Can Reading Fluency and Self-Efficacy of Reading Fluency be Enhanced with an Intervention Targeting the Sources of Self-Efficacy?

Aro, T.[1,2)], Viholainen, H.[3)], Koponen, T.[2,3)], Peura, P.[3)], Räikkönen, E.[3)], Salmi, P.[2)], Sorvo, R.[3)], & Aro, M.[3)]

[1)] Department of Psychology, University of Jyväskylä

[2)] Niilo Mäki Institute

[3)] Department of Education, University of Jyväskylä

Corresponding author:

Tuija Aro

Department of psychology

University of Jyväskylä

PO Box 35

40014 University of Jyväskylä

tuija.i.aro@jyu.fi

+358 40 8053732

Acknowledgements:

This research was supported by the Academy of Finland Program *The Health and Welfare of Children and Young People (SKIDI-KIDS;* Decision numbers 264344 and 264415).We wish to thank all the students and teachers as well as the project assistants who participated in this research.

Abstract

The first aim of the study was to analyze whether reading fluency and self-efficacy of reading fluency (SE-rf) are malleable for children (Grades 3–5) with deficits in fluent reading via a 12-week special education program targeting both reading fluency and the sources of SE-rf (SE-program). The second aim was to investigate whether changes in SE-rf are related to changes in reading fluency. The SE-program (n=40) was contrasted with the SKILL-program (n=42) providing training solely in reading fluency. The groups showed equal improvements in reading fluency. Positive change in SE-rf emerged only in the SE-group, and this change was associated with changes in fluency, but the association depended on the reading measure. The findings indicate that a reading fluency intervention supporting self-efficacy by providing concrete feedback and helping children to perceive their progress can yield positive changes in self-efficacy. More research is needed on the variability in intervention responsiveness.

Keywords: reading fluency, self-efficacy of reading, sources of self-efficacy, elementary school, intervention

Can Reading Fluency and Self-Efficacy of Reading Fluency be Enhanced with an Intervention Targeting the Sources of Self-Efficacy?

In recent years, interest has increased in the "non-cognitive" factors of school learning, such as motivation, emotions, beliefs, and contextual features (Farrington et al., 2012; Lazowski & Hulleman, 2015). Indications are that these diverse and partly overlapping factors are as essential as cognitive skills in determining academic outcomes, especially among low-achieving children (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009; see also Gutman & Schoon, 2013). Similar notions have appeared in intervention studies, which have shown that cognitively focused interventions have not produced the expected positive results on learning outcomes for children with learning difficulties, with the exception of phonological skills training for early reading problems (see Kearns & Fuchs, 2013). On the other hand, positive and long-lasting effects on achievement have been gained when using social-psychological interventions that target students' personal experiences (for a review, see Yeager & Walton, 2011).

In the domain of reading, the importance of self-concept and motivation has been shown in developmental (in transparent orthography see Lepola, Poskiparta, Laakkonen, & Niemi, 2005) and intervention studies. The research on interventions focusing either on the skill solely, but also evaluating changes in self-concept and motivation (e.g., Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008), or focusing on both (e.g., Guthrie, McRae, & Klauda, 2007) indicates that targeting merely the skill does not suffice when it comes to creating an effective intervention among struggling readers (see also March & Craven, 2006; Retelsdorf, Köller, & Möller, 2014).

In the present study, we focus on academic self-efficacy (SE-a), more specifically, on SE of reading fluency (SE-rf). SE-a refers to one's *task-specific* beliefs in his or her ability to perform a given academic task at a designated level (Bandura, 1997) and has been shown to be

associated with academic performance among adults (e.g., Honicke & Broadbent, 2016; Multon, Brawn, & Lent, 1991; Richardson, Abraham, & Bond, 2012), adolescents (e.g., Komarraju & Nadler, 2013; Lee, Lee, & Bong, 2014; Zuffianò et al., 2013), and children (e.g., Bandura, Barbarelli, Carpara, & Pastorelli, 1996). Less is known about SE of reading, especially about SE-rf, because previous SE-studies have mainly focused on reading comprehension, which has been found to have a strong association with SE (Cho et al., 2015; Guthrie et al., 2007; Hornstra, van der Veen, Peetsma, & Volman, 2013; Lee & Jonson-Reid, 2016; Schunk & Rice, 1993; Taboada, Tonks, Wigfield, & Guthrie, 2009). Recently, however, Carroll and Fox (2017) found that SE was particularly important for developing word-reading skill among children between 8 and 11 years of age, whereas no association was found with comprehension.

The relevance of SE for early reading skill and for gaining fluency (i.e., ability to read accurately and with speed) can be understood in light of the so-called self-teaching hypothesis (Share, 1995), which proposes that the development of accurate and speeded reading skill necessitates independent practice (cf. self-teaching). Thus, becoming a fluent reader requires repetitive practice to consolidate the orthographic and word-specific knowledge underlying fluent and effortless word recognition, which, in turn, entails perseverance and confidence in one's ability to become fluent. SE-research has shown that students with higher reading SE are more likely to be perseverant (Linnenbrink & Pintrich, 2003), whereas students with low SE tend to avoid challenging reading activities (Zimmerman, 2001). This lessens the time spent reading and diminishes the number of words read, thus hindering reading fluency development.

The development of reading skills can be seen as a process in which comprehension is the ultimate goal. Fluent decoding skill is an essential element in this process, forming an explicit bridge to comprehension (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Pikulski & Chard, 2005). Fluency is especially relevant in orthographically transparent languages, such as

Finnish, where children develop an accurate decoding skill as early as the first grade (Seymour, Aro, & Erskine, 2003) and where reading disability is mainly manifested as problems in gaining an efficient decoding skill (Aro & Wimmer, 2003; Landerl & Wimmer, 2008). Thus, finding effective interventions for students struggling with becoming fluent readers is of the utmost importance. Unfortunately, in the reading interventions, the effect sizes on reading fluency measures have been low (Flynn, Zheng, & Swanson, 2012) and fluency interventions have been associated with lower effect sizes than reading comprehension interventions (Scammacca, Roberts, Vaughn, & Stuebing, 2015). The two main skill-oriented approaches toward developing reading fluency are interventions based on repeated reading and those aiming to increase the amount of reading practice in educational settings (see Huemer, 2009). Studies show that repeated reading is the most effective intervention for improving fluency among students with learning disabilities (Lee & Yoon, 2017; for review see Stevens, Walker, & Vaughn, 2017). However, there are indications that the positive effects of repeated reading might to be specific to the trained material, thus restricting its efficacy (Berends & Reitsma, 2006; Heikkilä, Aro, Närhi, Westerholm, & Ahonen, 2013).

Low impact of reading fluency interventions and importance of SE for developing reading skill advocate a better understanding of SE-rf. According to the social cognitive theory (Bandura, 1997), SE beliefs are formed based on interpretations of previous experiences (mastery experiences), encouragement received from others (social/verbal persuasion), observations of others' mastery experiences (vicarious experience), and feelings while engaged in or thinking about an activity (physiological and affective states). Of these, mastery experiences have been reported as the most powerful source of SE among children and adolescents in different scholastic domains (see Britner & Pajares, 2006; Joët, Usher, & Bressoux, 2011; Pajares, Johnson, & Usher, 2007; Usher & Pajares, 2008, 2009). Although the sources of reading SE have received less attention, the few existing studies among early

adolescent learners suggest that along with mastery experiences, social persuasion or feedback are sources for inferring one's reading self-efficacy (Butz & Usher, 2015; Guthrie et al., 2007; Henk & Melnick, 1998).

Studies among individuals with learning difficulties indicate that in addition to having lower SE-a (e.g., Hampton & Mason, 2003; Klassen & Lynch, 2007; Yuen, Westwood, & Wong, 2008), their skill level may influence what sources they rely on and which sources are available to them to form their SE-a. For example, they may have fewer opportunities for experiencing success than their peers (Arslan, 2013; Hampton & Mason, 2003; Usher & Pajares, 2006; 2008). Therefore, special attention should be given to providing experiences of success to students who are struggling with learning as the unavailability of appropriate sources may influence the development of SE-a, leading to a vicious circle.

The existing intervention studies (e.g., on strategies, goal-setting, and feedback; García & Fidalgo, 2008; Schunk & Rice, 1993) assessing SE-a have shown positive outcomes in SE-a, persistence, interest, and performance (see also Gutman & Schoon, 2013; Zimmerman, 2001), as well as indicating that changes in SE-a may have a mediating effect in explaining changes in achievement outcomes (Schunk, 1981). SE-intervention studies in the domain of reading have mainly focused on comprehension. In a recent review of intervention studies by Unrau et al. (2018), measures of reading comprehension were found to have a significant impact on self-efficacy. However, the studies included in the review targeted reading comprehension, while studies on decoding were not included, and self-efficacy was a secondary concern of importance. Thus, there is need for intervention studies targeting both the skill and self-efficacy, especially in the area of decoding. To the best of our knowledge, the only intervention studies on both self-beliefs and *reading fluency* are a single-case study by Ferrara (2005), a study with 11 primary school children by Robson, Blampied, and Walker (2015), and a larger randomized controlled trial by Toste, Capin, Vaughn, Roberts, and Kearns

(2017) on motivational beliefs (i.e., beliefs about the self and reading, self-reflection, positive self-talk, and recognition of negative statements). These studies show that interventions incorporating self-beliefs in reading fluency instruction can yield positive results in reading and reader self-perception or attributions. However, the sample sizes were small (except in Toste et al.), the focus of the interventions was not explicitly on SE, and the measures used did not specifically tap into SE-rf.

In their meta-analysis, Unrau et al. (2018) indicated that intervention effects become larger as the number of sources of SE included in the reading comprehension intervention increases. Despite the well-documented importance of the sources of SE, intervention studies that *explicitly target all the four sources of SE* suggested by the social cognitive theory are few, and none have focused on SE-rf. To our knowledge, the only study targeting all four sources of SE among elementary school children has focused on writing skills. In their experiment, García and de Caso (2006) aimed at improving the writing skills of fifth- and sixth-grade students with learning difficulties or low achievement using a 10-session program in which the four sources (mastery experiences, verbal persuasion, vicarious experiences, psychological and affective state) were incorporated. They found a positive intervention effect and concluded that writing can be improved by enhancing children's writing SE "through establishing a good psychological and affective climate, giving verbal persuasion, demonstrating their mastery, and using vicarious experience" (p. 23).

