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**Is There Hope for First Graders at the Lowest Percentiles? The Roles of Self-Efficacy,
Task Avoidance, and Support in the Development of Reading Fluency**

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Abstract

Self-efficacious children are expected to be more task-focused in challenging achievement situations and consequently have better chances of overcoming learning difficulties than children who have lower self-efficacy. The present study investigates this presumption with Finnish-speaking first graders struggling with reading acquisition ($N = 285$). The development of the children's reading fluency, self-efficacy, and task avoidance was followed from the middle of Grade 1 to the end of Grade 2, and a six-week mobile game-based intervention was administered to those who exhibited the greatest risk for reading disabilities (≤ 5 th percentile). Exploratory structural equation modeling was used to test the theoretical model. The results suggest that higher self-efficacy in the middle of Grade 1 predicted lower task avoidance and higher reading fluency at the end of Grade 1, but no support for the mediating role of task avoidance was found. The intervention benefited both self-efficacy and reading fluency.

Keywords: self-efficacy, reading fluency, reading difficulties, task avoidance, intervention, mobile game-based learning

Is There Hope for First Graders at the Lowest Percentiles? The Roles of Self-Efficacy, Task Avoidance, and Support in the Development of Reading Fluency

Research has demonstrated that reading skills and motivation have a bidirectional relationship (e.g., Toste et al., 2020), suggesting that good reading skills promote reading motivation, which, in turn, contributes to future reading achievement. Thus, children who struggle with reading achievement are less likely to engage in reading activities, which decreases the likelihood that they will improve their reading skills. Lack of mastery experiences (i.e., success in reading tasks) will likely affect these children's self-efficacy (Peura et al., 2021)—their beliefs that they are capable of performing reading tasks successfully (see Bandura, 1997). Lack of confidence in reading tasks may diminish these children's focus and persistence in the classroom (Galla et al., 2014; Lee & Jonson-Reid, 2016; Schnell et al., 2015), further reducing their chances of experiencing mastery and achieving fluent reading skills. Because feedback and learning experiences start to affect children's ability beliefs soon after school entrance (Muenks et al., 2018), early interventions aimed at preventing this negative cycle are necessary.

Self-Efficacy and Reading Achievement

Existing research indicates that children's reading-related self-efficacy beliefs are associated with their reading achievement in the early years of primary school (Carroll & Fox, 2017; Lee & Jonson-Reid, 2016; Liew et al., 2008; Peura et al., 2019). Talsma et al.'s (2018) review concerning the general relationship between self-efficacy and achievement suggests that self-efficacy and performance have a reciprocal relationship, but reciprocity did not hold for child populations: past performance predicted children's subsequent self-efficacy beliefs, but self-efficacy did not predict performance. However, evidence suggests that self-efficacy predicts reading achievement (Galla et al., 2014; Lee & Jonson-Reid, 2016; Peura et

al., 2019; Usher et al., 2019), and Schöber et al. (2018) found partial support for reciprocal effects between reading self-efficacy and reading achievement in Grade 7 students, although reading achievement was a more consistent predictor of later reading self-efficacy than vice versa.

Considering that students in the lower primary grades (e.g., Muenks et al., 2018) and students with learning disabilities (Klassen, 2007) often overestimate their abilities, it is possible that self-efficacy and reading skill do not yet strongly correlate among children at risk for reading disabilities who have recently entered school. Struggling readers often receive at least part of their reading instruction in small groups (see Janhukainen & Itkonen, 2016), together with children who have similar difficulties, which may lead to the so-called big fish–little pond effect (Marsh, 1987), further supporting optimistic reading-related self-perceptions. Therefore, additional research is needed to clarify the relationship between reading self-efficacy and reading achievement among young struggling readers.

Task Avoidance and Reading Achievement

Task avoidance is a maladaptive achievement strategy characterized by low levels of effort, lack of persistence, and engagement in irrelevant activities to avoid aversive tasks, whereas task focus refers to high engagement and persistence even when tasks are difficult (Aunola et al., 2002; Onatsu-Arvilommi & Nurmi, 2000). The role of achievement strategies in the development of reading skills has been studied extensively, and support for a reciprocal relationship between achievement behaviors and reading has been found (Aunola et al., 2002; Georgiou et al., 2017; Hirvonen et al., 2010; Onatsu-Arvilommi & Nurmi, 2000). However, in regular orthographies, such as Greek and Finnish, task focus seems to predict reading comprehension and spelling more strongly than reading fluency (Georgiou et al., 2010; Hirvonen et al., 2010), possibly because in these languages, acquisition of reading fluency is

facilitated by consistent connections between speech sounds and letters and can therefore be considered a relatively straightforward skill to be learned. By contrast, reading comprehension and spelling require a wider range of cognitive skills, including grammatical and syntactic knowledge, and consequently the demands for self-regulation and task persistence are higher (Hirvonen et al., 2010). However, most existing research has not focused on children at risk for dyslexia for whom achievement of reading fluency is more challenging than for normal readers (Eklund et al., 2015). It seems likely that maintaining focus and persistence during reading fluency training is particularly important for these children, as implicated by Eklund et al.'s (2013) study, which demonstrated that task-focused behavior may protect against dyslexia.

