction and support with reading-related homework, which did not conform to the classical protective effects.

Given the observed correlations between pre-literacy skills, arithmetic fluency, and oral language (Appendix D), we further investigated whether the identified protective effects for each measure remained while controlling also for the direct effects of the other two measures. The analysis showed that the interaction effect for pre-literacy remained significant ($\beta = -.07$, $p = .003$) after controlling for reading fluency in Grade 1 ($\beta = .72$, $p < .001$), pre-literacy ($\beta = -.05$, $p = .37$), oral language ($\beta = .11$, $p = .01$), and arithmetic fluency ($\beta = -.02$, $p = .64$). The

interaction effect for oral language did not remain significant ($\beta = -.05$, $p = .06$) after controlling for reading fluency in Grade 1 ($\beta = .70$, $p < .001$), pre-literacy ($\beta = -.05$, $p = .38$), oral language ($\beta = .13$, $p = .01$), and arithmetic fluency ($\beta = -.02$, $p = .65$). Finally, the interaction effect for arithmetic fluency was still significant ($\beta = -.06$, $p = .002$) after controlling for reading fluency in Grade 1 ($\beta = .70$, $p < .001$), pre-literacy ($\beta = -.06$, $p = .29$), oral language ($\beta = .12$, $p = .02$), and arithmetic fluency ($\beta = .01$, $p = .79$).

Reading Comprehension

One significant interaction was found for oral language (Figure 3). The figure shows that individuals with lower reading comprehension skills in Grade 1 benefited more from better oral language skills compared to those with better reading comprehension skills in Grade 1, concerning their reading comprehension skills in Grade 9, indicating that oral language skills can act as a protective factor.

Discussion

While research on reading difficulties has traditionally concentrated on identifying factors that heighten the risk of encountering reading fluency or comprehension difficulties, less attention has been dedicated to elucidating the resilience mechanisms in reading skills development. Such mechanisms may help explain why some individuals, despite being at risk for reading difficulties – such as those with low reading fluency or comprehension skills in the early grades – do not ultimately develop these difficulties. This study contributes to this emerging research area by examining whether cognitive skills, motivational factors, and parental factors could serve as resilience mechanisms in reading skill development. Our large longitudinal dataset, encompassing a wide array of measures across various domains and developmental stages, enabled a rather comprehensive investigation of both promotive and protective factors. Our analysis identified specific factors that seem to function as promotive and protective in reading skills development in accordance with the theoretical framework of

resilience (Masten & Barnes, 2018; Masten & Reed, 2009; Wright et al., 2013). However, it is important to note that the design of our study precludes us from asserting causality. Therefore, while our findings suggest that these factors may be understood as ‘promotive’ or ‘protective’ within the framework of resilience theory, such designations are based on theoretical alignment rather than empirical proof of causation.

Consistent with prior research (e.g., Caravolas et al., 2019; Clayton et al., 2020; Hoff et al., 2023; Psyridou et al., 2021; Silinskas et al., 2022), our results revealed linear associations between RAN, oral language, nonverbal reasoning, self-concept for literacy, task value for literacy, homework persistence, teaching reading at home, support with reading-related homework, parental reading difficulties, and gender with reading fluency skills in Grade 9, while controlling for reading fluency skills in Grade 1. Furthermore, linear associations emerged between all the included measures and reading comprehension skills in Grade 9, while controlling for reading comprehension skills in Grade 1. In the current theoretical framework (Masten & Barnes, 2018; Masten & Reed, 2009; Wright et al., 2013), these factors signify not merely the absence of risk but the presence of factors that promote the development of reading fluency and comprehension skills. However, among the measures examined, pre-literacy skills, counting, arithmetic fluency, and SES did not have a significant effect on reading fluency skills in Grade 9 over and above the influence of Grade 1 reading fluency skills. The finding that SES was not associated with reading fluency aligns with some previous studies conducted in Finland (e.g., Khanolainen et al., 2023; Torppa et al., 2015). On the other hand, the finding that counting was not associated with reading fluency contradicts previous results (Bernabini et al., 2021; Koponen et al., 2016). This discrepancy could be explained by the use of the adjusted alpha level in the current study. If a less conservative alpha level had been used, counting would have emerged as a protective factor for reading fluency ($p = .007$ accompanied by a gap-closing effect). While pre-literacy and arithmetic fluency skills did not significantly contribute to

promoting the development of reading fluency skill from Grade 1 to Grade 9, they seem to act as protective factors.

Our analysis unveiled four factors that can serve as protective for Grade 9 reading fluency skills (pre-literacy, arithmetic fluency, oral language, and homework persistence), while one factor was identified as protective for Grade 9 reading comprehension (oral language). It is noteworthy that associations with reading fluency stemmed from the domains of cognition and motivation, while with reading comprehension, they derived from the cognitive domain. In contrast, no protective factors were observed within the realm of parental factors. These findings suggest the pivotal roles that cognitive skills and motivation factors may play in supporting reading skill development in children at higher risk for reading difficulties.

The identification of pre-literacy, arithmetic fluency, oral language, and homework persistence as protective factors for reading fluency extends the findings of prior research. Several previous studies have shown that better pre-literacy (e.g., Caravolas et al., 2019; Clayton et al., 2020; Lervåg et al., 2009; Melby-Lervåg et al., 2012), arithmetic fluency (Balhinez & Shaul, 2019; Koponen et al., 2016), and oral language (Hjetland et al., 2018; Hulme et al., 2015; Schatschneider et al., 2004) skills as well as increased task persistence (Georgiou et al., 2013, Hirvonen et al., 2010) are associated with better later reading fluency skills. Notably, pre-literacy and arithmetic fluency skills were found to serve solely as protective factors for reading fluency. In other words, while their main effects were not significant, suggesting that they do not serve as promotive factors (that is, supporting all children's reading fluency skills), it seems that individuals with lower reading fluency skills in Grade 1 benefit most from strong pre-literacy and arithmetic fluency skills. This may indicate that good pre-literacy and arithmetic fluency skills may help some children bridge initial gaps in reading fluency by Grade 9. Pre-literacy skills such as phoneme awareness, letter knowledge,

and word reading are foundational for reading development (e.g., Caravolas et al., 2012; Lervåg et al., 2009; Melby-Lervåg et al., 2012). However, in highly transparent orthographies like Finnish, where the letter–sound correspondence is almost one-to-one, many students acquire these skills early, and their predictive power drops quickly over time (Holopainen et al., 2001; Leppänen et al., 2006). Thus, while they may not function as promotive factors, they seem to serve more as protective factors, and individuals with lower reading fluency skills in Grade 1 seem to benefit the most from strong pre-literacy skills. Regarding arithmetic fluency, research has consistently shown a close association between reading and arithmetic skills (e.g., Balhinez & Shaul, 2019; Georgiou et al., 2021; Landerl & Moll, 2010). There is significant overlap in cognitive processes involved in both skills, such as nonverbal reasoning, working memory, processing speed, RAN, and serial retrieval fluency (Fuchs et al., 2016; Koponen et al., 2019; Spencer et al., 2022), and a substantial proportion of individuals with reading fluency difficulties also struggle with difficulties in arithmetic fluency (Khanolainen et al., 2023; Moll et al., 2019). Arithmetic fluency performance may reflect these shared unmeasured processes. Children with low reading fluency skills in Grade 1 may particularly benefit from the transfer of cognitive skills from arithmetic, as these shared processes may be helpful in improving their reading fluency over time. In contrast, for children with already strong reading skills in Grade 1, the additional support from arithmetic skills – or the shared cognitive processes – may not be as critical. Furthermore, for those with low reading fluency skills in Grade 1, early arithmetic proficiency may also indicate a compensatory mechanism through motivation. Strong early arithmetic skills seem to improve motivation for math-related tasks, which, in turn, positively influences motivation for literacy-related tasks (Viljaranta et al., 2009). Overall, the relationship between arithmetic fluency and reading fluency seems to be complex, suggesting a bidirectional influence. While reading fluency may have a more substantial influence on arithmetic development (Khanolainen et al., 2023), strong arithmetic fluency skills appear to