In the present study, we investigated whether reading fluency and SE-rf are malleable among third- through fifth-grade students by introducing a 12-week special education program specifically targeting the four sources of SE-rf, along with reading fluency training (SE-program). The SE-program participants were compared with participants of an equally intensive program that only provided the children with reading fluency training (SKILL-program). Furthermore, we studied whether individual changes in SE-rf were associated with

reading fluency development within and between the groups. The specific research questions were:

1) Do the SKILL- and SE-groups differ in their development of (a) reading fluency and (b) SE-rf during the intervention and follow-up periods?
2) Is a change in SE-rf during the intervention period associated with a change in reading fluency after controlling for school, grade, and pre-intervention levels of reading fluency and SE-rf? And, if so, is the association different between the SKILL- and SE-groups?

Methods

Procedure and Participants

The current study was part of the longitudinal *Self-Efficacy and Learning Disability Intervention* research (SELDI, 2013–2015) focusing on elementary school children's self-beliefs, reading and math fluency, and ways of supporting children with reading or math difficulties. In the present study, we report the findings concerning reading fluency interventions. The SELDI-study was carried out within the school context and its schedules and resources. Thus, a quasi-experimental design with pre-, post-, and follow-up assessments was applied. The pre-intervention assessment was conducted in November, and the 12-week intervention program started in January. The post-intervention reading assessment was conducted in May and the follow-up assessment after the summer holiday in September–October. SE-rf was measured before the interventions in January and again in May and September–October. The study was approved by the Ethical Committee of the XXX.

Recruitment of the participating schools. Special education teachers working with Grades 2 to 5 in four municipalities in Eastern and Central Finland were invited through special education coordinators to participate in the project (see Figure 1 for details). The number of participating schools was 20; fourteen of them provided reading interventions. The participating schools were selected to apply *either* the SE- *or* the SKILL-program to avoid

"contamination". Thus, the two programs were not provided in the same school. Because the schools had a varying number of students and special education teachers, the largest schools were first deemed to provide *either* the SE- *or* the SKILL-program. This was done to have the best possible balance between the two interventions in terms of the number of students and their grade levels. As we ran both math and reading interventions, matching the schools was conducted considering the math groups as well. Since the number of reading intervention groups in each school and the participating grade levels were decided based on the available personnel and the eligible students enrolled in the school, the grade levels of the intervention participants differed between the schools. The number of participants in each group varied from three to five students.

Recruitment of the students. Participants for the reading intervention were recruited from Grades 3 to 5. Participation was voluntary, and the parents gave written informed consent for participation. At the first stage, all participating classes were administered two time-limited group-level tests of reading fluency (ALLU and LUKSU, see the descriptions below; this assessment served as their pre-intervention assessment) and an individually administered standardized reading fluency test to verify the group-assessment results (Lukilasse-test; see the description below and Figure 1). The poorly performing children not participating in the interventions received support as usual (typically part-time special education), whereas the intervention children did not receive other support for reading at school during the intervention. The children participating in the group-assessments, but not in the intervention programs, formed the peer reference group. The total number of participants of the present study was 1,098 children: 42 in the SKILL-group (64.3% male), 40 in the SE-group (70% male), and 1,016 in the reference group (52% male). Grade Median was 4 in all groups (for details see Table 4).

Measures

SE-rf questionnaire. The group-administered questionnaire specifically targeting SE-rf was developed based on the guidelines outlined by Bandura (2006). Trained research assistants read aloud pre-written instructions and questionnaire items one by one to ensure that everyone could answer them irrespective of their reading skill. The children rated the strength of their confidence using a 7-point scale ranging from "*I'm totally certain I can't ...*" (1) to "*I'm totally certain I can ...*" (7). The questionnaire comprised 14 items (see Table 1), and the mean of all items was used as the SE-rf scale score. Three items covered SE-rf related to developing better reading skills, three items targeted everyday reading activities requiring fluency, and 8 items measured confidence in specific reading fluency tasks. The last items were included because it has been shown that SE should be measured also in a task-based level of specificity (Bandura, 1997). In these items, children were shown paragraphs of increasing length (from one sentence to a long paragraph, see Table 1), and they had to judge how certain they were in their ability to read each paragraph aloud in 30 seconds. The children were first shown how long 30 seconds is. Each paragraph was then presented on a data projector for 5 seconds. There were two practice items not included in the analysis to familiarize the children with the tasks and scales. The children filled out the SE-rf questionnaire before the reading assessment.

Reading fluency measures. Three measures tapping into the ability to read accurately and with speed at different levels (words, sentences, text) were used to follow the changes in reading fluency (pre-, post-, and follow-up). In all tests, children were instructed to perform as quickly and accurately as possible. Two of these tests were silent reading tasks administered as a group-test in the classroom (*Word-Chain Test, ALLU*, Lindeman, 1998; *Sentence Verification Task, LUKSU*, Salmi, Eklund, Järvisalo, & Aro, 2011). One reading-aloud test was administered individually after the group-assessments (*Text Reading, TEXT*, Salmi et al., 2011).

Additionally, the individually administered standardized achievement test *Lukilasse – Test battery for screening reading, spelling, and arithmetic* (Häyrinen, Serenius-Sirve, & Korkman, 1999) was used for selecting children for the intervention groups after the group-assessment with ALLU and LUKSU. In the Lukilasse-reading subtest, the children read aloud a graded list of words of increasing length and complexity. The score is the number of correctly read words within 2 minutes. The Cronbach's alpha has shown good scale reliability for all grades (varying between .94 and .98, standardization sample; Häyrinen et al., 1999).

The *ALLU* assesses word reading and has been shown to have a high scale reliability (Cronbach's alpha = .97, standardization sample; Lindeman, 1998); it consists of words written in clusters of two to four words with no spaces between them (78 word-chains in total). The task for the child is to read silently and separate the words with a vertical line. The test score is the number of correctly identified words within 3.5 minutes. Two parallel versions were used. The *LUKSU* is a Finnish adaptation of the Woodcock-Johnson Reading Fluency Test (Woodcock, McGrew, & Mather, 2001) and has three parallel versions. It assesses sentence-level reading and consists of 70 easy and short statements (e.g., "*Strawberries are red*."). The child is asked to silently read the sentences one by one and after each sentence decide whether the statement of the sentence is correct or incorrect. The test score is the number of correct answers given within 2 minutes. Both the scale reliability and split-half reliability have been found to be good (Cronbach's alpha = .94 and split-half = .97, standardization sample; Eklund, Salmi, Polet, & Aro, 2013). In *TEXT*, the child has to read aloud an informational 120-word text. Its correlation with the *Lukilasse* was .87. The test score is the number of correctly read words within 1.5 minutes, and there are three parallel versions.

Non-verbal reasoning skills. The Raven's Colored Progressive Matrices (Raven, Court, & Raven, 1990) was administered in a group in the classroom to estimate non-verbal reasoning skills. The test consists of 36 multiple-choice tasks presented in the form of a 2×3

matrix and listed in order of difficulty. The subject is asked to mark the missing element that completes a pattern. The final score is the number of correct answers. The split-half coefficient of reliability have been shown to be good among adults (r = .96; Burke, 1985) and children (6–14 years aged; r = .92; Cotton et al., 2005).

Questionnaire on Student's Experiences of the Intervention. At the end of the intervention, the children were asked about their experiences concerning the intervention they participated in (see Table 2). The questionnaire consisted of 24 items with a 5-point scale ranging from "*Always ...*" (1) to "*Never*" (5). Nine items tapped into feedback and verbal persuasion the child felt she or he had received from the teacher on his or her improvement, effort, or practices (teacher feedback). Seven items concerned verbal persuasion and feedback given by other group members (peer feedback). Four items concerned discussions on emotions and thoughts regarding learning (emotions/thoughts), and four items tapped into more general issues concerning the intervention atmosphere and content (general). The questionnaire was used to check the fidelity of the programs as experienced by the participants.

Intervention Programs

Both the SKILL- and the SE-program lasted 12 weeks and were carried out by the special education teachers. The programs comprised one weekly group session and three weekly individual computer-based practice sessions with two individually adaptive computer programs that were alternated every second week (see Table 3). The SKILL- and SE-programs were similar in terms of general setting (i.e., regular and structured group-sessions, individual practice with the computer programs).

Individual computer-based fluency practice. The computer-based practice started with the fluency version of the *GraphoGame* intervention program available for research purposes (Richardson & Lyytinen, 2014). In the game, the child hears a syllable, word, or pseudo-word that she or he also sees on the screen among distractor syllables, words, or

pseudo-words. The child's task is to choose the correct item by clicking the mouse as quickly as possible. In the second intervention program, *Reading Acceleration Program (RAP)* (Breznitz & Bloch, 2010; Snellings, van der Leij, de Jong, & Blok, 2009), the child sees a sentence on the screen, and the task is to read it as quickly as possible. After presentation of the sentence, the letters start to disappear one by one from the beginning of the sentence, thus forcing the child to read faster. After the sentence has disappeared, the child sees a multiple-choice question concerning the content of the sentence. The disappearance rate is adapted to the child's performance after every eight sentences according to the correctness of the answers (if 87.5% are correct, the rate is accelerated; if 50.0% are incorrect, the rate is decelerated).

The *difference between the interventions* in computer-based practice was that the log data recorded by both programs were used only in the SE-group for giving the participants feedback on their reading fluency development and the amount of practice each week. In addition, the participants of the SE-group wrote down their mastery experiences during the computer sessions (e.g., "*I noticed when I succeeded*," or "*I tried even though the task was difficult*").

Fluency practice during group sessions. Reading fluency was practiced in the *SKILL-program* in the weekly group sessions with tasks including general and repeated reading, and speeded and non-speeded reading practice of syllables, words, and texts. In the *SE-program*, the reading exercises were designed to allow for following the improvement and for providing feedback to enhance SE-rf. Thus, the SE-program's group-sessions included repeated reading: each child had an individual text from children's novels, which she or he read for 2 minutes, while the others followed her or his reading. The teacher scored the number of words read. The same text was used for four sessions. Because the group sessions were equally long in both programs and the SKILL-program did not include components targeting SE-rf,

less time was spent on fluency exercises in the SE-program than in the SKILL-program group sessions.