The Relationship of Self-Efficacy and Task Persistence

According to Bandura's social cognitive theory, self-efficacy determines what kind of goals people select for themselves, how much effort they put forth in pursuing them, and how persistent they are in the face of difficulties (Bandura, 1977). Research findings suggest that self-efficacious individuals are more persistent and exhibit greater effort in achievement situations than individuals with lower self-efficacy (Multon et al., 1991; Skaalvik et al., 2015). Studies conducted among university and high school students also verify that effort and persistence are significant mediators of the effect of self-efficacy on achievement (Honicke & Broadbent, 2016; Jung et al., 2017; Trautwein et al., 2009). However, to the authors' knowledge, only two studies have tested the significance of this indirect relationship among younger students. Galla et al. (2014) investigated primary school students between ages 5 and 12 and found that teacher-rated effortful engagement (i.e., effort, attention, and persistence) mediated the effect of self-efficacy on students' reading performance at the between-person level (i.e., students with higher self-efficacy showed greater engagement,

which predicted higher reading scores) but not at the within-person level (i.e., that within-person change in engagement mediated the effect of within-person change in self-efficacy on within-person change in reading). Lee and Jonson-Reid (2016) found that teacher-rated student motivation significantly mediated the effect of reading self-efficacy on reading achievement among first to third graders who were at risk for reading difficulties. However, this study used only one item to evaluate student motivation, compromising its reliability as a measure of task persistence. In addition, Schnell et al. (2015), investigating 15-year-old students in a cross-sectional setting, found that self-efficacy predicted self-reported effort investment and task persistence, which in turn predicted better academic performance, but the significance of the indirect effect was not tested. Taken together, these studies partially support the hypothesis that children with higher self-efficacy are more persistent and invest greater effort in challenging learning situations than children with lower self-efficacy and that higher levels of effort and persistence support their learning.

The alternative model with task persistence as a predictor of later self-efficacy should also be considered. Task persistence and self-regulation skills are known to be closely related (Mägi et al., 2018), and students who are better able to regulate their effort in challenging achievement situations are more likely to experience success and mastery, which should support their self-efficacy (e.g., Usher & Pajares, 2008). Liew et al. (2008) found that self-regulation assessed among low-achieving readers in Grade 1 predicted children's self-efficacy beliefs in Grade 2 and literacy in Grade 3. However, the tested indirect effect of self-regulation skills on literacy via self-efficacy was not significant. Galla et al. (2014) also found no support for the model in which self-efficacy served as the mediator between effortful engagement and reading. By contrast, Usher et al. (2019) found that self-efficacy significantly mediated the association between grit (i.e., self-reported perseverance of effort

in achievement situations) and achievement, but the model with grit as the mediator of self-efficacy to achievement was not supported. Thus, Usher et al.'s (2019) study supports the alternative hypothesis that persistence leads to the development of stronger self-efficacy, which in turn contributes to achievement.

Support for Reading Acquisition in the Schools of Finland

Most Finnish children enter school in mid-August in the year they turn 7 years old. Owing to the regularity of Finnish orthography, adequate decoding accuracy and fluency for reading comprehension are usually achieved by the end of Grade 1 (Torppa et al., 2016). Typically, Finnish children with dyslexia experience difficulties in reading speed and fluency rather than accuracy (Eklund et al., 2015).

Finland's special education system follows the Response to Intervention (RTI) framework with three levels of support (Björn et al., 2016; Janhukainen & Itkonen, 2016). *General support* is available to all students whenever they need occasional help, for example, by means of differentiation or additional support. *Intensified support* is targeted toward at-risk students with mild learning and behavioral special needs for longer periods in a specific area, such as in reading skills, and is received by 20–30% of the age group. *Special support* is individually planned long-term support (i.e., individualized education plans for students) that includes every possible form of support that can be offered in school and is received by around 6–7 % of the age group (Björn et al., 2016; Janhukainen & Itkonen, 2016). Part-time special education is a commonly used mode of support, particularly at the general and intensified levels and appears to be effective at closing the gap between poor and normal readers during the first years of school, particularly when difficulties are relatively mild (Virinkoski et al., 2021).

According to the Finnish Curriculum, children receive seven literacy lessons (7 x 45 minutes) per week in the first and second grades. This includes literacy-related activities, such as listening comprehension and vocabulary training. In Grade 1, special education usually focuses on basic literacy skills, such as phonological awareness, particularly letter–sound correspondences and identification of words’ initial or ending sounds as well as segmentation of words into syllables. Word- and syllable-level decoding and spelling are also taught. In Grade 2, some children may still need training in phonological awareness and word-level decoding and spelling, but the emphasis is on reading fluency and reading comprehension.

GraphoLearn

GraphoLearn (GL, also known as Ekapeli or GraphoGame) is a digital game originally developed to provide individualized reading support to Finnish children at risk for dyslexia and has since been adapted to many languages (Richardson & Lyytinen, 2014). The game trains the connection between spoken and written language. In the Finnish version, the game begins with sound-to-letter conversion and progresses to connecting spoken syllables or words to written syllables or words. The game uses an adaptation technique that adjusts the trained content to the player’s performance level and provides a high success rate, thus facilitating mastery experiences regardless of the learners’ initial reading skills. A meta-analysis by McTigue et al. (2020) suggested that GL has effects on sub-lexical skills but that the effect on word-level reading was moderated by adult involvement so that the effect size was moderately positive only when GL practice included intensive adult guidance. A randomized controlled trial (Ronimus et al., 2020) using part of the same dataset as the present study showed that a six-week GL intervention was not more effective than school-provided support at improving word reading fluency but that self-efficacy was a significant

moderator of the effect, suggesting that high self-efficacy may increase a child's responsiveness to GL.