serve as a protective factor for reading fluency, and individuals with lower reading fluency skills in Grade 1 seem to benefit the most from strong arithmetic fluency skills. Considering the broader educational and developmental context, it is possible that initial poor reading performance could stem from various factors, such as interest in other academic areas like mathematics or instruction or other classroom-related issues, due to which reading instruction is not optimal. However, their strong pre-literacy or arithmetic fluency skills before school entry might indicate that after appropriate or sufficient teaching or more focus on reading, they have the potential to develop good reading fluency skills over time. Moreover, as reading accuracy and reading fluency can have distinct cognitive profiles (Torppa et al., 2013), it is also possible that children with poorer reading fluency skills in Grade 1 might still develop automaticity and good reading fluency skills once they have acquired the grapheme–phoneme connections (albeit more slowly than their peers). This also underscores the importance of a nuanced approach to evaluating both outcomes and a child’s risk of developing reading difficulties.

The identification of oral language skills as both a promotive and a protective factor for reading fluency can be contextualized and supported by prior research findings. Oral language skills serve as the foundation for various aspects of learning, including reading (Hulme et al., 2020). Numerous studies (Hjetland et al., 2018; Hulme et al., 2015; Schatschneider et al., 2004) have highlighted the critical role of early oral language skills in learning to read. Early oral language skills facilitate the development of foundational reading skills such as phonological awareness, phoneme–grapheme knowledge, and decoding. As such, for children who begin with lower reading fluency skills in Grade 1, strong oral language skills may act as a protective factor by providing a buffer against reading difficulties by enhancing their ability to grasp the fundamentals of reading. These findings illuminate the dual nature of oral language skills as both promotive, benefiting all children’s reading fluency skills, and protective, offering critical

support to children with lower fluency skills in Grade 1, ultimately reinforcing their reading development and outcomes and helping them narrow the gap with their lower risk peers. Results from a previous study (Slomowitz et al., 2021) suggested that vocabulary acted as a skill enhancement factor, benefiting more those with lower risk. However, in that study, a different risk factor (i.e., phonological awareness) was used, while we used Grade 1 reading fluency. Furthermore, its focus was on word reading, while our study examined adolescent reading fluency. Additionally, our study was conducted with a language with transparent orthography, Finnish, while the study by Slomowitz et al. (2021) was conducted with English. These differences may explain the contrasting findings. It should be noted, though, that the interaction effect of oral language did not remain significant when controlling for the direct effects of pre-literacy and arithmetic fluency skills. This suggests that the influence of oral language on reading fluency may not be independent of pre-literacy and arithmetic fluency skills. Conversely, the significant interaction effects of pre-literacy and arithmetic fluency persisted even after accounting for the direct effects of each other and oral language.

Homework persistence was found to serve as both a promotive and a protective factor for reading fluency, supporting findings of previous positive correlations between task persistence and skills (Onatsu-Arvilommi & Nurmi, 2000; Zhang et al., 2011). While it supported all children's reading fluency skills, children with low reading fluency in Grade 1 seem to benefit the most from greater homework persistence. A growing body of empirical evidence points to a positive link between academic achievement and task-persistent learning behavior, or conversely, to a negative link between academic achievement and task avoidance (e.g., Georgiou et al., 2013; Hirvonen et al., 2010). Children who demonstrate persistence in homework gain additional practice opportunities (Viljaranta et al., 2018). For children with low Grade 1 reading fluency skills, this can be particularly important in overcoming reading difficulties and improving their reading fluency. This suggests that children who struggle with

reading early on may compensate by dedicating more time and effort to homework and studying. This increased persistence in homework completion could help them catch up and develop stronger reading fluency skills by Grade 9. It could also be likely that children who have high levels of homework persistence may also possess greater resilience and determination when encountering academic challenges.

In terms of reading comprehension, only oral language skills were identified as a protective factor. Various studies conducted across different orthographies have documented the strong association between oral language and reading comprehension (Caravolas et al., 2019; Goodwin et al., 2022; Hjetland et al., 2020; Lervåg et al., 2018). This association has also been observed in the Finnish language, both within the same sample as that of the current study (Manu et al., 2021; Psyridou et al., 2023b) and in different samples (Psyridou et al., 2018). The findings of our study further extend those of previous research, suggesting that while oral language skills are important for the reading comprehension skills of all children, individuals with lower reading comprehension skills in Grade 1 benefit the most from strong oral language skills. For children with lower reading comprehension skills at this early stage, oral language skills may act as a protective factor, aiding them in bridging the gap between their current reading comprehension abilities and the level of comprehension required for grade-level texts. A richer vocabulary may allow them to recognize and understand more words when reading, ultimately contributing to improved comprehension. In Grade 1, reading comprehension is still greatly dependent on reading fluency, and when reading is very slow, it may be a bottleneck for comprehension. However, this dependence diminishes over time. As children surpass this critical juncture, the influence of reading fluency on comprehension wanes, and oral language skills emerge as more pivotal (Florit & Cain, 2011; Torppa et al., 2016). For students facing early reading comprehension difficulties, strong oral language skills

in kindergarten may support long-term reading success, independent of early fluency limitations.

Within our analysis, two additional significant interactions for reading fluency emerged. The first involved the interplay between parental teaching of reading and Grade 1 reading fluency skills, and the second pertained to the relationship between parental support with reading-related homework and Grade 1 reading fluency skills, with both influencing reading fluency performance in Grade 9. However, these interactions were not consistent with the classic protective factor model. Instead, they revealed that those at high risk for reading difficulties benefited less from increased parental teaching of reading and greater parental support with reading-related homework compared to children at low risk for reading difficulties. This aligns with a study by Silinskas et al. (2015), which found that the more homework help mothers reported providing, the slower the development of their children's academic performance from Grade 1 to 4. In essence, the effects of parental involvement in teaching reading or providing homework support are multifaceted. Increased levels of teaching of reading at home or support with reading-related homework may not inherently cause the widening of the gap between children at lower and higher risk of reading difficulties. Instead, this may suggest that children with difficulties seek more support at home for their homework, or parents may become more attentive to their children's reading difficulties (e.g., after getting feedback from school that their child is struggling), leading to more support at home, either through homework assistance or teaching reading. In contrast, children at low risk for reading fluency difficulties, who likely started with stronger Grade 1 reading fluency skills, may have a more solid foundation. Therefore, parents may engage in less teaching of reading at home, and even lower levels of parental teaching of reading may have a greater positive impact on them, further enhancing their reading fluency by Grade 9. Moreover, parental support with homework may sometimes be inappropriate. For instance, a recent meta-analysis (Boonk et al.,

2018) suggested that parental support with homework can have negative associations with children's academic achievements, especially when parents inhibit children's autonomy.