Sources of SE-rf in the SE-program. The elements enhancing SE-rf were based on the four sources of SE (Bandura, 1997; Table 3). *Mastery experiences* were provided by using individually challenging but accessible tasks. This element was also present in the SKILL-program, but only in the SE-program, several forms of feedback was provided to assure mastery experiences. First, positive, explicit, and concrete feedback was provided on *improvement* in the computer exercises by sharing the graphs generated by the programs, and in the text-reading tasks by drawing graphs showing development. Second, feedback on *effort* was provided by graphing the amount of computer practice (number of read syllables, words, or sentences, minutes playing the game, etc.) and by discussing self-reports on practicing with the children. Third, feedback on the previous week's *practice* was visualized at the beginning of each group session by marking it on the children's notebooks. In addition, the teachers discussed all forms of feedback with the children to ensure that they interpreted it correctly.

To provide children with *verbal persuasion*, the teachers discussed the children's practice, effort, and improvement during the past week. Particular attention was paid to the children's development and effort, but the reasons for temporary setbacks were also discussed. Furthermore, the children were instructed to recognize and verbalize their own improvement and success and to write this in their notebooks. This gave the teachers the opportunity to discuss the children's observations of successful experiences.

To assure *vicarious experiences* the children were working in groups of similar level of reading. The participants were also encouraged by the teacher to observe the improvements of their peers and share these with the group to provide vicarious experiences and peer feedback. To enable discussions of learning-related *emotional experiences and difficulties*, the children's own observations and comments on their reading performance, emotions, and

practice were encouraged ("*I kept on going although the text was difficult," and "Last week I was tired and did not practice so much")*. Comparisons to one's own performance, but not between participants, were encouraged. Furthermore, the participants filled in an emotional checklist, indicating how motivated they were to practice and how they felt about practicing after the session. These self-ratings were filled in in the beginning and at the end of each session to ease discussion about emotions and to provide an opportunity to express feelings towards the tasks.

Teacher Training

Before the interventions, two 3-hour training sessions were organized to instruct all participating teachers on how to implement the programs and to provide them with detailed session-by-session manuals. The SKILL-program training covered the theory of reading fluency and an introduction to the SKILL-manual. The SE-program training covered the theory of reading fluency and SE-rf and an introduction to the SE-manual. The SKILL-manual included the theory on reading fluency and intervention principles, as well as a detailed description of each group-session, the tasks to be carried-out in each session, and the materials needed in each session. The SE-manual also included theory of SE and its sources. In the SE-manual and during teacher training, the main focus was on ensuring that all teachers understood why and how the elements intended to support SE-rf were implemented. After the third intervention session, the researchers called each teacher to check for any problems and to ensure that intervention manuals were followed and the main principles of the programs were understood. Group meetings were arranged separately for the SE-program (three meetings) and SKILL-program teachers (two meetings) during the intervention to allow teachers to share experiences and ensure that everyone had a common understanding of the key points of the programs. After the study, the teachers involved in the SKILL-program were offered training

on SE-rf, and the teachers involved in the SE-program were offered training on the SKILL-program.

Fidelity

A number of means were used to ensure the validity of the interventions. First, the teachers were trained in small groups to deliver the interventions separately for both intervention programs. Second, the teachers were provided session-by-session manuals and materials. Third, meetings and telephone conversations were arranged to monitor adherence to intervention protocols. Fourth, teachers had a checklist for every child of the feedback given on improvement, amount of work done, effort, and persistence during the practice. Finally, at the end of the intervention, the Questionnaire on Student's Intervention Experiences was given to the participants to check how their experiences within the interventions corresponded to the supposed content. The SKILL- and SE-groups differed in all the scales concerning SE-specific content, but no difference was observed on the general scale (see Table 2 for means, SDs, and comparisons of the groups with a multivariate analysis of covariance [MANOVA]). These differences imply that the interventions were perceived differently by the children in the aspects relevant for explicit SE support.

Statistical Analyses

As a preliminary analysis, a MANCOVA was applied to analyze whether the three groups (reference group, SKILL, SE) differed in the means of pre-intervention assessment in the three reading measures. An analysis of covariance (ANCOVA) was used to examine whether the groups differed in the mean of the pre-intervention SE-rf score. Because the participants were from three different grade levels, the grade level was controlled for.

To answer the first research questions, a repeated measures MANCOVA and ANCOVA were used to compare the mean level of development in reading fluency (ALLU, LUKSU, and TEXT) and SE-rf in the two *intervention groups* (a) during the intervention (from

pre- to post-assessment) and (b) during the follow-up period (from the post- to the follow-up assessment). The pre-intervention scores (reading/SE-rf) were used as covariates to control for possible pre-intervention differences between the groups and to reduce regression towards the mean. The grade was controlled for in the analyses on reading, and the school was controlled for in all analyses. In the pairwise tests, a Bonferroni correction was applied, but in the case of unequal variances, Dunnett's t test was used.

Additionally, the two intervention groups were compared using the Reliable Change Index (RCI; see Jacobson & Truax, 1991). RCI determines if a change in each reading measure and SE-rf measure over the course of the intervention (pre- vs. post-measure) for each student can be attributed to the intervention rather than chance or measurement error at a specified probability level (here $p < .05$ corresponding to value of a 1.96 standardized normal distribution). The RCI was calculated separately for each measure. The standard deviations of both intervention groups were used for computing the standard deviation used to calculate the RCI. A cut-off value was determined by counting the weighted midpoint between the means of the reference group and the intervention groups (Atkins, Bedics, McGlinchey, & Beauchaine, 2005). The RCI and cut-off values were used to classify individuals into those who did not show reliable change during the intervention period (RCI $\leq$ 1.96), those who showed reliable change (RCI > 1.96, but did not pass the cut-off criterion), and those who also passed the cut-off criterion, thus showing clear change (RCI > 1.96 + cut-off). Cross-tabulation and χ^2-test were used to scrutinize whether the intervention groups differed in the proportions of students whose scores did not change, changed reliably, or changed clearly.

Hierarchical regression analyses were used to analyze the association between changes in SE-rf during the intervention period and changes in reading performance during the intervention and follow-up periods. The dependent variables were gain scores of reading performance from pre- to post-assessment and from the pre- to follow-up assessment. The

dependent variables were analyzed separately. The control variables were entered into the analyses in the following steps: grade at Step 1; pre-intervention reading score at Step 2; and pre-intervention SE-rf score at Step 3. The independent variables were intervention status, gain score of SE-rf (pre- to post-assessment) and the interaction of intervention status and gain score. They were added to the analysis one by one in the aforementioned order in Steps 4–6. If the interaction term was statistically significant (i.e., the SE-rf gain score contributed differentially to the reading gain score in the two groups), further hierarchical regression analyses were conducted separately for the two groups to examine the contribution of the SE-rf gain score to the reading gain score in each group.

Although the main aim of the study was to compare the two intervention groups, the reading performances of the intervention groups were also compared with the reference group representing grade-appropriate development using a repeated measures MANCOVA (controlling for the effects of grade and school).

Because the data were nested under 14 schools, the nesting effect was taken into account by controlling for the school in all mean-level analyses. In hierarchical regression analyses, the nesting effect was considered by computing robust standard errors using bootstrapping.

Results

Descriptive Statistics

The partial correlations (adjusting for grade and school) between the three reading measures in the whole sample varied between .62–.70 and for the reading measures and the SE-rf-scores between .34–.40. As was expected, the intervention groups (SKILL and SE) and the peer reference group differed in all reading measures in the pre-intervention measures ($F(6, 2044) = 37.16$; $p < .001$; $\eta_p^2 = .098$; see Table 4 for the means and SDs). The pairwise tests indicated differences ($p < .001$) between the reference group and both the intervention groups

in all three measures, but no differences emerged between the two intervention groups in any of the reading measures (ALLU: $p = .929$; LUKSU: $p = .582$; TEXT: $p = .266$). As expected, main effect was detected for the grade level ($F(6, 2044) = 65.69$; $p < .001$; $\eta_p^2 = .162$). All grade levels differed from each other ($p < .001$) in all three measures of reading (the higher the grade level, the better the reading skills). Therefore, grade level was controlled for in the subsequent analyses of reading fluency.

The ANCOVAs indicated that the three groups differed in the pre-intervention SE-rf-score (Table 4). Both intervention groups differed from the reference group ($p < .001$), but no difference was detected between them ($p = .167$). A difference emerged between the grade levels ($F(2, 1024) = 8.67$; $p < .001$; $\eta_p^2 = .017$), but it was found only between Grade 3 and Grade 5 ($p < .001$; the older children having slightly better SE-rf).

Mean Development of Reading Fluency and SE-rf in the Intervention Groups

The reading fluency outcome was analyzed separately for the intervention and follow-up period with a repeated measures MANCOVA using the pre-intervention reading score, school, and grade as covariates. The analysis showed mean-level improvement in ALLU and LUKSU during the intervention period for all students receiving intervention (Table 5: Time effect; see also Figure 2), but no differences between the groups were detected. No improvement occurred in these measures during the follow-up period. In the TEXT, a differential development was detected between the groups during the follow-up period (Table 5: Time×Group effect; Figure 2). The SKILL-group slightly improved during the follow-up period, whereas the SE-group's performance slightly deteriorated. The pre-intervention reading score, school, or grade had no effect on the change in reading performance.

The repeated measures ANCOVAs (pre-intervention SE-rf score and school as covariates) indicated improvement in SE-rf during the intervention, but the groups differed in their level of improvement (Table 5). The SE-group's SE-rf improved more than the SKILL-

group's during the intervention (Figure 3). No effects were detected for school, but the pre-intervention SE-rf had an effect on the change in SE-rf (lower initial SE-rf was associated with improvement; $F(1, 72) = 27.20$; $p < .001$; $\eta_p^2 = .274$). No improvement occurred during the follow-up.

The percentage of students in each RCI class are shown in Table 6. The cross-tabulation and χ^2-test indicated that more than the expected number of participants in the SE-group (69.2%) scored above the cut-off (i.e., showed clear change) in the ALLU post-assessment, and more than the expected number of participants in the SE-group (25.6%) did so in the SE-rf post-assessment.

Association of Change in SE-rf with Change in Reading Fluency

As shown in Table 7, the partial correlations (adjusted for grade and school) between the change in SE-rf and change in the reading measures varied between -.23 and .61 in the SE-group and between -.03 and .14 in the SKILL-group. Thus, the association between the change in scores seemed to be stronger in the SE-group than in the SKILL-group.

