JYU DISSERTATIONS 397

Pilvi Peura

Children's Reading Self-Efficacy

Specificity, Trajectories of Change and Relation to Reading Fluency Development

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ABSTRACT

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Beliefs about our capabilities (i.e., self-efficacy) are important predictors of our learning and achievement. This research aimed to extend our understanding of primary school children's self-efficacy in the relatively unexamined context of reading fluency. It focused on examining the specificity of these beliefs and the ways in which they contribute to children's reading development. In addition, it was examined how these beliefs develop over an 11-month study period. More specifically, the roles of the four hypothesised sources of self-efficacy (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states) in predicting changes in self-efficacy were examined. These questions were assessed in three sub-studies using data on Finnish primary school children in Grades 2 to 5 (N = 1,327). First, the results showed that the children's efficacy beliefs varied according to three specificity levels (general, intermediate, and specific), and the structure of self-efficacy was similar among girls and boys as well as across grades. Second, self-efficacy was found to relate positively to reading fluency and its development. However, the relationship varied according to the specificity level of self-efficacy. The intermediate beliefs, which reflected beliefs in everyday reading tasks, bore the strongest relationship to reading fluency and were the only beliefs related to reading fluency development. Third, the children were found to differ in their self-efficacy development, showing increasing, stable, and decreasing trajectories of change over time. Moreover, the children's varying exposure to the four sources of self-efficacy and changes in these experiences over time were found to be associated with the trajectories children's self-efficacy follow. Overall, the findings extend the understanding of the specificity of children's beliefs related to reading and their varying contribution to reading fluency development. By revealing the positive longitudinal dynamics between self-efficacy and its sources, the results also provide support for the theoretical postulations of social cognitive theory as well as highlight the importance of supporting positive source experiences. Furthermore, the findings point to the importance of considering individual variability in self-efficacy development, in the contexts of both research and educational planning and support. Especially those children with low beliefs in their reading skills should be monitored and supported.

Keywords: self-efficacy, sources of self-efficacy, reading fluency, primary school children

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Peura, Pilvi
Lasten pystyvyysuskomukset lukemisessa: uskomusten spesifisyys, kehityskulut ja yhteys lukusujuvuuden kehitykseen
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Uskomusten, joita meillä on omista kyvyistämme (minäpystyvyys), tiedetään vaikuttavan oppimiseemme ja suoriutumiseemme. Tämän tutkimuksen tarkoituksena oli laajentaa ymmärrystä uskomuksista, joita alakouluikäisillä on omista kyvyistään lukemisessa. Tutkimus selvitti näiden uskomusten spesifisyyttä sekä sitä, miten uskomukset vaikuttavat lukusujuvuuden kehitykseen. Lisäksi tavoitteena oli selvittää, miten pystyvyysuskomukset kehittyvät noin vuoden pituisen seurantajakson aikana. Tarkemmin tutkittiin sitä, miten minäpystyvyyden lähteet (eli onnistumisen ja hallinnan kokemukset, kannustus ja palaute, vertaiskokemukset sekä tunnekokemukset) vaikuttavat minäpystyvyyden kehitykseen. Näihin tavoitteisiin vastattiin kolmessa osatutkimuksessa, joihin osallistui 1327 lasta 2.–5.luokilta. Tulokset osoittivat, että jo alakouluikäisten lasten pystyvyysuskomukset eroavat uskomusten spesifisyyden mukaan (yleiset, keskitason ja spesifit uskomukset). Lisäksi tulokset osoittivat, että pystyvyysuskomukset lukemisessa ovat yhteydessä lukemisen sujuvuuteen. Tämä yhteys kuitenkin vaihteli sen mukaan, millaisista uskomuksista oli kyse. Ainoastaan uskomukset, jotka liittyivät taidon hallintaan arkielämässä (keskitaso), olivat yhteydessä lukemissujuvuuden kehitykseen. Lasten pystyvyysuskomukset kehittyivät noin vuoden seurantajakson aikana eri tavoin ja erotettavissa oli nousevia, laskevia ja melko pysyviä kehityskulkuja. Lisäksi lasten vaihtelevat kokemukset minäpystyvyyden lähteistä olivat yhteydessä näihin erilaisiin kehityskulkuihin. Tutkimuksen tulokset lisäävät ymmärrystä lukemiseen liittyvien uskomusten spesifisyydestä sekä niiden erilaisesta roolista lukusujuvuuden kehityksessä jo alakouluiässä laajentaen näin aiempaa tutkimuskirjallisuutta. Osoittamalla pystyvyysuskomusten ja niiden lähteiden väliset positiiviset pitkittäisvaikutukset tutkimuksen tulokset vahvistavat sosiaalisen oppimisen teorian teoreettisia oletuksia. Näin tulokset vahvistavat ajatusta siitä, että tällaisia myönteisiä oppimistilanteissa saatuja kokemuksia on syytä tukea. Lisäksi tulokset osoittivat, että pystyvyysuskomusten kehityksessä on yksilöllistä vaihtelua. Sekä niin tutkimuksessa kuin oppimisen tukitoimia suunnitellessakin olisikin tärkeää ottaa huomioon lasten yksilölliset kehityspolut. Erityisesti niitä lapsia, joilla on heikko usko omiin kykyihinsä lukemisessa, tulisi seurata ja tukea.