Present Study

The present study's purpose is twofold: first, to investigate how self-efficacy and task avoidant behavior interact and affect the development of word reading fluency in children who experience reading acquisition difficulties and second, to investigate whether the support provided by schools, supplemented with GL, is effective in supporting children at high risk for dyslexia. The study was conducted as a part of a larger research project entitled Dyslexia: Genes, brain functions, interventions (DysGeBra), the purpose of which was to expand knowledge about the causes and remediation of dyslexia.

The study was guided by two main research questions:

1. How do self-efficacy, task avoidant behavior, and word reading fluency relate to each other during first and second grade among children at risk for dyslexia? More specifically,
 - a. Does self-efficacy predict later task avoidance?

Based on previous research, high self-efficacy may be expected to predict persistence and effort, or low levels of task avoidant behavior (e.g., Honicke & Broadbent, 2016; Multon et al., 1991). However, considering that most previous research has involved mainstream populations, these results may not be directly applicable to young students at risk for a reading disability.

- b. Does self-efficacy predict later word reading fluency either directly or indirectly via task avoidance?

Based on existing studies (Galla et al., 2014; Lee & Jonson-Reid, 2016; Peura et al., 2019; Usher et al., 2019), we expect self-efficacy to predict later word reading fluency.

Concerning the role of task avoidance as a mediator, it is not possible to form a strong hypothesis, as earlier research has yielded inconsistent results among younger students, suggesting that while task avoidance may mediate the effect of self-efficacy (Galla et al., 2014; Lee & Jonson-Reid, 2016), it is also possible that self-efficacy mediates the effect of task persistence on achievement (Usher et al., 2019).

c. Does task avoidance predict later self-efficacy or word reading fluency?

Previous studies suggest that task avoidance influences later reading achievement (Aunola et al., 2002; Georgiou et al., 2017; Hirvonen et al., 2010; Onatsu-Arvilommi & Nurmi, 2000), but there are also contrasting findings suggesting that task avoidance may be less important for the development of reading fluency in regular orthographies (Georgiou et al., 2010; Hirvonen et al., 2010). It is also possible that task persistence predicts later self-efficacy (Usher et al., 2019). Again, due to inconsistent findings, it is difficult to form a clear hypothesis.

d. Does word reading fluency predict later task avoidance or self-efficacy?

Previous studies have found support for a reciprocal relationship between reading achievement and task avoidance (Aunola et al., 2002; Georgiou et al., 2017; Hirvonen et al., 2010; Onatsu-Arvilommi & Nurmi, 2000). Past reading achievement has also been found to predict reading self-efficacy (Schöber et al., 2018). Therefore, we expect that better word reading fluency will positively affect children's self-efficacy in reading and task focus.

2. Is the combination of a six-week GL intervention and school-based support effective at improving reading fluency, self-efficacy, and task focus in children with literacy skills at or below the fifth percentile?

Earlier studies indicate that GL may not significantly affect word-level reading skills (McTigue et al., 2020; Ronimus et al., 2020). However, the combined effect of GL and

school-based instruction, with the effects of motivational factors controlled, has yet to be comprehensively studied. Part-time special education also seems effective in closing the gap between poor and normal readers, but children who require more intensive and long-lasting support tend to develop more slowly (Virinkoski et al., 2021). We hypothesize that children who qualified for the intervention only in Grade 1 but no longer in Grade 2 will exhibit the most positive development in reading fluency and motivation during the study period and have the best chances of catching up with their peers. By contrast, children whose reading fluency remains at the lowest percentiles at the end of Grade 1 and who were therefore selected for the Grade 2 intervention are expected to exhibit slower development in reading and motivation during the study period.

Method

The data were collected in three waves between 2015 and 2019, with the recruitment process starting in the fall semester of Grade 1. The research plan was reviewed and approved by the Ethical Board of the Central Finland Health Care District, and permissions from the officials of the participating municipalities were obtained prior to data collection. The data collection procedure is shown in Figure 1.

Figure 1 about here

Participants

The recruitment process aimed to identify first graders at risk for dyslexia. Information about the study was sent via email in September of each year to teachers and special needs teachers who had registered as users of GL or who had subscribed to a nationwide newsletter from the research institution in charge of carrying out the study. Teachers were asked whether they knew students who had difficulties with reading acquisition, poor letter knowledge, and/or family members with dyslexia. Teachers were

encouraged to use GL with these students during the fall semester. In December, teachers who, according to user logs, had used GL were contacted. Only students who lived close to the cities of Jyväskylä or Helsinki were considered as participants to avoid excessive traveling costs during data collection. Other exclusion criteria included hearing, sight and severe cognitive deficits, and Finnish not being the child's mother tongue. Interested teachers were sent more information about the study and consent forms to be delivered to the children and their guardians. Consent forms signed by the guardian and the child were required from all participants.

The full sample comprised 285 children, 174 boys (61.1%) and 111 girls. By the time of the final assessment at the end of Grade 2, nine children had dropped out of the study. Children's mean age at the time of the first assessment was 7.58 years ($SD = 0.37$). The children came from 67 schools and 158 classrooms; half of the schools (49.8%) were located in the Jyväskylä district in Central Finland and the other half in the Helsinki district in South Finland.