Change in the ALLU. The hierarchical regression analysis for the ALLU indicated that the SE-rf gain score contributed to a change in the ALLU *during the intervention*, explaining 12% of the variation in the change (Table 8: Step 5). The interaction term did not quite reach statistical significance (p =.07; Step 6). However, the correlation between the changes in the SE-rf and in the ALLU during the intervention was high in the SE-group (r = .61), and no correlation was found in the SKILL-group (r = .11). This, along with the small sample size, indicates that the difference would be statistically significant in a larger sample. Therefore, additional regression analyses were conducted separately for the intervention groups. These analyses indicated that in the SKILL-group, the change in SE-rf (Table 9: Step 4) was not associated with the change in the ALLU during the intervention period, explaining only 4.7% of the variation in the change. However, in the SE-group, a positive change in SE-rf

was associated with a positive change in the ALLU, explaining an additional 36.2% of the variation during the intervention.

The second hierarchical regression analysis for the ALLU indicated that the change in the SE-rf also contributed to the change in the ALLU *from the pre- to the follow-up assessment*, explaining 13.0% of the variation in the change (Table 10: Step 5), but also, the interaction term reached statistical significance (Step 6). Therefore, regression analyses were conducted separately for the groups. These analyses indicated that in the SKILL-group, a change in SE-rf was not associated with a change in the ALLU, explaining only 0.9% of the variation (Table 9: Step 4). However, in the SE-group, a positive change in SE-rf was associated with a positive change in the ALLU, explaining an additional 33.5% of the variation.

Change in the LUKSU. The hierarchical regression analysis for the LUKSU indicated that the change in SE-rf contributed to the change in LUKSU *during the intervention*, explaining 5.2% the variation (Table 8). There was no difference between the groups. The regression analysis for the change in the LUKSU between the *pre- and follow-up assessments* indicated that the initial level of SE-rf was associated with a change in reading, explaining 6.4% of the variation (Table 10: Step 3). The better pre-intervention SE-rf was associated with improvement.

Change in TEXT. The analysis for the TEXT indicated that the change in SE-rf did not contribute to the change in TEXT *during the intervention* (Table 8Step 5). However, the intervention group was associated with the change in TEXT between the *pre- and follow-up assessments* (Table 10: Step 4), which is in accordance with the findings in the repeated measures MANCOVA, indicating slightly more change in tahe SKILL-group.

Comparison with the Reference Group

The repeated measures MANCOVAs (grade and school as covariates) were performed to see how the two intervention groups developed their reading fluency compared with their peers during the intervention and follow-up periods. During the *intervention*, improvement occurred in all reading measures among all participants ($F(1;973) = 48{,}24$; $p < .001$; $\eta_p^2 = .047$; for the reference group *Cohen's d* and 95% *CI*[lower; upper]: $d = .61[.56; .66]$; $F(1;975) = 8.24$; $p = .004$; $\eta_p^2 = .008$, $d = .46[.41; .51]$, and $F(1;894) = 33.64$; $p < .001$; $\eta_p^2 = .033$, $d = .55[.51; .58]$; respectively). (For the Cohen's *d* and *CI* for the intervention groups see Table 5). During the *follow-up*, no improvement occurred in the ALLU ($F(1;904) = .29$; ns; $\eta_p^2 = .000$, for the reference group $d = .25[.21; .29]$), but some improvement was observed in the LUKSU ($F(1;908) = 6.19$; $p = .013$; $\eta_p^2 = .007$, $d = .25[.21; .29]$) and the TEXT ($F(1;921) = 13.69$; $p = .00$; $\eta_p^2 = .015$, $d = .09[.06; .12]$). No effects were detected for the group or the school. Thus, the three groups did not differ in their reading development indicating that the intervention groups improved equally to their peers, even though their reading levels were on a markedly lower level (Figure 2).

Discussion

The main aim of the current study was to analyze whether reading fluency and self-efficacy of reading fluency (SE-rf) among elementary school children who have deficits in reading fluency are malleable via a 12-week special education program that incorporates reading fluency training and elements focusing on the four sources of SE (Bandura, 1997). The SE-rf and reading fluency intervention (SE-program) was compared with an intervention targeting solely reading fluency and had no specific elements for enhancing SE-rf (SKILL-program). We also investigated whether a change in SE-rf during the intervention was associated with a change in reading fluency and whether the associations differed between the groups.

Two findings concerning SE-rf emerged. First, a more positive change in SE-rf occurred during the intervention in the SE-group than in the SKILL-group. Second, a change in SE-rf during the intervention was positively associated with a change in fluency during the intervention among the participants in the SE-program. The main finding concerning reading was that the two intervention groups showed equal improvement. During the intervention, both groups showed improvement in the ALLU and LUKSU, whereas a differential change occurred in the TEXT during the follow-up as the SKILL-group showed some improvement, and the SE-group did not. The percentage of participants showing a *clear* change in the ALLU during the intervention period was higher among the SE-participants (69%) than the SKILL-participants (41%).

There was greater improvement in SE-rf among participants of the SE-program compared with the SKILL-program, suggesting that SE-rf can be enhanced with intervention efforts explicitly targeting sources of SE-rf in a rather short time period. However, individual variability in the responsiveness was large: 25.6% of the SE-program participants showed *clear* improvement, and 74.4% did not show reliable improvement (5.0% and 82.5% in the SKILL-group, respectively). Our design did not allow for analyzing the factors contributing to individual variability or the intervention components that were the most influential. Based on the SE-program contents, it is plausible that being able to concretely see their own and their peers' improvement and associate this with their efforts influenced the students' SE-rf. This is supported by the reports of the SE-program participants indicating that they had, for instance, received more teacher and peer feedback and had discussed their emotions and thoughts more than the participants in the SKILL-program. Because the improvement in reading was rather similar between the groups during the intervention, it seems that the mere improvement in the skill did not yield a positive change in SE-rf.

Although, the importance of "non-cognitive" factors (Farrington et al., 2012; Gutman & Schoon, 2013) and the specific impact of SE-a on learning outcomes have been recognized (Schunk, 1981), intervention studies focusing specifically on the sources of SE for a *trained* academic skill are scarce. Furthermore, to our knowledge, there are no previous studies targeting both reading fluency and the four sources of SE-rf among elementary school children. Although tentative, our findings are encouraging because they imply that intervention programs comprising components that enhance positive self-beliefs can be applied in a school setting to decrease the negative effects of educational challenges faced by children with difficulties in gaining reading fluency. However, more research is needed on the factors influencing individual variability in responsiveness and to discern the components of effective and successful support for SE-rf.

After controlling for the initial levels of SE-rf and reading, the regression analyses indicated that the change in SE-rf was associated with the change in reading fluency. This effect was clearly evident (explaining 36% of the pre–post-intervention and 34% of the pre–follow-up variance in change) among the SE-program participants in the ALLU. The effect only being found in the SE-group and ALLU-test might be because of the nature of the ALLU and SE-program. The ALLU focuses on word recognition fluency, with low demands on reading comprehension, whereas because of their format, sentence verification (LUKSU) and text reading (TEXT) may *seem like* tasks requiring comprehension although the demand for comprehension is actually very minimal. Reading sentences and text could evoke a more cautious reading strategy in struggling readers when compared with reading words without context. In the SE-program, the children were provided feedback mainly on their technical reading skills with no emphasis on comprehension, which might be related to the differences observed between the measures. This interpretation would suggest that the intervention effects on SE are skill-specific, that is, SE improves for the specific skills being targeted in the

intervention, in this case, reading fluency. However, future research should aim to understand to what extent the relationship between the changes in SE-rf and reading is causal and to what extent it is reciprocal.

The interventions were not effective in terms of helping the children close the gap to the reading level of their peers, which is in accordance with studies showing the persistence of fluency problems (de Jong & van der Leij, 2002; Landerl & Wimmer, 2008) and the small impact of fluency interventions (Flynn et al., 2012; Scammacca et al., 2015). It should be noted, however, that both groups' means showed improvement and did not fall further behind the reference group, which often occurs among children with learning difficulties (cf. Matthew-effect; Stanovich, 1986). This indicates that both interventions probably boosted the participants' fluency development. The RCIs indicated that 36–84% of the intervention participants showed reliable change, and 31–69% showed clear change in reading, advocating for more research on the individual variation in how struggling readers respond to fluency interventions and on the elements influencing responsiveness (see Cho et al., 2015).

Taking into account the findings indicating the mediational role of self-beliefs in student's achievement (Schunk, 1981; Zimmerman, 2001) and the self-teaching hypothesis (Share, 1995), we would have expected to see improvement in reading in the SE-group during the follow-up; that is, their improved SE-rf would have increased motivation toward reading and using the skill outside educational settings. The only difference between the groups was detected in the TEXT reading during follow-up, where the SE-group slightly deteriorated while the SKILL-group slightly improved.

We can only speculate on why improvement was not observed during the follow-up. First, it is plausible that the summer holiday (early June to mid-August) influenced the amount of reading practice, especially among the students struggling with fluency, thereby fading away the possible boosting effect of improved SE-rf. Similarly, the SE-rf of the SE-group remained

at the reached level and did not continue to increase. These findings imply that continuous support for both reading and SE-rf is necessary; this is supported by earlier research showing that even though positive feedback can raise SE, the change does not necessarily endure if the child subsequently performs poorly (Schunk & Mullen, 2012; Talsma, Schüz, Schwarzer, & Norris, 2018). Because the support provided for SE during the intervention exceeded the amount of support the students gained in their regular classroom setting, finding improvement during the follow-up would probably have required explicit efforts, encouraging a transfer effect from the intervention to the classroom context. Second, it is possible that the effect would have been observable in the following semester. To verify this, however, an even longer follow-up period would be needed. Third, there might be factors that affect the relationship between SE-rf and fluency. As shown by Honicke and Broadbent (2016), factors such as effort regulation and goal orientation may mediate the relationship between SE-a and performance. As Honicke and Broadbent (2016) claimed, more research is needed on the complex interactions between SE-a, performance, and other variables, especially over time.

The main limitations of the current study are related to the quasi-experimental nature of the design. Because the study was conducted in *ecologically valid conditions* as part of the school's special educational support system, fully random matching of the participants was not possible. However, the children were selected based on several reading measures, and they represent students who normally receive special educational support in Finland. Efforts were also made to balance the groups in terms of grade and reading fluency level, and these were also controlled for in the statistical analyses. We acknowledge that because of our design, the regression to the mean (RTM) may have affected the results. However, we strived to reduce the RTM by controlling for the pre-intervention levels. Second, as is common in studies conducted within schools, procedures that would allow full monitoring of the reliability and validity of the intervention provision (e.g., video recordings) could not be implemented. However, the

questionnaire for the children produced group differences that aligned with the supposed differences in the contents of the programs. Third, our study may have suffered limited statistical power, owing to the rather small sample sizes in the intervention groups. This may have resulted in inability to detect differences between the intervention groups in the development of reading and SE. Thus, further studies with larger samples and longer follow-up periods are needed.