A critical question revolves around a child's potential to overcome risk factors and resolve their difficulties due to the promotive and, more significantly, protective factors that mitigate these risks, thereby narrowing the gap between those at higher and lower risk. Previous studies, both in Finland (Psyridou et al., 2020; Psyridou et al., 2021; Torppa et al., 2015) and in other countries (e.g., Catts et al., 2012; Leach et al., 2003), have indicated that some individuals manage to resolve their reading fluency or reading comprehension difficulties. It is, therefore, reasonable to hypothesize that these factors play a role in such instances. Nevertheless, further investigation is needed to assess the enduring nature of the protective effects identified in the present study. This is especially important in understanding whether the factors found as protective for Grade 9 reading fluency and comprehension skills continue to have a positive influence throughout subsequent years of schooling or exhibit similar protective effects at earlier stages of development. Furthermore, additional research is needed to develop models that measure cumulative and combinatorial profiles of risk, along with promotive and protective factors (McGrath et al., 2020; Pennington, 2006). Additionally, intervention studies are essential to explore the effects of the identified protective factors in practice and assess their contributions to improvements in reading skills.

Specific limitations associated with this study need to be addressed. First, Grade 1 reading comprehension was assessed with only one nationally normed test. By having more texts and items, we could have increased the reliability of the reading comprehension assessment at this time point. This approach would also enable the use of a latent variable for Grade 1 reading comprehension, thereby controlling for the effect of measurement error. Measurement error may affect the interpretation of some of our results, particularly for observed variables. It is possible that some children may have underperformed on the Grade 1

assessment due to factors not captured in our study, such as external influences on the day of testing. In such cases, even if a child appears to be at risk for reading difficulties at one assessment point, their performance in related skills might suggest that they are less at risk and perform well later. Although we have used latent variables for reading fluency in both Grades 1 and 9, reading comprehension in Grade 9, and most promotive/protective factors to mitigate measurement error, caution is still required when interpreting findings related to observed variables. Additionally, the reliability of the listening comprehension measure was relatively low. Yet, considering the young age of the participants, this is not extraordinary. The lower reliability could result in a less accurate estimation of the impact of this skill on reading. However, despite the low reliability, oral language emerged as both a promotive and a protective factor both for reading fluency and for reading comprehension. Second, it is important to consider the potential presence of promotive and/or protective factors within the school environment. These could include factors like supplementary school support, teacher experience, classroom composition, or class size. The current study did not investigate these specific factors, leaving open the possibility that the inclusion of these factors could have unveiled additional promotive and/or protective factors. Third, the assessment of parental reading difficulties was not optimal, relying on self-reported data using a single question. This assessment does not fully capture parental skills, potentially resulting in an underestimation of their influence. Nevertheless, even within the constraints of this measure, the absence of parental reading difficulties still emerged as a promotive factor. Finally, our findings focus on whether the measures examined in this study can act as promotive and/or protective against specific risk factors: Grade 1 performance in reading fluency or reading comprehension skills. These skills were selected as risk factors due to the stability of reading skills observed in prior research utilizing the same dataset (Khanolainen et al., 2020; Psyridou et al., 2023a). When considering alternative risk factors, different promotive and/or protective effects may emerge.

In summary, this study aimed to strengthen the incorporation of a resilience perspective within the field of reading research by identifying potential promotive and protective factors. Our findings also emphasize the higher end of the linear associations between specific skills and factors and reading fluency and reading comprehension skills, by explicitly labeling them as promotive factors. Moreover, our results suggest that certain factors act as protective for reading fluency and reading comprehension. Specifically, pre-literacy, arithmetic fluency, oral language, and homework persistence served as protective factors for reading fluency, while oral language served as a protective factor for reading comprehension. These factors contributed to narrowing the gap between children at higher and lower risk of reading fluency and comprehension difficulties, respectively. By mitigating the impact of poorer reading fluency and comprehension skills, these skills and factors may have offered alternative pathways for learning, enabling individuals to surpass anticipated outcomes over time. The findings on promotive and protective factors in this study offer valuable insights for developing more efficient and impactful interventions or educational programs addressing specific skills shown to reduce disparities among children with varying levels of risk for reading fluency and comprehension difficulties. Further research, though, is needed to investigate whether early interventions focusing on these specific skills or motivational factors can enhance reading fluency and comprehension performance and mitigate future reading difficulties among at-risk children.

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Table 1*Reading Measures, Cognitive Skills, Motivational Factors, and Parental Factors Used in the Study*

	Task	Assessment Year	Description	Scoring	Reliability
Reading fluency	Word reading fluency task (Grade 1: ALLU– <i>Ala-asteen lukutesti</i> [ALLU–Reading Test for Primary School]; Lindeman, 2000; Grade 9: YKÄ-test, Lerkkanen et al., 2018)	Grade 1 (spring 2008), Grade 9 (spring 2016)	80 items consisting of a picture of a common item presented with 4 orthographically and phonologically similar words. Students had 2 min to silently match pictures to their correct word. A similarly structured word reading fluency task with phonologically more difficult words was used in Grade 9.	Number of correctly matched pictures and words. Max 80.	-
	Word-chain task (Nevala & Lyytinen, 2000)	Grade 1 (spring 2008), Grade 9 (spring 2016)	10 word chains consisting of 4–6 words written without spaces. Students had 1 min 25 s in Grade 1 and 1 min 30 s in Grade 9 to silently read and mark the word boundaries.	Number of correctly marked divisions. Max 40.	-
	Sentence reading (Grade 1: TOSREC; Wagner et al., 2010; Finnish version by Lerkkanen et al., 2008; Grade 9: YKÄ; Lerkkanen et al., 2018)		Standardized test consisting of 60 sentences in Grade 1 and 70 sentences in Grade 9. Children were given 3 minutes in Grade 1 and 2 minutes in Grade 9 to read and verify the truthfulness of as many sentences as possible.	Number of correctly marked sentences. Max 60 (Grade 1), 70 (Grade 9).	-
Reading comprehension	Nationally normed reading test battery (Grade 1: ALLU test; Lindeman, 2000;	Grade 1 (spring 2008), Grade 9 (spring 2016)	In Grade 1, the children silently read the text at their own pace and then answered 11 multiple-choice questions and 1 question in which they had to arrange 5 statements in the correct	A score of 1 was given for every correct	Kuder-Richardson from the test manual = .85 (Grade 1)