Asiasanat: minäpystyvyys, minäpystyvyyden lähteet, lukemisen sujuvuus, alakoulu

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Jyväskylä, May 2021
Pilvi Peura

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications, which are referred to in the text as Study I, Study II, or Study III.

Study I Peura, P. I., Viholainen, H. J., Aro, T. I., Räikkönen, E. M., Usher, E. L., Sorvo, R. M., Klassen, R. M., & Aro, M. T. (2019). Specificity of reading self-efficacy among primary school children. *The Journal of Experimental Education, 87*(3), 496–516. https://doi.org/10.1080/00220973.2018.1527279

Study II Peura, P., Aro, T., Viholainen, H., Räikkönen, E., Usher, E. L., Sorvo, R., & Aro, M. (2019). Reading self-efficacy and reading fluency development among primary school children: Does specificity of self-efficacy matter? *Learning and Individual Differences, 73*, 67–78. https://doi.org/10.1016/j.lindif.2019.05.007

Study III Peura, P., Aro, T., Räikkönen, E., Viholainen, H., Koponen, T., Usher, E. L., & Aro, M. (2021). Trajectories of change in reading self-efficacy: A longitudinal analysis of self-efficacy and its sources. *Contemporary Educational Psychology, 64*. https://doi.org/10.1016/j.cedpsych.2021.101947

The author of this thesis is the first author of all three articles. She was responsible for drafting the study framework and conducting the literature review as well as the analyses and writing of the three manuscripts. She also actively participated in planning the study design and coordination for the data collection in the *Self-efficacy and learning disability interventions* project.

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ORIGINAL ARTICLES

1 INTRODUCTION

Reading skills are essential for everyday life in modern literate societies. In addition, fluent reading skills are a necessary prerequisite for understanding and making meaning of text, and therefore, for learning. Acquiring fluent reading skills, which refers to automaticity of the reading process (LaBerge & Samuels, 1974), is thus one of the key challenges a child faces during primary school. Difficulties in acquiring this skill or slow development in reading skills may have long-term effects with regard to shaping educational attainment and psychosocial wellbeing in later life (Aro et al., 2019; Eloranta et al., 2019). Moreover, children's reading skills and their engagement with reading activities have been declining in recent years; the same is also true in Finland (see Ahonen (2021) for the results of the Programme for International Student Assessment (PISA)). For these reasons, continual studies related to enhancing our understanding of the factors that contribute to children's reading development are essential. Much is already known about the cognitive factors supporting reading development (e.g., Lyytinen et al., 2004). Moreover, non-cognitive factors, such as motivation, seem to relate to reading achievement (e.g., Toste et al., 2020). One such important contributor might be children's beliefs about their capabilities, namely *self-efficacy*. Self-efficacy, as introduced in social cognitive theory (Bandura, 1997), has been found to affect learning in various positive ways. Students with high self-efficacy expend more effort and are more persistent than those with lower self-efficacy (e.g., Galla et al., 2014; Schnell et al., 2015). They are also more engaged (e.g., Schüller et al., 2017; Wigfield & Guthrie, 1997; Zhen et al., 2020) and set higher goals for learning (e.g., Schnell et al., 2015). Although the role of self-efficacy is also recognised in reading (e.g., Guthrie et al., 2007; Smith et al., 2012), our understanding about whether these beliefs contribute particularly to reading fluency and its development is limited. The importance of supporting learners' positive self-beliefs is increasingly recognised in practice as well. For example, Finland's national core curriculum (Finnish National Agency for Education, 2016) corroborates the idea of supporting positive self-beliefs together with skill development. Our comprehension of the formation

processes of such beliefs is, however, still limited to allow us to develop effective support practices.