Despite these limitations, our results on the lower SE-rf of children struggling with reading fluency compared with their peers support the importance of incorporating elements targeting self-efficacy in interventions for reading problems. As has been shown before, low confidence in one's skills has a negative impact on motivation and persistence (Zimmerman, 2001) and, consequently, on learning outcomes. Our findings indicate, however, that SE-rf is malleable via intervention targeting the sources of SE-rf among third- to fifth-grade students struggling with gaining grade-appropriate fluency in reading. More specifically, assuring mastery experiences by helping children observe and recognize their progress with explicit positive, accurate, and concrete feedback (such as graphs showing their improvement) can produce a change in SE-rf, but continuous support seems necessary for the change to endure. The teachers can help the students to concretely see their own improvement and to associate this with the effort put in practicing by providing information on number of read words or time used for practicing. Our findings also propose that receiving peer feedback and having possibilities to discuss emotions and thoughts have an effect on SE-rf suggesting that teachers should encourage discussion on emotions related to reading difficulties.

References

Aro, M. & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics 24,* 621–635.

Aro, M. (2004). *Learning to read: The effect of orthography*. Jyväskylä Studies in Education, Psychology and Social Research, 237. University of Jyväskylä.

Arslan, A. (2013). Investigation of relationship between sources of self-efficacy beliefs of secondary school students and some variables. *Educational Sciences: Theory & Practice, 13,* 1983–1993.

Atkins, D. C., Bedics, J. D., McGlinchey, J. B., & Beauchaine, T. P. (2005). Assessing clinical significance: Does it matter which method we use? *Journal of Consulting and Clinical Psychology, 73,* 982–989.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman and Company.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. C. Urdan (Eds.) *Self-efficacy Beliefs of Adolescents* (pp. 307-337). Greenwich, Conn: Information Age Publishing.

Bandura, A., Barbaranelli, C., Caprara, G.V., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development, 67,* 1206–1222.

Berends, I.E. & Reitsma, P. (2006). Remediation of fluency: Word specific or generalized training effects? *Reading and Writing, 19,* 221–234.

Breznitz, Z. & Bloch, B. (2010). Reading acceleration program (RAP) [Computer Software]. Haifa, Israel: The University of Haifa, the Edmond J. Safra Brain Research Center for the Study of Learning Disabilities.

Britner, S.L., & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching, 43,* 485–499.

Burke, H. (1985). Raven's Progressive Matrices (1938): More on norms, reliability, and validity. *Journal of Clinical Psychology, 41,* 231–235.

Butz, A.R., & Usher, E.L. (2015). Salient sources of early adolescents' self-efficacy in two domains. *Contemporary Educational Psychology, 42*, 49–61.

Carroll, J. & Fox, A. (2017). Reading self-efficacy predicts word reading but not comprehension in both girls and boys. *Frontiers in Psychology*, *7*, 2056.

Cho, E., Roberts, G.J., Capin, P., Roberts, G., Miciak, J., & Vaughn, S. (2015). Cognitive attributes, attention, and self-efficacy of adequate and inadequate responders in a fourth grade reading intervention. *Learning Disabilities Research & Practice*, *30*, 159–170.

Cohen, G.L., Garcia, J., Purdie-Vaughns, V., Apfel, N., & Brzustoski, P. (2009). Recursive processes in self-affirmation: Intervening to close the minority achievement gap. S*cience, 324*, 400–403.

Cotton, S., Kiely, P., Crewther, D., Thomson, B., Laylock, R., & Crewther, S. (2005). A normative and reliability study for the Raven's Coloured Progressive Matrices for primary school aged children from Victoria, Australia. *Personality and Individual Differences, 39,* 647–659.

de Jong, P.F., & van der Leij, A. (2002). Effects of phonological abilities and linguistic comprehension on the development of reading. *Scientific Studies of Reading*, *6*, 51–77.

Eklund, K., Salmi, P., Polet, J., & Aro, M. (2013). Tuen tarpeesta tunnistamiseen. Lukemisen ja kirjoittamisen arviointi. Toinen luokka. Tekninen opas. [A screening tool of reading and spelling for 2nd Grade. Technical manual]. Jyväskylä: Niilo Mäki Institute.

Farrington, C.A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T.S., Johnson, D.W., & Beechum, N.O. (2012). *Teaching adolescents to become learners. The role of noncognitive factors in shaping school performance: A critical literature review*. Chicago: University of Chicago Consortium on Chicago School Research.

Ferrara, S.L. (2005). Reading fluency and self-efficacy: A case study. *International Journal of Disability, Development and Education*, *52*, 215–231.

Flynn, L.J., Zheng, X., & Swanson, H.L. (2012). Instructing struggling older readers: a selective meta-analysis of intervention research. *Learning Disabilities Research & Practice*, *27*, 21–32.

Fuchs, L., Fuchs, D., Hosp, M. & Jenkins, J. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading*, *5*, 239–256.

García, J. N., & de Caso, A.M. (2006). Changes in writing self-efficacy and writing products and processes through specific training in the self-efficacy beliefs of students with learning disabilities. *Learning Disabilities: A Contemporary Journal*, *4*, 1–27.

García, J.N., & Fidalgo, R. (2008). Writing self-efficacy changes after cognitive strategy intervention in students with learning disabilities: The mediational role of gender in calibration. *The Spanish Journal of Psychology*, *11*, 414–432.

Guthrie, J. T., McRae, A., & Klauda, S. L. (2007). Contributions of Concept-Oriented Reading Instruction to knowledge about interventions for motivations in reading. *Educational Psychologist*, *42*, 237–250.

Gutman, L.M., & Schoon, I. (2013). The impact of non-cognitive skills on outcomes for young people. *London: Education Empowerment Foundations*.

Hampton, N.Z., & Mason, E. (2003). Learning disabilities, gender, sources of efficacy, self-efficacy beliefs, and academic achievement in high school students. *Journal of School Psychology*, *41*, 101–112.

Häyrinen, T., Serenius-Sirve, S., & Korkman, M. (1999). Lukilasse [Lukilasse graded achievement package for comprehensive school-age children]. *Helsinki, Finland: Psykologien Kustannus*.

Heikkilä, R., Aro, M., Närhi, V., Westerholm, J., & Ahonen, T. (2013). Does training in syllable recognition improve reading speed? A computer-based trial with poor readers from second and third grade. *Scientific Studies of Reading, 17*, 398–414.

Henk, W.A., & Melnick, S.A. (1998). Upper elementary-aged children's reported perceptions about good readers: A self-efficacy influenced update in transitional literacy contexts. *Literacy Research and Instruction, 38*, 57–80.

Honicke, T. & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review, 17*, 63–84

Hornstra, L., van der Veen, I., Peetsma, T., & Volman, M. (2013). Developments in motivation and achievement during primary school: A longitudinal study on group–specific differences. *Learning and Individual Differences, 23*, 195–204.

Huemer, S. (2009). *Training reading skills: Towards fluency*. Dissertation. University of Jyväskylä. Retrieved from https://jyx.jyu.fi/dspace/handle/123456789/20133

Jacobson, N., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59*, 12–19

Joët, G., Usher, E.L., & Bressoux, P. (2011). Sources of self-efficacy: An investigation of elementary school students in France. *Journal of Educational Psychology, 103*, 649.

Kearns, D.M., & Fuchs, D. (2013). Does cognitively focused instruction improve the academic performance of low-achieving students? *Exceptional Children, 79*, 263.

Klassen, R.M., & Lynch, S.L. (2007). Self-efficacy from the perspective of adolescents with LD and their specialist teachers. *Journal of Learning Disabilities, 40*, 494–507.

Komarraju, M., & Nadler, D. (2013). Self-efficacy and academic achievement: Why do implicit beliefs, goals, and effort regulation matter? *Learning and Individual Differences, 25*, 67–72.

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An eight-year follow-up. *Journal of Educational Psychology, 100,* 150–161.

Lazowski, R., & Hulleman, C. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational Research, 86,* 602–640.

Lee, J., & Yoon, S. (2017). The effects of repeated reading on reading fluency for students with reading disabilities: A meta-analysis. *Journal of Learning Disabilities, 50,* 213–224.

Lee, W., Lee, M.J., & Bong, M. (2014). Testing interest and self-efficacy as predictors of academic self-regulation and achievement. *Contemporary Educational Psychology, 39,* 86–99.

Lee, Y., & Jonson-Reid, M. (2016). The role of self-efficacy in reading achievement of young children in urban schools. *Child and Adolescent Social Work Journal, 33,* 79–89.

Lepola, J., Poskiparta, E., & Laakkonen, E., Niemi, P. (2005). Development of and relationship between phonological and motivational processes and naming speed in predicting word recognition in grade 1. *Scientific Studies of Reading, 9,* 367-399.

Lindeman, J. (1998). *ALLU: Ala-asteen Lukutesti* [ALLU: Reading test for elementary school]. Turku, Finland: University of Turku. Center for Learning Research.

Linnenbrink, E. & Pintrich, P. (2003). The role self-efficacy beliefs in student engagement and learning in the classroom. *Reading and Writing Quarterly, 19,* 119–137.

Marsh, H., & Craven, R. (2006). Reciprocal effects of self-concept and performance from a multidimensional perspective. Beyond seductive pleasure and unidimensional perspectives. *Perspectives on Psychological Science, 1,* 133–163.

Morgan, P., Fuchs, D., Compton, D., Cordray, D., & Fuchs, L. (2008). Does early reading failure decrease children,s reading motivation? *Journal of Learning Disabilities, 41,* 387–404.

Multon, K., Brown, S., & Lent, R. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38,* 30–38

Pajares, F., Johnson, M.J., & Usher, E.L. (2007). Sources of writing self-efficacy beliefs of elementary, middle, and high school students. *Research in the Teaching of English*, 104–120.

Pikulski, J. & Chard, D. (2005). Fluency-Bridge between decoding and reading comprehension. *The Reading Teacher, 58,* 510–519.

Raven, J., Court, J.H. & Raven, J.C. (1990). *Manual for Raven's Progressive Matrices and Vocabulary Scales – Section 2: Coloured Progressive Matrices*. Oxford: Oxford Psychologists Press.