Based on the results of the first assessment in the middle of Grade 1, the children were divided into a high-risk group (HR, $n = 184$), who scored at or below the fifth percentile in reading or spelling, and a low/moderate risk group ($n = 101$), which included the remaining participants. Previously, the 2.5th percentile has been used as a criterion for severe reading disability (Galuschka et al., 2014), but the present study used slightly less strict criteria in view of the instability of children's reading skills at this age. The Word Decoding and Spelling subtest scores from the standardized Lukilasse 2 test battery (Häyrinen et al., 2013) were used to determine the risk status. Both subtests have high internal consistency, as suggested by the high Cronbach's alphas reported in the test manual: .98 and .86 for Word Decoding and Spelling subtests, respectively. Data collected in another research project

(Hautala et al., 2020) were used to determine scores equaling the fifth percentile, because the Lukilasse 2 manual provides percentile scores only for readers who have completed Grade 1.

Procedure

The first assessment was administered in January or February of Grade 1, the second assessment in May of Grade 1, and the final assessment in April or May of Grade 2. Each assessment session included tests for reading, spelling, phonological awareness, rapid automatized naming, and motivation. The HR group participated in an additional assessment of non-verbal reasoning, vocabulary, associative learning, and auditory detection skills during the spring of Grade 1. Teachers and parents were also asked to complete questionnaires during the springs of Grade 1 and Grade 2. However, the present study uses only data concerning word reading fluency, self-efficacy, and task avoidance. Research assistants, who were students of special education from the University of Jyväskylä and the University of Helsinki, were trained to administer the tests during regular school hours. After each assessment, the teachers were sent a summary of each child's test scores, including reference scores for age-level performance, so that they could follow their students' progress during the study and adjust their instruction to the students' needs.

During the study, the children in the HR group were invited to participate in a six-week game-based intervention. Two interventions were implemented: one in the spring of Grade 1 (from mid-March to the end of April) and one in the fall of Grade 2 (from mid-October to the end of November). Most children in the HR group were invited to the Grade 1 intervention. However, during the springs of 2017 and 2018, some children in the HR group were randomly assigned to waiting-list control groups who received only school-provided support to study the impact of GL (see Ronimus et al., 2020). In total, 135 students were assigned to the intervention groups and 49 students to the control groups.

The participants of the Grade 2 intervention were selected on the basis of their score in a pseudoword decoding test (Lerkkanen et al., 2018) at the end of Grade 1, so that those scoring below the eighth (years 2016 and 2017) or sixth percentiles (year 2018) were invited to participate, regardless of whether they had already taken part in the Grade 1 intervention. Waiting-list controls from Grade 1 spring were invited to participate, regardless of their reading level. Some children from the low/moderate risk group also fulfilled the selection criterion for the Grade 2 intervention ($n = 11$). Altogether, 127 children participated in the Grade 2 intervention. More variation was observed in the reading skill of the participants in the Grade 2 intervention, partly for reasons described above and partly because of the relatively long gap between administration of the criterion test (Grade 1 May) and the start of the intervention (Grade 2 October). Based on the pretest (Salmi et al., 2011) administered immediately before the Grade 2 intervention, 55.6% of the participants were at or below the fifth percentile in the pseudoword decoding subtest, and 91.9% were below the 30th percentile.

Six children initially assigned to the HR group did not receive either of the interventions. These were the waiting-list controls, of whom three dropped out of the study before the Grade 2 intervention while three chose not to participate because their reading skills had improved.

Description of the Support Received by the Participants

School-provided support

Table 1 reports the number of children receiving general, intensified, or special support in the three intervention groups and the no-intervention group. The children who were selected as intervention participants received more intensive support than did the children who did not meet the selection criteria, both in Grade 1, $\chi^2 = 26.25$, $df = 9$, $p = .002$

and in Grade 2, $\chi^2 = 47.41$, $df = 9$, $p < .001$. However, among the three intervention groups, support level and group were not associated in Grade 1, $\chi^2 = 10.34$, $df = 6$, $p = .111$, or in Grade 2, $\chi^2 = 11.18$, $df = 6$, $p = .083$. Part-time special education in reading was received by 71.7% of the students during Grade 1 and by 70% during Grade 2, with similar percentages between the groups.

Table 1 about here

Mobile Game-Based Intervention

Slightly different versions of GL were used in the different years of the study, but the training content was similar across the versions. Therefore, the present study expects that all versions will have a similar impact on children's reading development.

At the beginning of each intervention, the children were provided with headphones and tablet computers with a version of GL preinstalled. The teachers were instructed (both orally and with a written guide) that children should play the game daily during the six-week intervention, for a total playing time of approximately 10 hours. Children could take the tablet computer home with them, to after-school clubs, or to any other places conducive to using the game. Teachers were asked to deliver these instructions to the children's homes. Both teachers and parents (if the game was used regularly at home) were encouraged to monitor the accumulation of playing time via the app and keep a weekly diary of the playing times to ensure the training was regular over the six-week period.

After the intervention, the game logs were copied from the tablet computers. The game logs indicated that during the Grade 1 intervention, children used the game for an average of 585 minutes ($SD = 277$ min), of which 315 minutes ($SD = 157$ min) were spent completing training tasks. During the Grade 2 intervention, children used the game for an average of 527 minutes ($SD = 277$ minutes), of which 283 minutes ($SD = 167$ minutes) were

spent on training tasks. The considerable difference between total playing time and time spent on tasks can be attributed to the children's spending time on the game's various motivational features.