	Grade 9: YKÄ test; Lerkkanen et al., 2018)		sequence based on information gathered from the text. The maximum time allotted was 45 min. In Grade 9, the test had the same aim, instructions, and number of tasks but different texts and items.	response. Max 12.	Revelle's omega = .78 (Grade 9). Cronbach's alphas = .69 (Grade 1), .63 (Grade 9)
	PISA Reading link items (OECD, 2010)	Grade 9 (fall 2015)	Students were given 60 min to read 8 sets of reading material and answer 31 questions. The reading material consisted of texts, tables, graphs, and figures. There were 15 multiple-choice questions and 16 questions which required written responses, of which 12 required accessing and retrieving information, 12 required integrating and interpreting information, and 7 required reflecting and evaluating information.	A score of 1 was given for every correct response. Max 31.	Cronbach's alpha = .75
Cognitive skills	Initial phoneme identification (ARMI; Lerkkanen et al., 2006)	Kindergarten (fall 2006)	10 sets of 4 pictures, each depicting an object. Students were first asked to name aloud the objects and then identify the object with the same initial phoneme as the one spoken aloud by the assessor.	A score of 1 was given for every correctly selected object. Max 10.	Cronbach's alpha = .77
	Letter knowledge (ARMI; Lerkkanen et al., 2006)	Kindergarten (fall 2006)	29 uppercase letters arranged in random order across 3 rows. Students were shown the letters row by row and asked to name them aloud. Either a phoneme or a letter name was regarded as correct. The test was discontinued after 6 incorrect responses.	A score of 1 was given for every correct response. Max 29.	Cronbach's alpha = .94

Reading Words (ARMI; Lerkkanen et al., 2006)	Kindergarten (spring 2007)	Students were asked to read aloud a set of 10 words (7 two-syllable words, 2 three-syllable words, and 1 five-syllable word).	A score of 1 was given for every correctly read word. Max 10.	Cronbach's alpha = .85
Counting	Kindergarten (fall 2006, spring 2007)	Pre-math skills were assessed through 4 tasks in which children were asked to count aloud forward (from 1 to 31 and from 6 to 13) and backward (from 12 to 7 and from 23 to 1).	Scored using a 3-point scale: 2 = no errors, 1 = one small error, 0 = two or more errors. Max 8.	Cronbach's alpha = .48 (fall), .64 (spring) / Revelle's omega = .52 (fall), .87 (spring)
Rapid serial naming of objects ([RAN]; Denckla & Rudel, 1976)	Kindergarten (spring 2007)	Students were asked to name a series of 50 objects (5 objects presented 10 times each) arranged in a matrix.	Total matrix completion time in seconds.	-
Receptive Vocabulary (PPVT-R, Form L; Dunn & Dunn, 1981)	Kindergarten (spring 2007)	30-item version of the Peabody Picture Vocabulary Test. Students were required to select the picture, out of 4 options, that correctly depicted a spoken word.	A score of 1 was given for every correct response. Max 30.	Cronbach's alpha = .61
Listening comprehension (Vauras et al., 1995)	Kindergarten (spring 2007)	Groups of 6 students were read aloud a story, twice, and then asked 6 questions based on the story 1 question at a time. Each question was accompanied by 3 pictures, and students responded by marking the picture that correctly matched the story in their own test booklet.	2 points were given for every correct answer. Max 12.	Cronbach's alpha = .31 / Revelle's omega = .42

	Arithmetic fluency	Kindergarten (spring 2007), Grade 1 (fall 2007) (Räsänen & Aunola, 2007)	28 items of increasing difficulty were included in the test. Students were required to complete as many arithmetic operations as possible within a 3-min time limit. Performance required both accuracy and speed (automatization of basic calculation routines). The test included addition (e.g., $2 + 1 =$) and subtraction (e.g., $11 - 2 =$) items.	A score of 1 was given for every correct response. Max 28.	-
	Nonverbal reasoning (Raven task; Raven, Court & Raven, 1995)	Grade 3 (spring 2010)	It comprised a battery of colored progressive matrices with a piece missing. Children saw a colored pattern and were asked to select the missing piece to complete the pattern out of 6 options (6 to 8) which were displayed beneath the design.		-
Motivation, children questionnaire	Self-concept for literacy	Grade 6 (spring 2013), Grade 7 (spring 2014), Grade 9 (spring 2016)	Two questions were asked about the participant's self-concept of ability in literacy, and participants rated their self-concept both in general and compared to their classmates on a 5-point scale (1= bad/not so good, 5 = very good).	A latent variable of the 6 items was used.	Cronbach's alpha = .87 (Grade 6), .87 (Grade 7), and .89 (Grade 9)
	Task value for literacy	Grade 6 (spring 2013), Grade 7 (spring 2014), Grade 9 (spring 2016)	Students' interest, importance, and utility in literacy were assessed in Grades 6, 7, and 9. Students were asked to rate 2 questions for each value separately (Interest: "How much you do you like literacy?" "How much do you like doing literacy assignments?" Importance: "How important is it for you to get good grades in literacy?" "How important is it for you to do well in literacy?" Utility: "How useful do you	A latent variable of the 18 items was used.	Cronbach's alpha = .87 (Grade 6), .88 (Grade 7), and .87 (Grade 9)

		think literacy is for your future?” “How useful is literacy in your daily life?”) according to a 5-point Likert scale (1 = “not at all,” 5 = “very much”).		
Motivation, parental questionnaire		Parents rated participants’ persistence when doing homework in Grades 1, 2, 3, 4, 6, 7, and 9 with the use of 5 questions (“If difficulties arise in the task, does the child easily start doing something else?” “Does the child actively try to cope with even difficult tasks?” “Does the child easily give up trying?” “Does the child show activity or persistence when doing tasks?” “If the task isn’t going well, does the child start fussing about these things?”) according to a 5-point Likert scale (1 = “not at all,” 5 = “very much”). The questions “If difficulties arise in the task, does the child easily start doing something else?”, “Does the child easily give up trying?”, “If the task isn’t going well, does the child start fussing about these things?” were reversed so that in all questions higher values indicate more persistence.	A latent variable of the 35 items was used.	Cronbach’s alpha = .91 (Grade 1), .90 (Grade 2), .90 (Grade 3), .91 (Grade 4), .91 (Grade 6), .92 (Grade 7), and .92 (Grade 9)
Parental factors, parental questionnaire	Parental education level	Parents reported their education level using a 7-point scale: no vocational education, vocational course (min. 4 months), vocational school degree, vocational college degree, polytechnic degree or bachelor’s degree, master’s degree, licentiate or doctoral degree.		-

Family income	Grade 4 (spring 2011), Grade 6 (spring 2013), Grade 7 (spring 2014), Grade 9 (spring 2016)	Parents reported their monthly family income using a 10-point scale: less than 500 euros, 500–1,000 euros, 1,001–1,499 euros, 1,500–1,999 euros, 2,000–2,499 euros, 2,500–2,999 euros, 3,000–4,999 euros, 5,000–7,499 euros, 7,500–10,000 euros, more than 10,000 euros.		-
Teaching reading at home	Grade 1 (spring 2008), Grade 2 (spring 2009), Grade 3 (spring 2010), Grade 4 (spring 2011), Grade 6 (spring 2013), Grade 7 (spring 2014), Grade 9 (spring 2016)	Parents rated how often they taught reading to their children in Grades 1, 2, 3, 4, 6, 7, and 9 with the use of a single question according to a 5-point Likert scale (1 = “not at all,” 5 = “once a day/on a daily base”). In Grades 2, 3, 4, the scale was from 0 to 5 (0 = “not at all, because the child has acquired the skill,” 1 = “not at all,” 5 = “once a day/on a daily base”). In these grades, the variables were recoded, and 0 was regarded as a missing value.	A latent variable of the 7 items was used.	-
Support with reading-related homework	Grade 1 (spring 2008), Grade 2 (spring 2009), Grade 3 (spring 2010), Grade 4 (spring 2011), Grade 6 (spring 2013), Grade 7 (spring 2014), Grade 9 (spring 2016)	Parents rated how often they helped or guided their child with homework related to reading in Grades 1, 2, 3, 4, 6, 7, and 9 with the use of a single question according to a 5-point Likert scale (1 = “never,” 5 = “always when there is an assignment”).	A latent variable of the 7 items was used.	-
Parental reading difficulties		Parents were asked to indicate on a 3-point scale whether they had clear difficulties, some difficulties, or no difficulties.	A child was considered to have family risk if the mother or father reported	-

that she/he had
experienced
some or clear
reading
difficulty.