Retelsdorf, J., Köller, O., & Möller,J. (2014). Reading achievement and reading self-concept–Testing the reciprocal effects model. *Learning and Instruction, 29,* 21–30.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychological Bulletin*, *138*, 353.

Richardson, U., & Lyytinen, H. (2014). The GraphoGame Method: The theoretical and methodological background of the technology-enhanced learning environment for learning to read. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, *10*, 39–60.

Robson, C., Blampied, N., & Walker, L. (2015). Effects of feedforward video self-modelling on reading fluency and comprehension. *Behaviour Change*, *32*, 46–58.

Salmi, P., Eklund, K., Järvisalo, E., & Aro, M. (2011). LukiMat-Oppimisen arviointi: Lukemisen ja kirjoittamisen tuen tarpeen tunnistamisen välineet 2. luokalle. [A screening tool of reading and spelling for 2nd Grade] Jyväskylä: Niilo Mäki Institute.

Scammacca, N., Roberts, G., Vaughn, S., Edmonds, M., Wexler, J., Reutebuch, C.K., & Torgesen, J.K. (2007). Interventions for adolescent struggling readers: A meta-analysis with implications for practice. *Journal of Learning Disabilities, 48,* 369–390.

Schunk, D. & Mullen, C. (2012). Self-efficacy as an engaged learner. In S. Christenson & A. Reschly, & C. Wylie (Eds.). *Handbook of Research on Student Engagement* (pp. 219–235). New York: Springer.

Schunk, D.H. (1983). Reward contingencies and the development of children's skills and self-efficacy. *Journal of Educational Psychology, 75,* 511–518

Schunk, D.H., & Rice, J.M. (1993). Strategy fading and progress feedback: Effects on self-efficacy and comprehension among students receiving remedial reading services. *The Journal of Special Education, 27,* 257–276.

Seymour, P.H., Aro, M., & Erskine, J.M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94,* 143–174.

Share, D.L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition, 55,* 151–218.

Snellings, P., van der Leij, A., de Jong, P.F., & Blok, H. (2009). Enhancing the reading fluency and comprehension of children with reading disabilities in an orthographically transparent language. *Journal of Learning Disabilities, 42,* 291–305.

Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21,* 360–407.

Stevens, E., Walker, M., & Vaughn, S. (2017). The effects of reading fluency interventions on the reading fluency and reading comprehension performance of elementary students with learning disabilities: A synthesis of the research from 2001 to 2014. *Journal of Learning Disabilities, 50,* 576–590.

Taboada, A., Tonks, S.M., Wigfield, A., & Guthrie, J.T. (2009). Effects of motivational and cognitive variables on reading comprehension. *Reading and Writing, 22,* 85.

Talsma, K., Schüz, B., Schwarzer, R., & Norris, K. (2018). I believe, therefore I achieve (and vice versa): A meta-analytic cross-lagged panel analysis of self-efficacy and academic performance. *Learning and Individual Differences, 61,* 136–150.

Toste, J.R., Capin, P., Vaughn, S., Roberts, G.J., & Kearns, D.M. (2017). Multisyllabic word-reading instruction with and without motivational beliefs training for struggling readers in the upper elementary grades. *The Elementary School Journal, 117,* 593–615.

Unrau, N., Robert Rueda, R., Son, E., Polanin, J., Lundeen, R., & Muraszewski, A. (2018). Can reading self-efficacy be modified? A meta-analysis of the impact of interventions on reading self-efficacy. *Review of Educational Research, 88,* 167–204.

Usher, E.L. & Pajares, F. (2006). Sources of academic and self-regulatory efficacy beliefs of entering middle school students. *Contemporary Educational Psychology, 31,* 125–141.

Usher, E.L. & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research, 78,* 751–796.

Usher, E.L. & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology, 34,* 89–101.

Woodcock, R.W., McGrew, K.S., & Mather, N. (2001). *Woodcock-Johnson Tests of Cognitive Abilities and Tests of Achievement (3rd Ed).* Rolling Meadows, IL: Riverside.

Yeager, D.S., & Walton, G.M. (2011). Social-psychological interventions in education: They're not magic. *Review of Educational Research, 81,* 267–301.

Yuen, M., Westwood, P., & Wong, G. (2008). Self-efficacy perceptions of Chinese primary-age students with specific learning difficulties: A perspective from Hong Kong. *International Journal of Special Education, 23,* 110–119.

Zimmerman, B.J. (2001). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, *25*, 82–91.

Zuffianò, A., Alessandri, G., Gerbino, M., Kanacri, B.P.L., Di Giunta, L., Milioni, M., & Caprara, G.V. (2013). Academic achievement: The unique contribution of self-efficacy beliefs in self-regulated learning beyond intelligence, personality traits, and self-esteem. *Learning and Individual Differences*, *23*, 158–162.

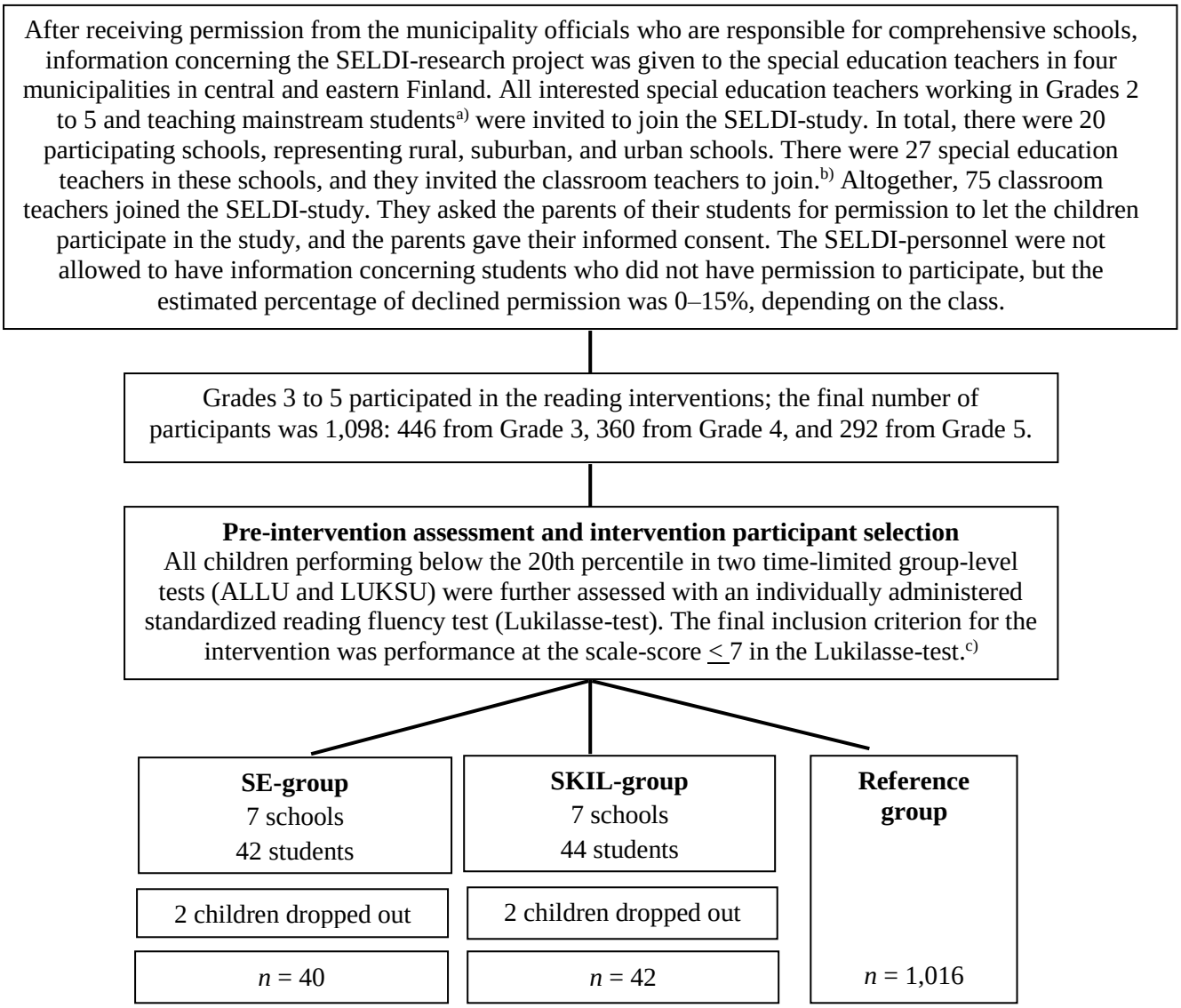

Figure 1. Flow chart demonstrating the selection procedure.

Note. [a)] In Finland, the students do not need a formal diagnosis to receive special education: any student with difficulties in learning is entitled to support with or in addition to his or her regular classroom education. However, those with intellectual or other disabilities that markedly affect learning are often studying in special education classes within their local school. These special education classes were not included in the present study. Thus, all participating students followed the standard curriculum. The research group did not set any other restrictions, and all mainstream classes willing to participate were welcomed. [b)] In Finland, each school has its own special education teacher(s) who has a master's degree and thereby the qualifications and skills to adopt new interventions and instructional methods. Special education teachers work in close collaboration with classroom teachers. Each class has its own appointed special education teacher who may be available for several classes depending of the size of the school. [c)] If the number of children meeting the inclusion criteria exceeded the number of children that could be included in the groups (this occurred in the large schools), the participating children were selected based on their score to keep the skill-level difference between the SKILL- and SE-program participants minimal. Thereby, a number of extremely poorly performing children still struggling with basic decoding accuracy and needing more support on basic decoding skills, rather than fluency, were excluded as outliers. In the same vein, in the small schools, if there were only few students meeting the inclusion criteria, they were all included in the intervention. The range in the Lukilasse-test was 1–7.

Table 1
Items in the Reading Self-Efficacy Questionnaire.

Self-Efficacy of Reading Fluency Questionnaire (Cronbach's alpha = .91; *n* =1,098)
Items related to developing better reading skill: *How certain are you that you can…* *...learn to read faster?* *...learn to read so that you make fewer mistakes?* *...learn to read so that you understand everything you read?*
Items targeting everyday reading activities requiring fluency: *How certain are you that you can…* *…read all the subtitles of a TV program easily?* *...read long texts on the Internet?* *...easily read a long book?*
Items measuring confidence in specific reading fluency tasks (8 paragraphs): *How certain you are that you can read this paragraph aloud in 30 seconds?* 1st paragraph 20 words, 2nd paragraph 32 words, 3rd paragraph 58 words, 4th paragraph 74 words, 5th paragraph 103 words, 6th paragraph 146 words, 7th paragraph 179 words, and 8th paragraph 258 words

Note. The original items were presented in Finnish.