Measures

Word Reading Fluency

Three tasks were used to measure the children's word reading fluency. In all tasks, the children were given the items on a piece of paper and asked to read them aloud. The *word list* included 90 words in increasingly difficult order, arranged in three columns. The time limit was 2 minutes. The test is a part of the standardized reading battery Lukilasse 2 (Häyrynen et al., 2013). According to the test manual, Cronbach's alphas for this test are .98 and .97 for first and second graders, respectively. The *pseudoword list* included 90 pseudowords, beginning with two-letter single-syllable words and increasing in length and complexity, arranged in three columns. The time limit was 45 seconds. The pseudoword list has been published as a part of a standardized reading test battery for upper comprehensive schools (Lerikkanen et al., 2018), and, according to the test manual, it can be considered a reliable and valid measure of reading fluency considering high correlations (.76–.86) with other reading fluency tests. The *text reading* task was a short story of 124 words with a time limit of 1 minute. The test has not been published but has been used in large-scale studies at the University of Jyväskylä, including the First Steps study (e.g., Nurmi et al., 2013). In all tests, children received one point from each correctly read word or pseudoword. The scores were standardized using the means and standard deviations retrieved from datasets collected in earlier studies on Finnish children's reading development (see Hautala et al., 2020; Nurmi et al., 2013). Thus, *Word Reading Fluency (WRF)* is a composite of these three tests, indicating

reading performance relative to the average performance of children of the same age, with Cronbach's alpha reliabilities of .93, .94 and .96 at T1, T2, and T3, respectively.

Self-Efficacy

Self-efficacy was measured using a scale adapted from Peura et al. (2019). The scale includes eight items that assess children's confidence in their skills in letter knowledge, phonological skills, reading, and spelling; for example: "How certain are you that you can say the names of all the letters?" or "How certain are you that you can read long words?" Three practice items unrelated to reading were presented before the actual items. The items were read aloud to the child who responded on a scale from 1 (totally certain I cannot do this) to 5 (totally certain I can do this), represented by five squares of different sizes. Cronbach's alpha reliabilities for the self-efficacy scale were .85, .82, and .77 at T1, T2, and T3, respectively.

Task Avoidance

Children's task avoidant behavior was measured using the Behavioral Strategy Rating Scale (Zhang et al., 2011). Teachers rated children's behavior in classroom situations at the ends of Grades 1 and 2. The scale included five items; for example: "Does the student actively attempt to solve even difficult situations and tasks?" and "Does the student have a tendency to find something else to do instead of focusing on the task at hand?" The teachers answered using a scale ranging from 1 (not at all) to 5 (to a great extent). Cronbach's alpha reliabilities for task avoidance were .88 and .89 at T2 and T3, respectively. In most cases, class teachers made the ratings, either alone or in collaboration with special needs teachers (87.1% in Grade 1, 84.5% in Grade 2). In the remaining cases, the ratings were made by a special needs teacher alone.

Data Analysis

To test the theoretical model's accuracy, we used exploratory structural equation modeling (ESEM) (Asparouhov & Muthén, 2009). ESEM specifies the measurement model for exploratory factors and combines exploratory factors with other structural equation models similarly to when using confirmatory factors. The model was specified so that each of the three measurement points had their own factors, allowing cross-loadings only within time (Marsh et al., 2020). At T1, there were indicators for self-efficacy and word reading fluency, and the indicators were allowed to freely estimate the two exploratory factors. At T2 and T3, self-efficacy, word reading fluency, and task avoidance indicators were allowed to freely estimate the three exploratory factors. The paths between successive factors were further allowed to freely estimate, and the factors at the same measurement points were allowed to freely covariate. During the next stage, two dichotomous intervention variables were added to the model, and paths from the intervention variables to the factors were added based on large modification indices.

The model was estimated using full information maximum likelihood on the assumption that missing values were missing at random (MAR). The full sample size was 285. The missing values varied slightly depending on the indicator. In word reading fluency, the numbers of missing values were 1 (0.4%), 3 (1.1%), and 10 (3.5%) for T1, T2, and T3, respectively, owing to some students dropping out of the study and, on rare occasions, test refusal. In task avoidance, the numbers of missing values were 18 (6.3%) at T2 and 43 (15.1%) at T3, owing to some teachers' failure to return the survey. In the case of self-efficacy, the missing values were 35 (12.3%), 25 (8.8%), and 10 (3.5%), at T1, T2, and T3, respectively. The numbers were higher at T1 and T2 because in the first year of the study, the self-efficacy scale was administered only to students who had participated in the GL intervention in Grade 1 spring and their classmates who had participated in the study.

The two model fit indicators used were RMSEA and SRMR. RMSEA considers the model complexity (e.g., 43 indicators and 8 factors), and SRMR is the average residuals. For a well-fitted model, RMSEA should be lower than .06 and SRMR lower than .08 (B. O. Muthén, 1998–2004). The model was estimated using Mplus 8.3 statistical software (L. K. Muthén & B. O. Muthén, 1998–2017).

Results

Table 2 details the descriptive data, including means, standard deviations, and correlations between the self-efficacy, task avoidance, and word reading fluency scales (scale item averages).

Table 2 about here

The ESEM model fit the data well: RMSEA=.050 and SRMR=.051. Further, the 946 normalized residuals were distributed normally, and only 2.2% residuals had absolute values greater than two. As Table 3 demonstrates, the reading, self-efficacy, and task avoidance dimensions appear clearly. Standardized factor loadings for items associated theoretically with reading were .93–.98, for self-efficacy .39–.78, and for task avoidance .59–.91. There were seven statistically significant cross-loadings, with standardized values varying from .08 to .20. The solution appears to be theoretically clear.