Table 2*Models Examined and Their Respective Constructs*

Name of the model	Type of testing variable	Variables included
Pre-literacy	latent	phonological awareness, letter knowledge, word reading
RAN	observed	RAN
Counting	latent	number counting (fall & spring assessment)
Arithmetic	latent	arithmetic fluency (kindergarten spring and Grade 1 fall assessment)
Oral language	latent	vocabulary, listening comprehension
Raven	observed	nonverbal reasoning
Self -concept for literacy	latent	self-concept for literacy in general in grades 6, 7, and 9, self-concept for literacy compared to the other students in the classroom in grades 6, 7, and 9
Task value for literacy	latent	importance of literacy in grades 6, 7, and 9, interest in literacy in grades 6, 7, and 9, utility of literacy in grades 6, 7, and 9
Homework persistence	latent	participants' homework persistence in Grades 1, 2, 3, 4, 6, 7, and 9
Parental teaching of reading	latent	parental teaching of reading at home in Grades 1, 2, 3, 4, 6, 7, and 9
Parental support with reading-related homework	latent	parental support with reading-related homework in Grades 1, 2, 3, 4, 6, 7, and 9
SES	latent	parental education level, family income in Grades 4, 6, 7, and 9
Parental reading difficulties	observed	parental reading difficulties
Gender	observed	gender

Note. Except for parental reading difficulties and gender, which were entered as binary into the multiple regression models, all cognitive skills, motivational factors, and parental factors (i.e.,

the testing variables) were entered as continuous variables into the models to test for promotive and/or protective effects. For the testing variables, latent factors were utilized when feasible. The table offers a comprehensive overview of the 14 models, specifying whether observed or latent variables were employed for the testing variables. In cases where a latent variable was utilized, the final column (variables included) specifies which variables were regressed on the latent factor.

Table 3

Descriptive Statistics for Gender, Cognitive Skills, and Motivational and Parental Factors and Reading Fluency and Reading Comprehension Tasks in Grades 1 and 9

	N	M	S.D.	Min	Max	Skewness	Kurtosis
<i>Kindergarten</i>							
Gender	2671		(47.6% girls; 51.7% boys)				
Phoneme identification (fall)	1867	7.46	2.45	0	10	-.81	-.21
Letter knowledge (fall)	1867	16.95	9.01	0	29	-.25	-1.27
Reading words (spring)	1823	4.03	4.29	0	10	.44	-1.61
Counting (fall)	1866	4.43	2.83	0	8	-.21	-1.33
Counting (spring)	1836	6.06	2.20	0	8	-1.10	.25
RAN (spring)	1835	173.71	17.78	34	210	-1.72	6.69
Vocabulary (spring)	1839	19.82	3.38	7	29	-.38	.31
Listening comprehension (spring)	1832	7.71	2.34	0	12	-.31	-.13
Arithmetic fluency (spring)	1803	2.95	2.21	0	17	1.15	2.45
Parental reading difficulties	1790	(45.3% no parental reading difficulties; 21.3% parental reading difficulties)					
<i>Grade 1</i>							
Arithmetic fluency (Grade 1)	2021	3.80	2.62	0	19	1.12	2.29
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	1519	3.59	.98	1	5	-.53	-.21
Homework persistence: Does the child actively try to cope with even difficult tasks?	1517	3.49	.89	1	5	-.26	-.37
Homework persistence: Does the child easily give up trying? (recoded)	1512	3.50	.88	1	5	-.46	.01
Homework persistence: Does the child show activity or persistence when doing tasks?	1514	3.56	.82	1	5	-.22	-.20
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	1518	3.54	.95	1	5	-.45	-.28
Parental support in child's homework: How often do you help or guide the child with homework related to reading?	1517	2.92	1.04	1	5	.32	-.91
Parental teaching: How often do you teach your child to read?	1520	2.39	1.02	1	5	.58	-.26
<i>Grade 2</i>							
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	1495	3.54	.97	1	5	-.36	-.47

Homework persistence: Does the child actively try to cope with even difficult tasks?	1496	3.55	.84	1	5	-.26	-.33
Homework persistence: Does the child easily give up trying? (recoded)	1495	3.51	.88	1	5	-.31	-.23
Homework persistence: Does the child show activity or persistence when doing tasks?	1496	3.59	.79	1	5	-.14	-.31
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	1494	3.56	.96	1	5	-.40	-.36
Parental support in child's homework: How often do you help or guide the child with homework related to reading?	1492	2.71	.87	1	5	.39	.24
Parental teaching: How often do you teach your child to read?	833	2.38	.88	1	5	.95	.74
<i>Grade 3</i>							
Nonverbal reasoning	1993	16.61	1.84	1	18	-2.67	12.76
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	1398	3.50	.99	1	5	-.40	-.39
Homework persistence: Does the child actively try to cope with even difficult tasks?	1399	3.46	.89	1	5	-.19	-.49
Homework persistence: Does the child easily give up trying? (recoded)	1398	3.47	.87	1	5	-.31	-.14
Homework persistence: Does the child show activity or persistence when doing tasks?	1397	3.46	.84	1	5	-.15	-.23
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	1397	3.52	.99	1	5	-.36	-.43
Parental support in child's homework: How often do you help or guide the child with homework related to reading?	1400	2.47	.84	1	5	.49	.51
Parental teaching: How often do you teach your child to read?	766	2.12	.74	1	5	.89	1.45
<i>Grade 4</i>							
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	1317	3.54	1.00	1	5	-.41	-.42
Homework persistence: Does the child actively try to cope with even difficult tasks?	1319	3.57	.87	1	5	-.22	-.38
Homework persistence: Does the child easily give up trying? (recoded)	1317	3.54	.91	1	5	-.26	-.45