Table 2.
Means and SDs of the Intervention Groups (SKILL, SE), Items, and Cronbach's Alpha of the Questionnaire on Student's Experiences of the Intervention.

	Group						
	SKILL *n* = 42		SE *n* = 40				
	M	*SD*	*M*	*SD*	*F*-value (df_1; df_2)	Pairwise comparisons	Cohen's *d* for pairwise comparisons
Teacher Feedback	2.21	.09	1.51	.09	29.42 (1;74)***	SKILL>SE[a)]	7.78
Peer Feedback	2.83	.11	2.03	.12	24.19 (1;74)***	SKILL>SE	6.96
Emotions/Thoughts	2.56	.11	2.08	.12	8.46 (1;74)**	SKILL>SE	4.17
General	1.91	.08	1.80	.09	.73 (1:74)		.19
Items of the Questionnaire on Student's Experiences of the Intervention							
Teacher Feedback (Cronbach's alpha = .89)							
The teacher told me how much I had improved							
The teacher compared my performance with my own earlier performance							
The teacher guided me in comparing my performance with my earlier performance							
The teacher told me that I know how to practice							
The teacher told me how much I had practiced							
The teacher showed me how much my fluency had improved in the computer game							
The teacher showed me how much my reading fluency had improved							
We followed each other's improvement in the group							
The teacher praised me for my improvement							
Peer Feedback (Cronbach's alpha =.90)							
My peers noted when I had improved in reading fluency							
My peers cheered me on to try my best							
The teacher instructed us to cheer each other on							
The teacher instructed us to notice each other's improvement							
My peers cheered me on for my improvement							
I cheered on my peers if they had improved							
My peers cheered me on for hard work							
Emotions/Thoughts (Cronbach's alpha = .62)							
We discussed the importance of practicing							
The teacher encouraged me to put in effort when I was tired or not keen on practicing							
We discussed the feelings and thoughts about failure and learning difficulties							
The teacher asked about my enthusiasm in the beginning and at the end of the session							
General (Cronbach's alpha =.51)							
Practicing in the group was nice							
The things we practiced were important							
The exercises were at the right difficulty level for me							
The teacher encouraged me to try my best							

Note. [a)] The lower score indicates more positive perceptions; ***$p \leq .001$; **$p \leq .01$

Table 3.
Intervention Structure: Computer Based Fluency Training, Weekly Group Session, and Elements of the SE-Program to Foster Self-Efficacy

	SKILL-program	SE-program
Time used	**Weekly computer-based individual fluency training**	
10–15 min three times per week	GraphomeGame [a)] or Reading Acceleration Program [b)] supervised by special education teacher, regular classroom teacher, or school assistant	GraphomeGame [a)] or Reading Acceleration Program [b)] supervised by special education teacher, regular classroom teacher, or school assistant
Time used	**Weekly group-sessions**	
5 min	Welcome and orienting	Welcome and orienting and emotion checklist
15–20 min	Reading (syllables, words, and texts)	Feedback from last week's outcome and effort
15–20 min	Game-like reading exercises	Text reading and feedback on progress
5 min	Cleaning up, filling attendance passport	Cleaning up, filling emotion checklist & attendance passport
	Sources of self-efficacy provided during the weekly group sessions	
Mastery experience	• Reachable challenges with exercises adapting to each child's skills.	• Reachable challenges with exercises adapting to each child's skills. • Individual concrete visual feedback provided by the computer programs and on time used for practicing and read items (i.e., reading speed development and a proportional number of mistakes). • Individual concrete visual feedback on improvement in text reading (i.e., graphs indicating reading speed development). • Individual concrete feedback on working habits and effort during and after each group session and weekly individual computer-based sessions (e.g., graphs on time used for practice, discussions).
Vicarious experience	• Exercises in peer group with a similar skill level.	• Exercises in peer group with a similar skill level • Mastery models observing peers and focusing on good performance and improvement of peers.
Verbal persuasion		• Systematic feedback on development and effort verbalized by teacher. • Directing child's attention to his or her own improvement and recognizing it.
Affective reactions		• Naming of affective state, discussions on emotions concerning learning, and self-ratings of willingness to practice. • Mistakes and setbacks accepted and allowed in a positive atmosphere. • Filling the emotional checklist in the beginning and at the end of the session.

Note. [a)] GraphomeGame is the registered trademark of the Niilo Mäki Foundation and the University of Jyväskylä for a non-commercial computerized learning game; see Richardson and Lyytinen (2014). The reaction time and the number of correct answers were recorded by the program. [b)] The Reading Acceleration Program was developed Breznitz and Bloch (2010).

Table 4.
Demographic information and Means and SDs of the Groups (SKILL, SE, and Reference) in the Raven Progressive Matrices, Lukilasse and in the Pre-, Post, and Follow-up Assessments of Reading Fluency (ALLU, LUKSU, TEXT) and Self-Efficacy (SE-rf) and Differences between the Groups in Pre-Intervention Assessment.

	Group					
	SKILL (n)		SE (n)		Reference (n)	
Total [a)]	42		40		1016	
Girls/Boys	15/27		12/28		487/527[b)]	
Grade 3/4/5	15/14/13		14/10/16		417/336/263	
	M	*SD*	*M*	*SD*	*M*	*SD*
RCPM	29.05	4.63	29.64	4.75	30.70	3.90
Lukilasse (standard score)	3.90	1.83	4.61	1.76	-	-

	SKILL % (n)	SE % (n)
Mother's education [c)]		
Comprehensive school	7.9 (3)	11.1 (3)
High school /Vocational school	57.9 (22)	48.1 (12)
College/Polytechnic/ Bachelor	34.2 (13)	40.7 (11)
Master degree	0 (0)	3.7 (1)
Finnish spoken as the main language at home [c)]	92.3 (36)	88.9 (24)
The child has diagnoses (e.g., asthma, migraine, SLI) [c)]	2.6 (1)	11.1 (3)

	Group								Cohen's *d* for pairwise comparisons		
	SKILL		SE		Reference						
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*-value (df_1; df_2)	Pairwise comparisons	SKILL vs SE	SKILL vs REF	SE vs REF
ALLU											
Pre	53.64	21.16	61.36	21.95	99.13	38.60	77.26 (2;1023)***	SKILL,SE<ref.	.35	1.46	1.20
Post	75.13	26.12	84.20	27.51	123.06	39.84					
Follow-up	82.07	25.51	91.56	32.15	132.76	40.60					
LUKSU											
Pre	19.24	5.18	21.95	6.24	32.70	10.29	83.11(2;1023)***	SKILL,SE<ref.	.47	1.26	1.65
Post	23.98	7.59	27.13	8.32	37.72	11.36					

Follow-up	26.32	6.75	27.62	6.64	40.48	11.29					
TEXT											
Pre	46.63	12.66	54.39	15.21	81.51	21.48	107.24(2;1023)***	SKILL,SE<ref.	.55	1.98	1.46
Post	57.13	17.51	64.33	18.92	94.16	23.04					
Follow-up	61.23	17.82	64.72	18.77	96.34	22.25					
SE-rf											
Pre	4.75	1.07	5.11	.84	5.52	.82	22.11(2;1024)***	SKILL, SE<ref.	.37	.81	.49
Post	4.87	.92	5.46	.76	5.61	.79					
Follow-up	5.10	.80	5.39	.67	5.71	.75					

Note. Lukilasse = Reading subtest of the Test battery for screening reading, spelling, and arithmetic (Häyrinen, Serenius-Sirve, & Korkman, 1999), RCPM = Raven's Colored Progressive Matrices (Raven, Court, & Raven, 1990), ALLU = Word chain test (Lindeman, 1998), LUKSU = Sentence verification test (Salmi, Eklund, Järvisalo, & Aro, 2011), TEXT = Text reading task (Salmi et al., 2011), SE-rf = Self-efficacy of Reading Fluency. [a)] Due to missing data (absence from school during the assessment) number of children varied: final range of *n* in the SKILL group 41-42, in the SE-group 38-39, and in the reference group 948 949. [b)] Two children had missing data on gender. [c)]38-39 participants of the SKILL and 26-27 of the SE-group had data on mother's education, home language, and child diagnoses. Raw scores were used on all the measures except for the Lukilasse. ***$p \leq .001$.

Table 5.
Repeated Measures MANCOVA (Pre-, Post, and Follow-up Assessments) for the Intervention Groups (SKILL and SE).

		Time×Group effect		Time effect		Group effect		*Cohen's d 95% CI [lower; upper]*	
Measure		*F*-value	(df_1, df_2)	*F*-value	(df_1, df_2)	*F*-value	(df_1, df_2)	*SKILL*	*SE*
ALLU	pre-post	.16	(1; 69)	6.13*	(1; 69)	.16	(1; 69)	.89 [.54; 1.23]	.86 [.59; 1.13]
	post-follow	.41	(1; 67)	.37	(1; 67)	1.72	(1; 67)	.20 [.04; .46]	.30 [.07; .53]
LUKSU	pre-post	1.34	(1; 69)	6.51*	(1; 69)	.00	(1; 69)	.76 [.42; 1.09]	.68 [.38; .97]
	post-follow	.13	(1; 67)	.62	(1; 67)	.09	(1; 67)	.31 [.07; .54]	.11 [-.18; .39]
TEXT	pre-post	.85	(1; 72)	.01	(1; 72)	2.58	(1; 72)	.69 [.45; .92]	.56 [.33; .78]
	post-follow	5.08*	(1; 67)	.37	(1; 67)	4.24*	(1; 67)	.26 [.04; .46]	-.01 [-.27; .08]
SE-rf	pre-post	5.75*	(1; 72)	34.69***	(1; 72)	5.75*	(1; 72)	.01 [.54; 1.23]	.45 [.11; .77]
	post-follow	.51	(1; 72)	.71	(1; 72)	.06	(1; 72)	.20 [.12; .51]	-.05 [-.28; .18]

Note. ALLU = Word chain test (Lindeman, 1998), LUKSU = Sentence verification test (Salmi, Eklund, Järvisalo, & Aro, 2011), TEXT = Text reading task (Salmi et al., 2011), SE-rf = Self-efficacy of Reading Fluency. *** $p \leq .001$; *$p \leq .05$.