This thesis aimed to refine our understanding of the longitudinal dynamics between primary school children's reading self-efficacy and the development of fluent reading skills as well as the formation of these beliefs pertaining to reading. Thus, this thesis aimed to gain new insights in relation to the theoretical perspectives of social cognitive theory (Bandura, 1997) as well as its practical applications towards supporting children's reading skills. First, efficacy beliefs are hypothesised to vary between different specificity levels and contribute differently to students' learning and achievement (Bandura, 1997). By examining whether these different specificity levels may be already identified among primary school children, this study aimed to increase understanding of children's efficacy beliefs in reading. Further, by examining the associations between different specificity levels in reading self-efficacy and reading fluency development, new insights into the role of self-efficacy in reading fluency development can be gained. Second, self-efficacy beliefs are regarded as malleable beliefs shaped through learning experiences and the interpretations of those experiences. In particular, four key experiences are considered to be the *sources of self-efficacy*: mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states (Bandura, 1997). Although these sources have been extensively studied (e.g., Byars-Winston et al., 2017; Sheu et al., 2018; Usher & Pajares, 2008), less is known of how they shape reading self-efficacy (for exceptions, see Butz and Usher (2015), Guthrie et al. (2007), and Henk and Melnick (1998)). By examining these sources in reading and their dynamic association with self-efficacy over time, this thesis aimed to enhance our understanding of the formation of reading self-efficacy. Moreover, to reveal the possible individual variations in this formation, both the variable and the person-centred approaches were used to explore changes in children's self-efficacy. This knowledge could help in the identification of children who may be more likely to lose their confidence over time and may need more targeted support in their learning paths.

1.1 Social cognitive theory

Social cognitive theory, proposed by Bandura (1986, 1997), is a theory of learning and human functioning. It integrates both the social and cognitive aspects of learning for human functioning. The first development of the theory dates back to the 1960s or 1970s, when it was referred to as a social learning theory (Bandura, 1977; Rotter, 1954). Observational learning and learning from models were central aspects in the early developments of the theory, thus widening the perspectives of behaviourism and explaining learning mainly as an activity directed by reinforcements or rewards. Bandura's (1961) Bobo doll study challenged the prevailing views claiming that direct rewards or punishments are essential for learning. Rather, as per social cognitive theory, learning is

considered to happen by observing others and interpreting those observations as well, not just by performing or doing the task itself. The role of personal influences, and especially the role of self-efficacy in human functioning, became more important in later developments of the theory (Bandura, 1986, 1997). Central to social cognitive theory is the idea of dynamic interactions during learning; personal, behavioural, and environmental processes are assumed to affect each other in triadic reciprocity (Figure 1). Learners do not simply react to environmental inputs; rather, they proactively interact in reciprocal functional dependencies with their social environments. Bandura called these *agentic transactions*, referring to learner's active role and exercise of control over what they do. Learning is considered to occur between the person and the environment and within this interaction, that is, in the social and cognitive learning environments.

In social cognitive theory, the sense of *agency* is considered to be a pivotal force directing human functioning. According to Bandura (1997, p. 3), the key personal agentic process is *self-efficacy*, which is defined as

> …beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments.

Hence, self-efficacy refers to our beliefs of what we can or cannot do. Self-efficacy is perceived as an essential force influencing our actions through inner (e.g., by affecting thoughts or affects) and outer (e.g., by changing behaviours) processes. Efficacy beliefs affect how we perceive and interpret our observations as well as direct our efforts, persistence, and goals towards learning. In social cognitive theory, our behaviours and actions are considered to be based to a greater extent on what we believe we can do rather than on our actual abilities and skills.

Efficacy beliefs function and change through previously presented reciprocal interactions. For example, when a student believes in their capabilities, they are more likely to engage in activities and put forth more effort, which in turn will affect what kind of feedback they will be exposed to. Similarly, the persuasions they will garner will affect their perceptions of their capabilities, which will either motivate or demotivate them to proceed with their learning tasks. Efficacy beliefs can thus either promote or inhibit learning. It has been theorised (Bandura, 1997, p.6) that the interactions between personal, behavioural, and environmental processes, which function in triadic reciprocity, are causal and that

> …it takes time for causal factor to exert its influence.