Homework persistence: Does the child show activity or persistence when doing tasks?	1317	3.56	.83	1	5	-.13	-.37
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	1316	3.57	1.00	1	5	-.40	-.49
Parental support in child's homework: How often do you help or guide the child with homework related to reading?	1318	2.25	.77	1	5	.38	.34
Parental teaching: How often do you teach your child reading tasks?	740	2.04	.61	1	5	.90	2.63
Family income	1287	7.18	1.65	1	10	-.95	1.07
<i>Grade 6</i>							
Literacy self-concept (general)	1815	3.43	.80	1	5	-.18	.29
Literacy self-concept (compared to others)	1813	3.25	.86	1	5	-.15	.11
Task value for literacy: importance, How important is it for you to get good grades in literacy?	1815	3.82	.85	1	5	-.59	.50
Task value for literacy: importance, How important is it for you to do well in literacy?	1818	3.72	.88	1	5	-.48	.22
Task value for literacy: interest, How much do you like literacy?	1813	2.79	1.03	1	5	-.08	-.56
Task value for literacy: interest, How much do you like doing literacy assignments?	1814	2.93	1.08	1	5	-.03	-.59
Task value for literacy: utility, How useful do you think literacy is for your future?	1812	3.76	1.01	1	5	-.64	.04
Task value for literacy: utility, How useful is literacy in your daily life?	1814	3.45	1.09	1	5	-.34	-.49
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	1074	3.76	1.01	1	5	-.64	-.23
Homework persistence: Does the child actively try to cope with even difficult tasks?	1075	3.81	.96	1	5	-.56	-.39
Homework persistence: Does the child easily give up trying? (recoded)	1072	3.75	.94	1	5	-.52	-.27
Homework persistence: Does the child show activity or persistence when doing tasks?	1071	3.71	.94	1	5	-.42	-.49
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	1071	3.72	1.04	1	5	-.54	-.53
Parental support in child's homework: How often do you help or guide the	1073	2.21	.66	1	5	.07	-.19

child with homework related to reading?							
Parental teaching: How often do you teach your child mother tongue tasks (time in reading)?	1075	1.72	.54	1	5	.52	1.72
Family income	1042	7.49	1.55	1	10	-1.15	2.25
<i>Grade 7</i>							
Literacy self-concept (general)	1742	3.40	.81	1	5	-.17	.22
Literacy self-concept (compared to others)	1732	3.25	.86	1	5	-.02	.15
Task value for literacy: importance, How important is it for you to get good grades in literacy?	1742	3.74	.88	1	5	-.53	.39
Task value for literacy: importance, How important is it for you to do well in literacy?	1733	3.62	.92	1	5	-.39	.04
Task value for literacy: interest, How much do you do you like literacy?	1740	2.90	1.06	1	5	-.08	-.53
Task value for literacy: interest, How much do you like doing literacy assignments?	1730	2.96	1.04	1	5	-.05	-.41
Task value for literacy: utility, How useful do you think literacy is for your future?	1744	3.58	1.06	1	5	-.47	-.24
Task value for literacy: utility, How useful is literacy in your daily life?	1731	3.35	1.12	1	5	-.31	-.49
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	873	3.77	1.03	1	5	-.64	-.21
Homework persistence: Does the child actively try to cope with even difficult tasks?	875	3.79	.99	1	5	-.53	-.49
Homework persistence: Does the child easily give up trying? (recoded)	871	3.75	.99	1	5	-.56	-.38
Homework persistence: Does the child show activity or persistence when doing tasks?	869	3.67	1.01	1	5	-.43	-.46
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	872	3.72	1.03	1	5	-.58	-.30
Parental support in child's homework: How often do you help or guide the child with homework related to reading?	880	2.10	.68	1	4	.01	-.64
Parental teaching: How often do you teach your child mother tongue tasks (time in reading)?	883	1.61	.53	1	4	.31	-.25
Family income	841	7.51	1.56	1	10	-1.13	2.09
<i>Grade 9</i>							

Literacy self-concept (general)	1705	3.44	.83	1	5	-.15	.26
Literacy self-concept (compared to others)	1702	3.31	.89	1	5	-.16	.19
Task value for literacy: importance, How important is it for you to get good grades in literacy?	1709	3.81	.92	1	5	-.57	.22
Task value for literacy: importance, How important is it for you to do well in literacy?	1705	3.65	.97	1	5	-.46	-.03
Task value for literacy: interest, How much you do you like literacy?	1707	2.91	1.07	1	5	-.13	-.56
Task value for literacy: interest, How much do you like doing literacy assignments?	1704	2.85	1.08	1	5	-.02	-.58
Task value for literacy: utility, How useful do you think literacy is for your future?	1708	3.63	1.09	1	5	-.56	-.26
Task value for literacy: utility, How useful is literacy in your daily life?	1708	3.34	1.14	1	5	-.30	-.60
Homework persistence: If difficulties arise in the task, does the child easily start doing something else? (recoded)	976	3.70	1.11	1	5	-.61	-.48
Homework persistence: Does the child actively try to cope with even difficult tasks?	976	3.74	1.05	1	5	-.56	-.49
Homework persistence: Does the child easily give up trying? (recoded)	976	3.75	1.04	1	5	-.59	-.41
Homework persistence: Does the child show activity or persistence when doing tasks?	978	3.65	1.05	1	5	-.44	-.64
Homework persistence: If the task isn't going well, does the child start fussing about these things? (recoded)	975	3.66	1.10	1	5	-.49	-.62
Parental support in child's homework: How often do you help or guide the child with homework related to reading?	977	1.94	.69	1	4	.27	-.47
Parental teaching: How often do you teach your child mother tongue tasks (time in reading)?	980	1.51	.52	1	4	.77	.94
Family income	951	7.57	1.56	2	10	-.92	1.29
<i>Reading measures</i>							
Word reading task, Grade 1	2051	18.28	8.97	0	58	.66	.20
Differentiate words, Grade 1	1707	41.47	9.07	11	72	-.02	.27
Sentence reading, Grade 1	2047	6.91	5.08	0	32	1.04	1.72
Word reading task, Grade 9	1704	46.06	11.55	8	76	-.17	-.10
Differentiate words, Grade 9	2049	17.91	8.19	0	46	.35	.02
Sentence reading, Grade 9	1705	37.53	8.48	0	70	-.05	.38
Reading comprehension, Grade 1	2035	5.50	3.18	0	12	.00	-.96

Reading comprehension, Grade 9	1702	7.02	2.43	0	12	-.15	-.57
PISA, Grade 9, total sum of accurate answers	1512	20.26	6.20	0	32.73	-.56	-.04

Table 4

Standardized Estimates from Multiple Regressions Predicting Reading Fluency Skills and Reading Comprehension Skills in Grade 9 With the Use of Cognitive Skills

Variable	Reading Fluency						Reading Comprehension					
	Pre-literacy	RAN	Counting	Arithmetic	Oral language	Raven	Pre-literacy	RAN	Counting	Arithmetic	Oral language	Raven
Risk (RF in Grade 1)	.72*	.67*	.70*	.69*	.66*	.66*						
Risk (RC in Grade 1)							.48*	.52*	.54*	.54*	.52*	.51*
Pre-literacy	.00						.29*					
Risk \times Pre-literacy	-.07*						.01					
RAN		.11*						.16*				
Risk \times RAN		-.05						.01				
Counting			.01						.15*			
Risk \times Counting			-.07						.11			
Arithmetic				.04						.13*		
Risk \times Arithmetic				-.07*						.00		
Oral language					.11*						.47*	
Risk \times Oral language					-.07*						-.11*	
Raven						.18*						.27*
Risk \times Raven						-.01						.03
R ²	.52*	.46*	.51*	.52*	.52*	.47*	.32*	.33*	.32*	.31*	.50*	.39*

Note. For reading fluency, risk was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks in Grade 1. Reading fluency in Grade 9 was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks. For reading comprehension, risk was estimated as an observed variable with participants' reading comprehension scores in the nationally normed reading comprehension task in Grade 1. Reading comprehension in Grade 9 was estimated as a latent variable with participants' reading comprehension scores in the nationally normed reading comprehension task and the PISA tasks. All estimates and confidence intervals presented in the table are standardized (STDYX estimates). $*p < .0042$ (Bonferroni-adjusted alpha level).