Table 3 about here

After adding the intervention variables and paths based on large modification indices, the model fit remained unchanged (RMSEA=.050 and SRMR=.050). The model in Figure 2 shows that the rank order stability from Grade 1 winter to Grade 1 spring is relatively high for word reading fluency and self-efficacy. Rank order stability from Grade 1 spring to Grade 2 spring is high for word reading fluency and task avoidance and relatively high for self-efficacy.

Figure 2 about here

The model suggests, first, that self-efficacy in winter of Grade 1 negatively predicted task avoidance in spring of Grade 1 (research question 1a). Second, self-efficacy in winter of Grade 1 positively predicted reading fluency in spring of Grade 1 (research question 1b). Task avoidance did not predict later self-efficacy or word reading fluency (research question 1c) and reading fluency did not predict later self-efficacy or task avoidance (research question 1d).

The model also suggests that interventions directly affected self-efficacy and word reading fluency (Figure 2). To clarify the development of each intervention group from T1 to T3, the mean differences relative to the control group (i.e., the children with milder difficulties who did not receive intervention, mean = 0) in self-efficacy, task avoidance, and word reading fluency were calculated using the significant standardized coefficients detailed in Figure 2 (see Table 4). For example, Intervention 1's effect on T2 word reading fluency was calculated by multiplying $-.41$ at T1 by $.47$ and by adding $-.09$ on the product. This gives a value of -0.28 , which is further multiplied by $1/(SD \text{ of Intervention 1})$, which is about 2 (SD 's of both interventions were about 0.50). This produces the value -0.57 , suggesting that the word reading fluency of the children in the Intervention 1 group was 0.57 standard deviations lower than in the no-intervention control group at T2—a considerably smaller difference than at T1 (-0.82 , see Table 4). In the case of task avoidance, which was not directly affected by intervention, we used the indirect effect via self-efficacy to calculate the mean differences between each intervention group and the comparison group.

Table 4 about here

Discussion

This study's purpose was twofold: to investigate how self-efficacy, task avoidance, and word reading fluency relate to one another from Grade 1 to Grade 2 in children who struggle with reading acquisition, and whether children at greatest risk for dyslexia can be supported by school-based support enriched with GL. The results suggest, first, that self-efficacy plays an important role in the development of reading fluency in Grade 1, after which reading fluency appears to stabilize and become less affected by motivational factors. Second, the offered support seemed to help those at greatest risk for dyslexia, reducing the gap between them and their peers with milder problems.

The Relations of Self-Efficacy, Task Avoidance, and Word Reading Fluency

Concerning the first research question, the tested model revealed several significant associations between self-efficacy and task avoidance and word reading fluency. First, concerning research question 1a, self-efficacy measured in the middle of Grade 1 predicted task avoidance at the end of Grade 1. This finding aligns with the results of earlier studies (Honicke & Broadbent, 2016; Galla et al., 2014; Multon et al., 1991; Skaalvik et al., 2015) and suggests that confidence helps struggling readers regulate their level of effort in challenging achievement situations while less confident children give up more easily.

Second, regarding research question 1b, self-efficacy measured in the middle of Grade 1 predicted word reading fluency at the end of Grade 1, suggesting that children who started the study with higher confidence in their reading and spelling skills were more advanced readers at the end of Grade 1. This is consistent with earlier studies (Galla et al., 2014; Lee & Jonson-Reid, 2016; Peura et al., 2019; Usher et al., 2019). However, self-efficacy assessed at the end of Grade 1 did not predict word reading fluency at the end of Grade 2, possibly because word reading fluency from Grade 1 spring to Grade 2 spring was stable, and little variance remained to be explained by other variables. Thus, the results do not

support the hypothesis that task avoidance mediates the effect of Grade 1 self-efficacy on Grade 2 reading fluency. However, as self-efficacy predicted task avoidance in Grade 1 and task avoidance in Grade 1 strongly predicted task avoidance in Grade 2, it seems possible that Grade 1 self-efficacy has long-term effects on students' future achievement behaviors, which may eventually affect learning.

Concerning research question 1c, task avoidant behavior measured at the end of Grade 1 did not predict reading skill or self-efficacy at the end of Grade 2. Again, it seems that because of the high stability of word reading fluency after Grade 1, there was not enough variance left to be explained by task avoidance, as has been found previously (Hirvonen et al., 2010; Georgiou et al., 2010). Moreover, task avoidance did not predict later self-efficacy. It seems that the ability to focus and persist during achievement situations did not give these children such mastery experiences that would have increased their confidence in reading tasks, as was suggested by the results of Liew et al. (2008) and Usher et al. (2019).

Finally, regarding research question 1d, word reading fluency did not predict future self-efficacy or task avoidant behavior, which was unexpected. In previous studies, task avoidance and reading achievement have been shown to be reciprocally related (Aunola et al., 2002; Georgiou et al., 2017; Hirvonen et al., 2010; Onatsu-Arvilommi & Nurmi, 2000), and some support has been presented for a similar relationship between self-efficacy and reading achievement (Schöber et al., 2018). However, the present study differs from earlier studies by focusing on students with poor reading skills, by simultaneously including self-efficacy and task avoidance in the model, and by offering additional support for the poorest readers. These children's self-efficacy beliefs and task persistence appear to be less affected by their actual performance because of the individualized support they received and because of the big fish–little pond effect (Marsh et al., 1987). Therefore, the development of these

children's self-efficacy beliefs and task persistence may have been primarily affected by the amount of positive feedback, encouragement, and mastery experiences they received during reading skills training. As Peura et al. (2021) found, various sources of self-efficacy play an important role in the development of primary school students' reading self-efficacy.