However, empirical evidence on whether and how the personal, behavioural, and environmental processes are related over time is scant, especially in children. Better understanding of these developmental processes is important, as the foundation for future self-efficacy may be created in the early school years and can thus have a long-term influence on one's future achievements (Bandura et al., 2001).

Social cognitive theory has been applied widely in different fields, such as education, sports, health, and career studies (e.g., Bandura, 1998; Lent & Brown, 2013; Moritz et al., 2000; Schunk & DiBenedetto, 2020). The functional role of self-efficacy in learning has been studied in the context of schools too, although to a lesser extent in the early primary school years. This study aimed to refine and extend our knowledge of the longitudinal interactions between personal, behavioural, and environmental processes, as postulated in social cognitive theory, among primary school children. The following sections offer a more detailed outline of the key concepts and processes of social cognitive theory as well as the empirical findings in the context of reading.

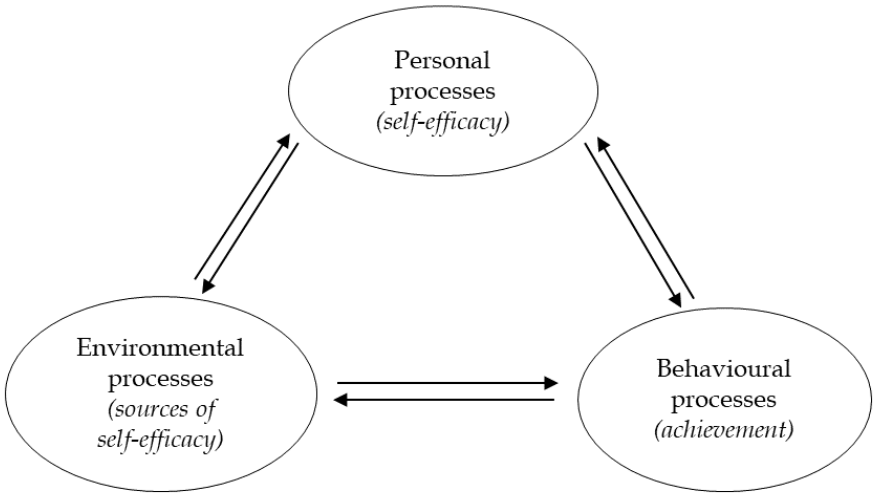

FIGURE 1 Triadic reciprocal interactions between personal, behavioural, and environmental influences according to Bandura (1986, 1997). The processes examined in the present study appear in brackets.

1.2 Self-efficacy

1.2.1 Self-efficacy and overlapping academic self-constructs

In an academic context, self-efficacy is defined as the beliefs people hold about their perceived capabilities to perform given academic tasks at designated levels or execute certain actions or tasks (Schunk, 1991). When students evaluate their self-efficacy, they can be thought to answer the question "Can I do this?" or "Am I capable of doing this?" Other achievement-related *self*-focused constructs that populate the motivation literature are "*academic self-concept*" (Marsh, 1989), "*perceived competence*" (Harter, 1982), "*self-concept of ability*" (Eccles, 2005; Nurmi & Aunola, 2005), "*expectations for success*" (Eccles, 2005; Eccles & Wigfield, 1995), "*competence beliefs*" (Eccles et al., 1983; Wigfield et al., 1997), and "*outcome*

expectations" (Bandura, 1986). All these constructs relate to learners' perceptions or beliefs about their abilities or capabilities and share the basic idea about the functional roles of these perceptions. Children who feel competent and capable, and expect to do well, are more likely to perform better than children who doubt their capabilities (Bandura, 1997; Eccles & Wigfield, 1995; Marsh & Yeung, 1997). Similarly, these perceptions and beliefs are theorized to develop through influences from social and cognitive environments of the learner (Bandura, 1997; Eccles & Wigfield, 2020). Despite the similarities, these concepts are situated in different achievement motivation theories and are slightly different from self-efficacy as introduced in social cognitive theory (Bandura, 1997). These related constructs are briefly outlined below.