Table 5

Standardized Estimates from Multiple Regressions Predicting Reading Fluency Skills and Reading Comprehension Skills in Grade 9 With the Use of Motivational Factors

Variable	Reading Fluency			Reading Comprehension		
	Self-concept for literacy	Task value for literacy	Homework persistence	Self-concept for literacy	Task value for literacy	Homework persistence
Risk (RF in Grade 1)	.61*	.67*	.66*			
Risk (RC in Grade 1)				.48*	.53*	.50*
Self-concept	.23*			.38*		
Risk \times Self-concept	-.04			-.05		
Task value		.21*			.32*	
Risk \times Task value		.00			-.01	
Persistence			.12*			.38*
Risk \times Persistence			-.05*			-.04
R ²	.54*	.53*	.51*	.38*	.38*	.40*

Note. For reading fluency, risk was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks in Grade 1. Reading fluency in Grade 9 was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks. For reading comprehension, risk was estimated as an observed variable with participants' reading comprehension scores in the nationally normed reading comprehension task in Grade 1. Reading comprehension in Grade 9 was estimated as a latent variable with participants' reading

comprehension scores in the nationally normed reading comprehension task and the PISA tasks. All estimates and confidence intervals presented in the table are standardized (STDYX estimates). $*p < .0083$ (Bonferroni-adjusted alpha level).

Table 6

Standardized Estimates from Multiple Regressions Predicting Reading Fluency Skills and Reading Comprehension Skills in Grade 9 With the Use of Parental Factors

Variable	Reading Fluency				Reading Comprehension			
	Teaching reading at home	Parental support with reading-related homework	SES	Parental reading difficulties	Teaching reading at home	Parental support with reading-related homework	SES	Parental reading difficulties
Risk (RF in Grade 1)	.62*	.62*	.69*	.66*	.50*	.48*	.57*	.51*
Risk (RC in Grade 1)								
Teaching reading	-.16*				-.39*			
Risk × Teaching reading	.06*				.03			
Support in homework		-.16*				-.40*		
Risk × Support in homework		.07*				.07		
SES			.05				.17*	
Risk × SES			-.04				-.02	
Parental reading difficulties				-.06*				-.08*
Risk × Parental reading difficulties				.04				.06
R ²	.52*	.53*	.49*	.48*	.41*	.40*	.35*	.32*

Note. For reading fluency, risk was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks in

Grade 1. Reading fluency in Grade 9 was estimated as a latent variable with participants' reading fluency scores in the three reading fluency

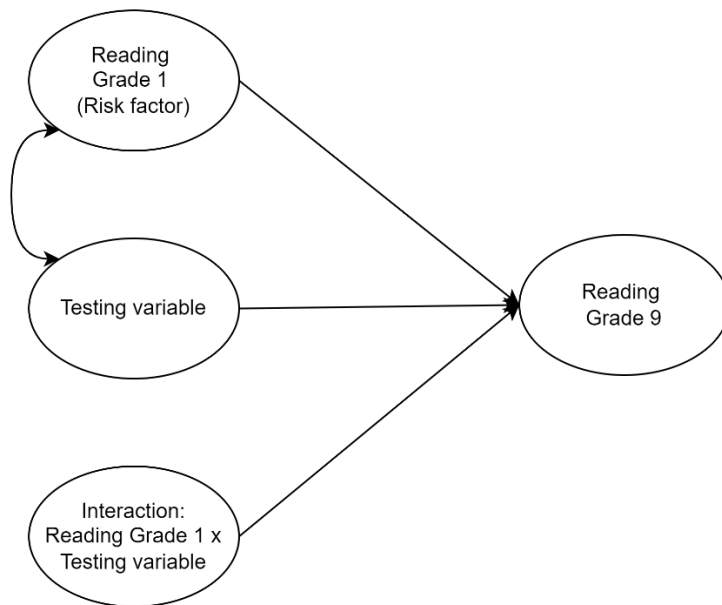
tasks. For reading comprehension, risk was estimated as an observed variable with participants' reading comprehension scores in the nationally normed reading comprehension task in Grade 1. Reading comprehension in Grade 9 was estimated as a latent variable with participants' reading comprehension scores in the nationally normed reading comprehension task and the PISA tasks. All estimates presented in the table are standardized (STDYX estimates). $*p < .0063$ (Bonferroni-adjusted alpha level).

Table 7

Standardized Estimates from Multiple Regressions Predicting Reading Fluency Skills and Reading Comprehension Skills in Grade 9 With Gender

Variable	Reading Fluency	Reading Comprehension
	Gender	Gender
Risk (RF in Grade 1)	.60*	
Risk (RC in Grade 1)		.44*
Gender	-.25*	-.25*
Risk \times Gender	.03	.10
R ²	.52*	.38*