The Role of Intervention

Concerning the second research question, the results suggest that the interventions positively affected the development of self-efficacy and word reading fluency. As expected, the children who participated only in the Grade 1 intervention responded well to the support, as evidenced by the narrowing of the gap between them and the no-intervention group with milder difficulties.

The children who received the intervention only in Grade 2 were either waiting-list controls or children who had not met the selection criterion for the Grade 1 intervention but met the criterion for the Grade 2 intervention. These children clearly lagged behind their peers with milder difficulties in the middle of Grade 1, and the gap increased by the end of Grade 1, particularly with respect to word reading fluency. During Grade 2, the gap diminished in self-efficacy and word reading fluency, but in the latter, the difference was still nearly one standard deviation to the group with milder difficulties at the end of Grade 2. It thus appears that the intervention's timing was not ideal for this group. Considering the stability of word reading fluency during Grade 2, interventions targeting word-level fluency appear to be more effective when administered during Grade 1, at least in regular orthographies such as Finnish, in which individual differences in reading fluency appear to stabilize early.

Those who did not exhibit adequate responses to the Grade 1 intervention and continued to meet the selection criterion for the Grade 2 intervention received both

interventions. As expected, of all intervention groups, they exhibited the greatest difference to the no-intervention group in all measures and time points. However, during Grade 2, these children were able to decrease the gap both in self-efficacy and reading, although the difference was still considerable, especially in word reading fluency at the end of Grade 2.

These results are at odds with McTigue et al. (2020) and Ronimus et al. (2020), who found no evidence that GL interventions could effectively support the development of word-level reading skills. However, in the present study, the effect of GL cannot be disentangled from the effect of school-provided support. Most participants in all groups received part-time special education in reading. Therefore, the results align well with the earlier studies, which indicate that part-time special education during early school years helps Finnish children with reading difficulties catch up with their peers and that the need for more intensive or long-lasting part-time special education is associated with more persistent reading difficulties (Virinkoski et al., 2021). All teachers received regular feedback about their students' test scores during the study. This may have increased teachers' awareness of their students' difficulties, which in turn may have affected the intensity and quality of support provided to the children. Controlling the effect of self-efficacy in the model may also have helped the effects of the intervention to emerge, because an earlier study (Ronimus et al., 2020)—using a part of the same dataset—found self-efficacy to affect children's response to GL.

The development of self-efficacy mostly paralleled that of word reading fluency in all intervention groups, suggesting that the support that improved reading fluency also positively affected self-efficacy. Mastery experiences and positive feedback received during training are possible reasons for improved self-efficacy (Usher & Pajares, 2008). Children selected for the intervention groups exhibited only slightly greater task avoidance than the comparison group

with milder difficulties, suggesting that problems related to task focus and persistence were not major factors in these children's difficulties at this early stage of reading acquisition.

Limitations

The study has four key limitations. First, the gaps between the measurement points were not equal, with only approximately four months between Time 1 and Time 2 and about 12 months between Time 2 and Time 3. This may have impacted the associations between the variables, with the shorter gap producing stronger associations. However, the rank order stabilities of word reading fluency and task avoidance between Time 2 and Time 3 were high, leaving less variance to be explained by other variables. Therefore, an additional measurement point in the middle of Grade 2 may not have made a difference. Second, task avoidance was measured only twice during the study, at the ends of Grades 1 and 2. Task avoidance may have been a stronger predictor of later reading fluency had it been measured in the middle of Grade 1, when children's reading fluency was less stable. Third, task avoidance was a domain-general measure, whereas self-efficacy was measured specifically in relation to reading. Stronger associations typically emerge when the same level of specificity is used for both measures (see, e.g., Usher et al., 2019). Finally, the same self-efficacy measure was used at all time points, which may be problematic. The scale was designed to assess confidence in tasks that are important for beginning readers, such as knowing letter names, whereas in Grade 2, confidence in more demanding tasks, such as reading a full page of text, may be more relevant for reading achievement. Future studies investigating self-efficacy with children whose skills are rapidly developing should consider preparing different versions of the self-efficacy measure with items that match the expected skill level at different measurement points.

Future Research

The study suggests that in regular orthographies, such as Finnish, individual differences in reading fluency tend to stabilize early, which should be taken into account in future studies investigating the role of motivation during the early stages of reading development. Of particular interest would be to investigate further the factors affecting the reading motivation of struggling readers. Previous research conducted with normal readers strongly suggests that reading achievement is an important predictor of motivation (e.g., Toste et al., 2020), but in the present study reading achievement did not predict self-efficacy or task avoidance, indicating the need for more research on the factors shaping these children's reading motivation.

Implications for Practice

The study highlights the importance of self-efficacy for the reading development and achievement behaviors of first graders experiencing difficulties in reading acquisition. The finding that past reading achievement may not affect later self-efficacy and task persistence suggests that interventions aiming to improve at-risk children's reading motivation should include direct motivational support instead of focusing solely on reading skills. Owing to the early stabilization of word reading fluency, early interventions carried out during Grade 1 are likely to be most effective at promoting word reading fluency and motivation in this group of children. The findings also suggest that even severe difficulties in reading acquisition can be effectively remediated by school-based methods and by appropriately timed game-based GL training. Despite these encouraging findings, however, the participants' word reading fluency remained clearly below the normative age level by approximately one standard deviation at the end of Grade 2. Therefore, it is important that these students continue to receive high-quality individualized support during their later school years.