Academic self-concept (SC) is defined as one's perceived competence in Marsh's internal/external frame of reference model (Harter, 1982; Marsh, 1989). Previously, also the term "perceived competence" (Harter, 1982) was used. When students evaluate their self-concept, they are thought to answer the question "Am I good in…?" Self-concept is thus considered to represent the general view of one's ability. Self-concept has been studied in reference to academic performance in general or with regard to different domains, such as mathematics or reading self-concept. In expectancy-value theory (Eccles, 2005; Wigfield & Eccles, 2000), the term "self-concept of ability" (SCA) is used to refer to an individual's perception of their current competence in a domain (also referred to as competence beliefs) in a manner somewhat similar to Marsh's (1989) academic self-concept. The term "expectancies for success," which refers to expectations about how well one will do on upcoming tasks, is also introduced in the expectancy-value theory. Expectations for success comes close to the conceptualisation of self-efficacy. Empirically, SCA and expectancies for success are not found to be distinct (Eccles & Wigfield, 1995) and were later treated as a single construct. Recently, expectancy value theorists (Eccles & Wigfield, 2020) have discussed the possibility that more nuanced measures could capture the possible differences between SCA and expectancies better and suggest treating them separately. Conceptually close to the expectations for success come "outcome expectations" (Bandura, 1986), which refer to beliefs about the consequences or outcomes of one's actions (i.e., a certain behaviour will lead to certain outcome). This term has also been used in social cognitive theory; however, empirical research on outcome expectations is scarce.

Based on the original conceptualisations, the main distinctions between the above self-constructs and self-efficacy are as follows: 1) Self-efficacy evaluations are assumed to focus on one's future potential to perform in a specific context, not on one's past performance (such as in SC and SCA). 2) Self-efficacy evaluations are assumed to be based on one's self-referenced evaluations rather than relative ability comparisons with the performances of others (such as in SC and SCA). 3) Self-efficacy evaluations are assumed to change (rather than remain stable) due to the contextual nature of efficacy beliefs. 4) Self-efficacy evaluations are assumed to vary between different tasks, not only between domains (see e.g., Bong and Skaalvik (2003), and Muenks et al. (2018)). Efficacy beliefs are considered to be beliefs of the potential to perform or develop a skill in the future,

that is, *capability* beliefs, whereas SC and SCA are considered as perceptions of current or past competence, that is, *ability* beliefs (Usher, 2015). However, people evaluate their capabilities based on their accomplishments (i.e., abilities); thus, these concepts are closely related. Similarly, expectancy-value theory is recently introduced as situated expectancy value theory (Eccles & Wigfield, 2020), in which the focus comes to the situated beliefs and thus close to the social cognitive perspectives of social cognitive theory (Bandura, 1997). The differences between self-constructs at the functional level in learning is still an area of discussion and debate (Hattie et al., 2020; Marsh et al., 2019; Wigfield & Koenka, 2020). What somewhat complicates integrating and contrasting the findings from different theoretical frameworks to that of self-efficacy, is that the operationalisation of self-efficacy has largely varied from and partly overlapped with other constructs, as discussed in the next section. Thus, despite the theoretical and definitional distinctions between self-efficacy and related constructs, they are not as clearly distinct in practice. The aim of this study, however, is not to compare these constructs, but to focus on self-efficacy as conceptualised in social cognitive theory (Bandura, 1986, 1997).

1.2.2 Specificity of self-efficacy

By definition, self-efficacy is context-specific, and thus, people are considered to hold multiple beliefs of their capabilities, which can vary (Bandura, 1997). In a learning context, this means that students hold a belief about their general academic capabilities, for example whether they believe they are capable of meeting the academic demands of school. In addition, they hold beliefs about their capabilities, which can vary not only across different skill areas (such as math or reading) (Bong, 1997), but also within a skill, namely between different sub-skills (Bruning et al., 2013; Shell et al., 1995). For instance, students may judge themselves as highly capable in sports but lack a similar self-efficacy in arts. In addition to the context-specificity of efficacy beliefs, self-efficacy is assumed to vary in *level* (i.e., the level of the task demand), *strength* (weak or strong), and *specificity* (generality) (Bandura, 1997, p. 42). Variation with respect to the level of task demands means that a student can believe in their capabilities in easy math tasks but may feel less capable when confronted with difficult math tasks. The strength of self-efficacy refers to how weak or strong the belief in one's capabilities is. In assessing self-efficacy, this dimension has been considered by asking students to rate the strength of their perceived efficacy, for example with a 0 to 100 point scale ranging from "Cannot do" to "Highly certain can do." Finally, specificity of self-efficacy refers to the generality of self-efficacy assessments: one can have high self-efficacy across different contexts and tasks or only in certain contexts or tasks. This research focuses on the specificity of self-efficacy, as little is known about it, especially in children.