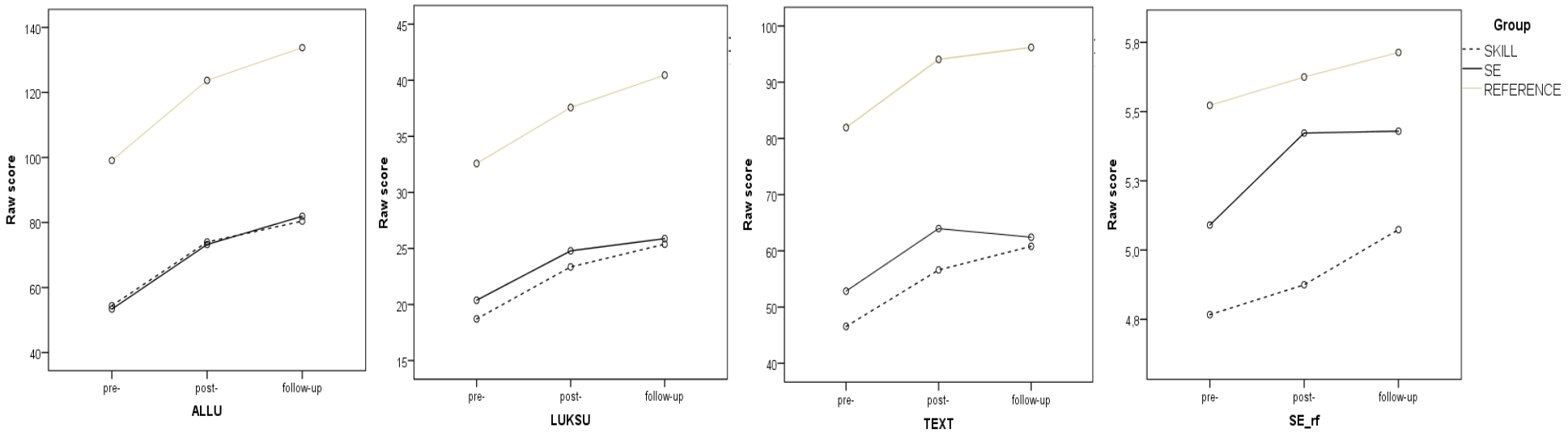

Figure 2.
Development of the Three Groups (SKILL, SE, Reference) in ALLU, LUKSU, and TEXT Reading Tests' Raw Scores (Controlling for Grade Level and School) and in Self-Efficacy Scale Raw Score (Controlling for School) During Intervention and Follow-Up Periods.

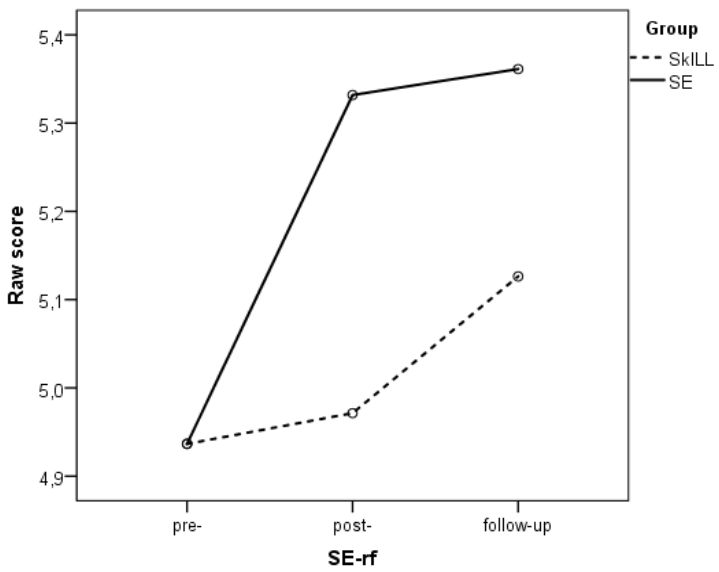

Figure 3.
Change in Self-Efficacy in the SKILL and SE Groups during Intervention and Follow-Up Periods (Controlling for Pre-assessment Score and School).

Table 6.
Percentages of Participants in the Intervention Group Demonstrating no Change (RCI[a)] ≤ 1.96), Reliable Change (RCI > 1.96) and Clear Change (> cut-off) During the Intervention (pre vs. post).

	Intervention group							
	SKILL %			SE %				
RCI	No change ≤1.96	Reliable change >1.96	Clear change >1.96 + cut-off	No change ≤1.96	Reliable change >1.96	Clear change >1.96 + cut-off	$\chi^2(2)$	Adjusted standardized residual (AdjR)
ALLU	41.0	17.9	41.0	15.4	15.4	69.2[b)]	7.44*	2.5
LUKSU	28.6	22.9	48.6	31.0	10.3	58.6	1.78 [ns]	-
TEXT	54.8	11.9	33.3	64.1	5.1	30.8	1.41 [ns]	-
SE-rf	82.5	12.5 [b)]	5.0	74.4	0.0	25.6[b)]	10.58**	2.3/2.5

Note. ** $p \leq .01$; * $p \leq .05$; [ns] = not statistically significant
[a)] Reliable Change Index (RCI; Jacobson & Truax, 1991). [b)] More children than expected in the cell (AdjR > 1.96).

Table 7.
Partial Correlations (Adjusting for Grade and School) between the Changes in the SE-rf and the Three Reading Measures in the SE- and SKILL-groups (Below and Above the Diagonal, Respectively).

	Change in SE-rf	Change in ALLU		Change in LUKSU		Change in TEXT	
	Pre-post	Pre-post	Pre-Foll.	Pre-post	Pre-Foll.	Pre-post	Pre-Foll.
Change in SE-rf	-	.11	-.01	.14	.06	-.03	.07
Change in ALLU							
Pre-post.	.61***	-	.67***	.18	04	.12	.30
Follow-up	.59***	.42*	-	.22	.21	.46*	.32
Change in LUKSU							
Pre-post.	.08	-.13	.20	-	.58***	.02	.30
Follow-up	-.23	-.02	-.17	.21	-	.12	.08
Change in TEXT							
Pre-post.	.07	.19	-.06	-.04	.05	-	.36*
Follow-up	-.02	-.20	-.01	.34	.15	.53**	-

Note. ***$p \leq .001$; *$p \leq .05$

Table 8.
Hierarchical Regression Models[a)] for Change in ALLU, LUKSU, and TEXT during the Intervention Period (pre to post).

	Change pre to post											
	ALLU				LUKSU				TEXT			
	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$
Step 1:												
Grade	.043	.003	.003	.25 (1;72)	-.154	.015	.015	1.08 (1;72)	.030	.009	.009	.63 (1;73)
Step 2:												
Reading pre	-.276	.024	.021	1.53 (1;71)	-.066	.027	.013	.91 (1;71)	.031	.019	.011	.78 (1;72)
Step 3:												
SE-rf pre	.274	.026	.001	.10 (1;70)	.433*	.071	.044	3.29 (1;70)	.280	.036	.017	1.22 (1;71)
Step 4:												
Group	-.081	.026	.000	.02 (1;69)	-.108	.074	.003	.19 (1;69)	-.102	.038	.002	.17 (1;70)
Step 5:												
Change in SE-rf	.224	.148	.122	9.75 (1;68)**	.292	.125	.052	4.03 (1;68)*	.171	.074	.036	2.66 (1;69)
Step 6:												
Group×change in SE-rf	.281*	.187	.039	3.24 (1;67)	-.007	.125	.000	.00 (1;67)	.082	.077	.003	.25 (1;68)

Note. **$p \leq .01$; *$p \leq .05$. [a)] Robust standard errors of the estimates computed using Bootstrapping method.

Table 9.
Hierarchical Regression Models[a)] for the Change in ALLU during Intervention and during Intervention and Follow-Up Period Separately for the SKILL- and SE-Groups.

	Change in ALLU pre to post								Change in ALLU pre to follow-up							
	SKILL				SE				SKILL				SE			
	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$
Step 1: Grade	.178	.001	.001	.025 (1;357)	-.323	.039	.039	.34 (1;33)	.107	.004	.004	.16 (1;36)	-.164	.011	.011	.35 (1;32)
Step 2: ALLU pre	-.471*	.062	.062	2.36 (1;36)	.075	.046	.007	.26 (1;32)	.167	.009	.004	.16 (1;35)	-.001	.011	.000	.00 (1;31)
Step 3: SE-rf pre	.439*	.117	.055	2.17 (1;35)	.183	.094	.049	.66 (1;31)	.238	.031	.022	.78 (1;34)	.249	.042	.031	.96 (1;30)
Step 4: Change in SE-rf	.266	.164	.047	1.93 (1;34)	.728***	.457	.362	20.01 (1;30)***	.116	.040	.009	31 (1;33)	.718*	.377	.335	15.61 (1;29)***

Note. ***$p \leq .001$; *$p \leq .05$. [a)] Robust standard errors of the estimates computed using Bootstrapping method.

Table 10.
Hierarchical Regression Models[a)] for Change in ALLU, LUKSU, and TEXT during Intervention and Follow-Up Period.

	Change pre- to follow-up											
	ALLU				LUKSU				TEXT			
	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$	β	R^2	ΔR^2	$F(df_1;df_2)$
Step 1:												
Grade	-.006	.001	.001	.04 (1;70)	-.002	.038	.038	2.83 (1;71)	.002	.003	.000	.22 (1;68)
Step 2:												
Reading pre	-.123	.002	.002	.11 (1;69)	-.369*	.064	.026	1.92 (1;70)	.093	.008	.004	.57 (1;67)
Step 3:												
SE-rf pre	.230	.002	.000	.01 (1;68)	.359*	.128	.064	5.04 (1;69)*	.306	.039	.018	2.70 (1;66)
Step 4:												
Group	-.029	-.054	.003	.22 (1;67)	-.130	.139	.011	.87 (1;68)	-.416	.085	.103	6.35 (1;65)*
Step 5:												
Change in SE-rf	.122	.070	.130	9.93 (1;66)**	.129	.146	.007	.55 (1;67)	.304	.044	.051	3.44 (1;64)
Step 6:												
Group×change in SE-rf	.453**	.170	.105	8.97 (1;65)**	-.033	.146	.001	.04 (1;66)	-.040	.002	.001	.19 (1;63)

Note. **$p \leq .01$; *$p \leq .05$. [a)] Robust standard errors of the estimates computed using Bootstrapping method.