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Table 1

The Number and Percentage of Children Receiving General, Intensified, and Special Support at School in Different Intervention Groups

Intervention group	General		Intensified		Special		Unknown		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Grade 1										
No intervention	50	52.10	36	37.50	4	4.20	6	6.30	96	100.00
Grade 1 intervention	23	37.10	25	40.30	9	14.50	5	8.10	62	100.00
Grade 2 intervention	19	35.20	26	48.10	6	11.10	3	5.60	54	100.00
Both interventions	19	26.00	38	52.10	16	21.90	0	0.00	73	100.00
Grade 2										
No intervention	43	44.80	36	37.50	7	7.30	10	10.40	96	100.00
Grade 1 intervention	12	19.40	28	45.20	11	17.70	11	17.70	62	100.00
Grade 2 intervention	9	16.70	29	53.70	8	14.80	8	14.80	54	100.00
Both interventions	7	9.60	28	38.40	26	35.60	12	16.40	73	100.00

Table 2

Correlations, Means, and Standard Deviations for Self-Efficacy, Task Avoidance, and Word Reading Fluency

	SE T1	SE T2	SE T3	TA T2	TA T3	WRF T1	WRF T2	WRF T3
SE T1	--							
SE T2	.57***	--						
SE T3	.33***	.39***	--					
TA T2	.27***	.22***	-.05	--				
TA T3	.15*	.10	-.08	.63***	--			
WRF T1	.30***	.29***	.18**	-.20***	-.06	--		
WRF T2	.42***	.44***	.26***	-.28***	-.12	.77***	--	
WRF T3	.30***	.41***	.27***	-.23***	-.14*	.62***	.82***	--
<i>M</i>	3.60	3.84	4.10	3.11	3.00	-1.53	-1.03	-1.05
<i>SD</i>	0.96	0.83	0.63	1.02	1.08	0.46	0.66	0.92
<i>N</i>	250	260	275	267	242	284	282	275

Note. SE = self-efficacy, TA = task avoidance, WRF = word reading fluency, T1 = Grade 1 winter measurement, T2 = Grade 1 spring measurement, T3 = Grade 2 spring measurement.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3*Standardized Factor Loadings from the ESEM Model*

Item	WRF	SE	WRF	TA	SE	WRF	TA	SE
	T1	T1	T2	T2	T2	T3	T3	T3
Wd T1	0.98***	0.00	0.97***	-0.03	0.01	0.97***	-0.04	0.00
Pswd T1	0.94***	0.04	0.93***	-0.00	0.03	0.97***	0.02	-0.01
Text T1	0.96***	-0.08**	0.98***	0.01	-0.05	0.95***	-0.00	0.01
TA1 T2			0.02	0.91***	0.02	-0.03	0.91***	0.04
TA2 T2			-0.02	-0.59***	0.15	0.01	-0.65***	0.12
TA3 T2			0.00	0.72***	-0.08	0.01	0.71***	-0.15
TA4 T2			0.02	-0.61***	0.09	-0.05	-0.69***	0.08
TA5 T2			-0.03	0.87***	0.10	-0.01	0.91***	0.01
SE1 T1	-0.00	0.63***	0.00	0.07	0.53***	0.11	0.05	0.39***
SE2 T1	-0.06	0.57***	-0.09	-0.02	0.59***	-0.06	0.05	0.57***
SE3 T1	-0.01	0.67***	-0.09	-0.00	0.62***	0.02	-0.04	0.64***
SE4 T1	-0.01	0.69***	0.01	0.03	0.64***	-0.06	-0.04	0.57***
SE5 T1	0.15**	0.62***	-0.03	-0.13*	0.57***	-0.02	-0.00	0.49***
SE6 T1	0.11*	0.60***	0.14*	-0.02	0.55***	0.20***	0.01	0.62***
SE7 T1	0.00	0.78***	0.02	0.13*	0.68***	-0.01	0.01	0.56***
SE8 T1	0.03	0.55***	0.05	0.01	0.65***	0.07	-0.09	0.42***

Note. Wd = word list reading test, Pswd = pseudoword list reading test, Text = text reading test, TA1–TA5 = task avoidance scale items 1–5, SE1–SE8, self-efficacy scale items 1–8. T1 = Grade 1 winter measurement, T2 = Grade 1 spring measurement, T3 = Grade 2 spring measurement.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4*The Mean Difference of Each Intervention Group from the No-Intervention Control Group*

	Intervention 1	Intervention 2	Both interventions
SE T1	-0.40	-0.62	-1.02
SE T2	-0.24	-0.68	-0.93
SE T3	-0.12	-0.34	-0.46
TA T1	–	–	–
TA T2	0.08	0.13	0.22
TA T3	0.06	0.09	0.15
WRF T1	-0.82	-0.97	-1.79
WRF T2	-0.57	-1.28	-1.85
WRF T3	-0.32	-0.94	-1.26

Note. Standard deviations used in the calculation are based on the standardized model consisting of all individual variation when differences between group means are controlled (Figure 2). SE = self-efficacy, TA = task avoidance, WRF = word reading fluency, T1 = Grade 1 winter measurement, T2 = Grade 1 spring measurement, T3 = Grade 2 spring measurement, Intervention 1 = the group who received intervention only in Grade 1 spring, Intervention 2 = the group who received intervention only in Grade 2 fall, Both interventions = the group who received both Grade 1 and Grade 2 interventions.

Figure 1*The Data Collection Procedure*