According to Bandura (1997), efficacy beliefs differ across three levels of specificity: general, intermediate, and specific level beliefs. The *general level* refers to beliefs about one's capabilities, without specifying particular activities or the conditions under which they must be performed. This is the most general level

of self-efficacy, and these general level beliefs can further refer either to general academic efficacy beliefs, such as "I'm sure I can perform well at school," or to general beliefs in certain skill areas, such as "I'm sure I can perform well at math." The *intermediate level* refers to "a class of performances within the same activity domain under a set of conditions sharing common properties" (Bandura, 1997, p. 49). It refers to beliefs in reference to certain competencies or sub-skills, such as "I'm sure I can do mental calculations" or "I'm sure I can write a novel." The most *specific level* refers to beliefs of one's capabilities to perform a particular task, such as "I'm sure I can do this math task" or "I'm sure I can read this text." Correspondingly, people may have varying beliefs of their capabilities (e.g., in math in general or in reference to certain math competencies or specific math tasks). Moreover, each of these beliefs can be important to study as they may have partly different functional roles in one's behaviour and learning (Bong, 2002; Talsma et al., 2018; Usher & Pajares, 2009).

Although efficacy beliefs are proposed to differentiate according to the three specificity levels (Bandura, 1997), empirical evidence about these specificity levels is largely absent, especially in children. Existing studies on adolescents and adults suggest that efficacy beliefs differ according to the specificity of underlying beliefs, as the items assessing different specificity levels are found to form separate factors (Bong, 2001, 2002a; Bong & Hocevar, 2002; Phan et al., 2018). In these studies, self-efficacy was differentiated as subject- (or course-), task- (or content-), and problem-specific self-efficacy, which roughly correspond to the previously presented three specificity levels. Moreover, other researchers have considered different specificity levels of self-efficacy in concert among adolescents (e.g., Pajares & Miller, 1995; Piercey, 2013; Usher & Pajares, 2009); however, they have not explicitly empirically examined whether the beliefs are distinct using factor analytical methods. In addition, self-efficacy has been assessed in various ways and for many specificity levels across studies and different skill domains, which complicates the interpretation and summarising of the previous research findings concerning the specificity of efficacy beliefs. For example, math-related efficacy beliefs have often been examined in specific tasks (e.g., Lee, 2009), whereas reading-related efficacy beliefs have been mostly studied at the general level (e.g., Smith et al., 2012). Consequently, this variability in the assessment of self-efficacy may relate to the partly differing associations between self-efficacy and achievement in different skill areas. Studying whether the beliefs also vary in the hypothesised specificity levels in children could extend researchers' understanding of children's self-efficacy, as the level of specificity in which self-efficacy is assessed may affect the findings concerning self-efficacy. For example, it may relate to the associations found between learning and achievement (e.g., Pajares & Miller, 1995; Talsma et al., 2018), as will be discussed in more detail in the following sections.

1.2.3 Children's self-efficacy

Although self-efficacy is a widely studied concept, fairly little is known of efficacy beliefs in children; in particular, we lack knowledge on the age children

form these beliefs and the extent of differentiation in their beliefs across contexts and tasks. Cognitive and motivational theories posit that children's self-appraisal skills gradually improve as a result of their cognitive development and become more differentiated, realistic, and more closely related to their behaviours and performance over time (Bandura, 1997; Harter, 2012). By middle childhood, children's self-representations begin to differ across domains and contexts, and simultaneously, these self-beliefs become more integrated within the student and the contexts (Harter, 2012). It is assumed that with the growing understanding of their abilities and improvement in self-appraisal skills, children begin to judge their own efficacy. According to social cognitive theory, self-efficacy develops through the experiences children gather from learning situations, that is, in reciprocal interactions with their environments (Bandura, 1997). Children gain understanding of their skills by being exposed to these kinds of efficacy-relevant experiences (e.g., learning experiences, exposure to models, and instructional guidance) increasingly as they age and widen their learning environment from family to diverse learning situations and school environment. By self-reflecting on these experiences, children are considered to form knowledge of their capabilities. Bandura (1997) proposed that these self-beliefs turn into functional self-appraisals over time; that is, the beliefs in one's capabilities begin to influence and increasingly interact with one's actions. Therefore, children begin to progressively exercise control over their behaviours and thoughts as well as regulate their actions (Harter, 2012). Recent views on developing self-representations suggest that accumulating experience with different tasks, rather than cognitive maturation itself, leads to increasing differentiation and accuracy with regard to self-beliefs (Cimpian, 2017).