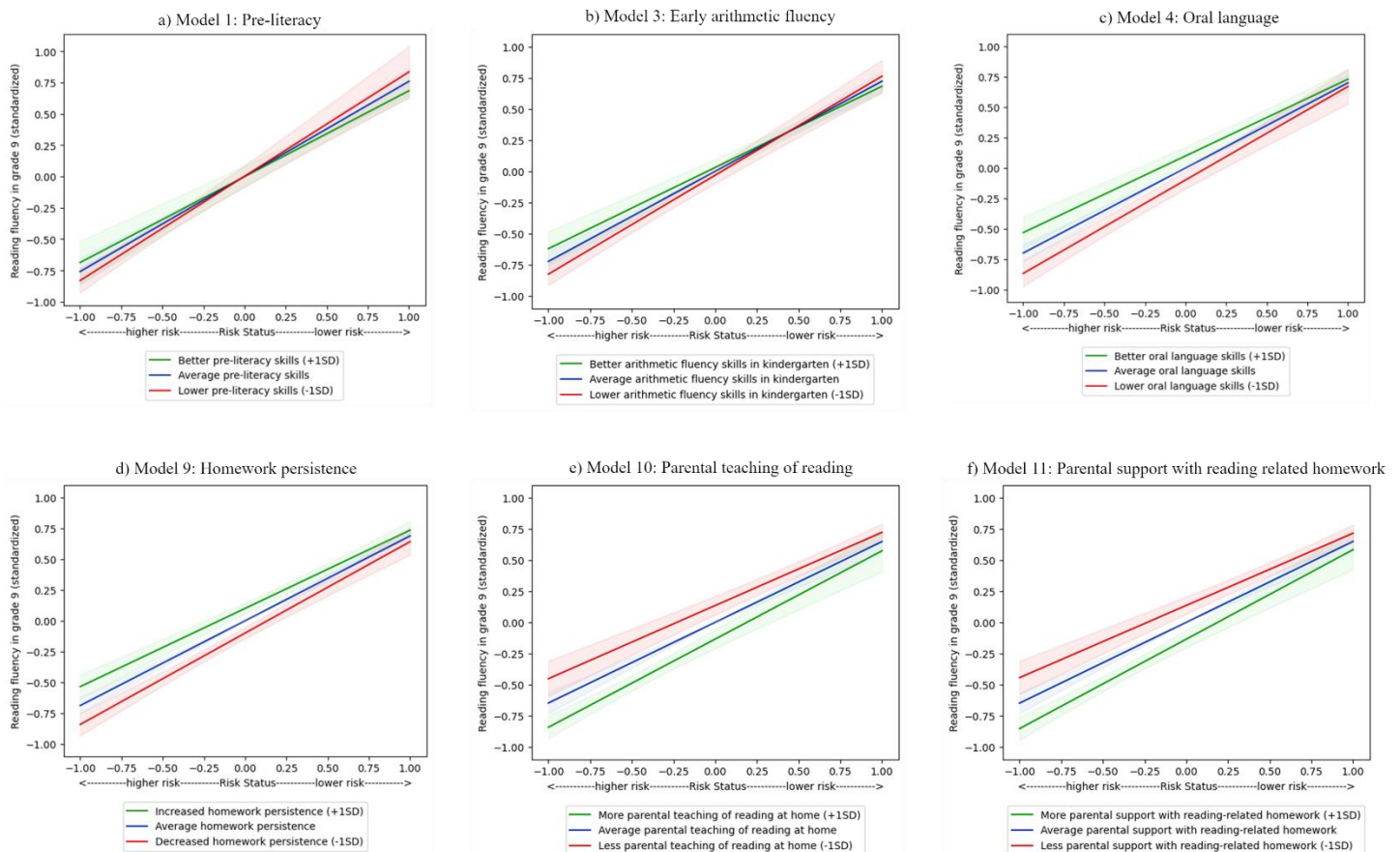
Note. For reading fluency, risk was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks in Grade 1. Reading fluency in Grade 9 was estimated as a latent variable with participants' reading fluency scores in the three reading fluency tasks. For reading comprehension, risk was estimated as an observed variable with participants' reading comprehension scores in the nationally normed reading comprehension task in Grade 1. Reading comprehension in Grade 9 was estimated as a latent variable with participants' reading comprehension scores in the nationally normed reading comprehension task and the PISA tasks. All estimates presented in the table are standardized (STDYX estimates). * $p < .001$.

Figure 1*Specification of the Interaction Models*

Note. Specification model examining the effect of reading fluency/comprehension skills in Grade 1 (risk factor) on reading fluency/comprehension skills in Grade 9 (outcome variable) are influenced by the testing variable. The “Testing variable” stand in for pre-literacy, counting, RAN, oral language, nonverbal reasoning, arithmetic fluency, self-concept for literacy, task value for literacy, homework persistence, teaching reading at home, parental support with reading-related homework, parental reading difficulties, SES, and gender in 14 separate models.

Figure 2

Simple Slope Plots for (a) Risk \times Pre-literacy, (B) Risk \times Arithmetic Fluency, (C) Risk \times Oral Language, (D) Risk \times Homework Persistence, (E) Risk \times Teaching Reading, and (f) Risk \times Support with Reading-related Homework Interaction for Reading Fluency

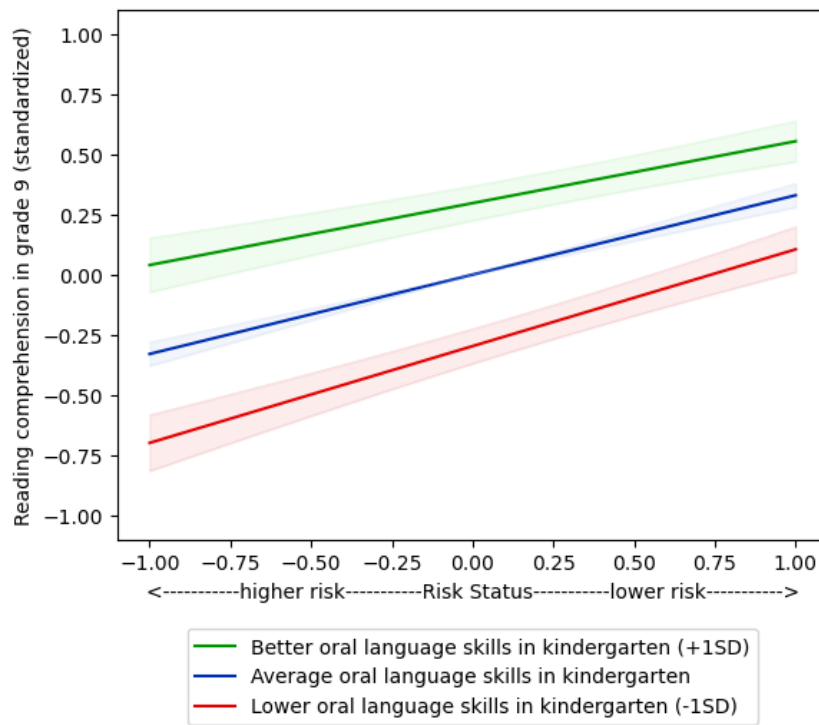


The plots show the interaction between (a) kindergarten-age pre-literacy (phoneme identification, letter knowledge, word reading) skills, (b) early arithmetic fluency (kindergarten spring and Grade 1 fall assessment) skills, (c) kindergarten-age oral language (vocabulary and listening comprehension) skills, (d) homework persistence (Grades 1–9), (e) parental teaching of reading at home (Grades 1–9), and (f) parental support with reading-related homework (Grades 1–9) and reading fluency skills in Grade 1 in determining reading fluency performance in Grade 9. Reading fluency skills in Grade 9 are reported as standardized scores (STDYX estimates) on the vertical axes. Reading fluency skills in Grade 1, which represent the risk status, are reported on the horizontal axes. The separate regression lines show different levels of pre-literacy/arithmetic fluency/oral language/ homework persistence/parental teaching of reading at home/parental support with reading-related homework. The blue line represents those whose pre-literacy/arithmetic fluency/oral language/homework persistence/parental teaching of reading at home/parental support with reading-related homework scores were at the sample mean, the red line represents those whose pre-literacy/arithmetic fluency/oral language/homework persistence/parental teaching

of reading at home/parental support with reading-related homework scores were 1 SD below the sample mean (-1 SD), and the green line represents those whose pre-literacy/arithmetic fluency/oral language/homework persistence/parental teaching of reading at home/parental support with reading-related homework scores were 1 SD above the sample mean ($+1$ SD). Shaded regions around the regression lines show 95% confidence intervals.

Figure 3

Simple Slope Plot Risk \times Oral Language Interaction for Reading Comprehension



The plots show the interaction between kindergarten-age oral language (vocabulary and listening comprehension) skills and reading comprehension skills in Grade 1 in determining reading comprehension performance in Grade 9. Reading comprehension skills in Grade 9 are reported as standardized scores (STDYX estimates) on the vertical axis. Reading comprehension skills in Grade 1, which represent the risk status, are reported on the horizontal axis. The separate regression lines show different levels of oral language skills. The blue line represents those whose oral language skills were at the sample mean, the red line represents those whose oral language skills were 1 SD below the sample mean (-1 SD), and the green line represents those whose oral language skills were 1 SD above the sample mean ($+1$ SD). Shaded regions around the regression lines show 95% confidence intervals.