Current understanding of the development of self-beliefs and self-appraisal skills thus suggests that efficacy beliefs may be less differentiated among younger than older children. However, empirical evidence on the differentiation and specificity of children's self-efficacy is limited. Comparisons of younger (primary and middle school) and older (secondary and high school) students have suggested an increasing differentiation in self-efficacy by school subject (Bong, 2001) and task difficulty (Street et al., 2017). Some evidence also shows that students' efficacy beliefs vary between different learning contexts (Wilson & Trainin, 2007) and situations (Määttä et al., 2016) already in early primary school years. However, there is less evidence of whether efficacy beliefs are differentiated by the specificity levels of the beliefs as early as in primary school.

1.2.4 Self-efficacy and achievement

A wealth of research shows that students' efficacy beliefs are positively associated with various learning-related outcomes (Bandura, 1997; Klassen & Usher, 2010; Talsma et al., 2018). Students with high self-efficacy tend to set higher goals for learning (Schnell et al., 2015), expend more effort (Galla et al., 2014; Komarraju & Nadler, 2013), and persist longer in tasks (Schnell et al., 2015) than students with low self-efficacy. Moreover, students with high self-efficacy have been found to perform better than those with low self-efficacy (e.g.,

Bandura, 1997; Multon et al., 1991; Talsma et al., 2018). Although the association between self-efficacy and achievement is well documented, less is known about whether the association varies by the specificity level of self-efficacy, especially in children. That is, it is uncertain whether the various beliefs children have of their capabilities play different functional roles in their achievement behaviours.

Social cognitive theory assumes that the specificity in which self-efficacy is evaluated or assessed influences the associations found between self-efficacy and achievement and motivational outcomes. Pajares (1996, p. 5) referred to Bandura's (1986) seminal ideas and proposed that

> Reasonably precise judgments of capability matched to a specific outcome afford the greatest prediction and offer the best explanations of performance outcomes, for these are typically the sorts of judgments that individuals use when confronted with behavioral tasks.

This proposition suggests that beliefs related to specific tasks relate more strongly to achievement in those tasks than more general beliefs of one's capabilities. Supporting this hypothesis, meta-analyses show that self-efficacy relates more strongly to achievement when the specificity of self-efficacy and achievement measures match (Multon et al., 1991; Talsma et al., 2018). Similarly, studies examining different specificity levels found the relationship between self-efficacy and performance to be stronger when the two are assessed at a corresponding specificity (Bong, 2002; Pajares & Miller, 1995; Usher & Pajares, 2009; however, see Lent et al. (1997) for an exception). Despite researchers repeatedly underlining the need to consider the specificity levels of self-efficacy due to their differentiated functional roles (Bandura, 1997; Bong, 2006; Pajares, 1996; Schunk & DiBenedetto, 2020), this aspect has received less attention in empirical research, especially that examining children.

Another factor that may relate to the strength of the association between self-efficacy and achievement is the age of the student. Efficacy beliefs possibly become more important predictors of one's actual performance as children age (Bandura, 1997). Therefore, children's beliefs about their capabilities may affect their behavioural engagement (such as effort and persistence) and achievement less in early childhood than later on. Thus far, however, empirical evidence of these possible age-related differences in the association between self-efficacy and achievement is limited. Recently, McTigue and colleagues (2019) found that children's efficacy beliefs already relate to their reading achievements in Grade 1, suggesting that these beliefs matter from the beginning of one's school career. In addition, there is some evidence of the growing influence of these beliefs on achievement as children grow. Davis-Kean and colleagues (2008) found that self-efficacy related more strongly to math skills among secondary than primary school students; however, the association was not found to differ between early (Grades 1 to 2) and late (Grades 3 to 5) primary school students.

Efficacy beliefs likely relate positively to skill development, as high beliefs are supposed to lead to higher behavioural engagement (Bandura, 1997). However, less is known about whether the efficacy beliefs at different specificity levels are similarly related to achievements over time. Moreover, prior research

in children has been mainly cross-sectional and less is known about whether and how efficacy beliefs relate to developments in children's achievements over time, especially in certain contexts, such as beginning reading skills.

1.2.5 Changes in self-efficacy

Efficacy beliefs are considered to be rather malleable perceptions of one's capabilities. As these beliefs are considered to be formed in interaction with one's environment (triadic reciprocity; see Figure 1) and be sensitive to contextual influences, they are believed to resemble state-like characteristics rather than more stable trait-like personality characteristics (Bandura, 1997). By definition, efficacy beliefs are assumed to change more easily than related self-beliefs, such as self-concept which is considered to be a more stable perception of one's abilities (e.g., Bong & Skaalvik, 2003). Although self-beliefs are considered to form and develop during childhood (Harter, 2012), there is little empirical research on such processes specifically in terms of self-efficacy and primary school children.

In general, children report increasing beliefs in their capabilities over time (e.g., Hornstra et al., 2016; Phan 2012a, 2012b). However, findings considering the trend of this change in self-efficacy are inconsistent. Researchers have reported linearly increasing patterns across Grades 5 to 6 (Hornstra et al., 2016), nonlinear patterns for Grades 3 to 6 across one school year (Phan, 2012a, 2012b), and a curvilinear U-shaped pattern across Grades 3 to 6 (Hornstra et al., 2013). In addition, the trends in self-efficacy development may differ slightly between different groups of students (e.g., between girls and boys and due to parents' educational levels according to Hornstra et al. (2013)).

Studies considering stability of self-efficacy over time (i.e., change in the relative ordering of children's self-efficacy levels) have also reported mixed results. The relative ordering of children's levels of math self-efficacy was found to change only slightly over one year among Grade 6 students (the stability coefficients ranged from .64 to .79; Phan & Ngu, 2016), whereas for Grade 7 students, self-efficacy was found to be fairly unstable (over the course of 9 months, the stability coefficients ranged from .23 to .44; Phan et al., 2018). Other researchers have suggested that math self-efficacy is more stable among older (i.e., secondary school) than among younger (i.e., primary school) students (Davis-Kean et al., 2008; Talsma et al., 2018). These findings thus indicate that children's self-efficacy may change at varying rates over time.

These few previous studies investigating changes in self-efficacy over time have focused on the overall patterns of change, stability, or general variability in self-efficacy by applying variable-centred approaches (Bergman & Trost, 2006; Howard & Hoffman, 2018). However, it may be that all children do not follow the same pattern of change in their respective self-efficacy. Indeed, previous studies indicate overall variability in self-efficacy changes (Hornstra et al., 2013). In addition, the rates (c.f. Phan & Ngu, 2016; Phan et al., 2018) and trends (c.f. Hornstra et al., 2013; Hornstra et al., 2016) of change in self-efficacy are somewhat contradictory across studies (see also Scherrer & Preckel, 2019). Thus, it is likely

that some children may hold positive beliefs about their skills, which further increase over time, whereas others may lower their beliefs of their capabilities and yet others hold more stable beliefs over time. However, these possible differences in the levels, directions, and rates of change in self-efficacy have not been considered simultaneously in prior research.

This possible heterogeneity among learners could be revealed by using person-centred approaches (Bergman & Trost, 2006; Gillet et al., 2019; Howard & Hoffman, 2018; Woo et al., 2018). Whereas variable-centred approaches assume that children are drawn from the same population and follow the same development, person-centred approaches, on the contrary, assume that children are drawn from diverse populations, and therefore may represent different profiles or patterns of development (Bergman & Trost, 2006; Gillet et al., 2019; Howard & Hoffman, 2018; Woo et al., 2018). When used in longitudinal research, person-centred approaches aim to understand development by considering unobserved heterogeneity in changes within a population. They are intended to search for typical trajectory patterns of development, that is, sub-groups of individuals representing qualitatively and quantitatively different trajectories. Examining possible heterogeneity in the development of self-efficacy could both extend current understanding and help to clarify inconsistent prior findings with respect to changes in children's self-efficacy. In addition, this knowledge could help to identify and target support to groups of children with negative initial beliefs or those who may be more likely to lose confidence in their skills over time.

Another view is that the differing findings may relate to the varying specificity levels in which self-efficacy is being assessed. In a recent study, general efficacy beliefs in math tasks were found to be more stable over time than specific efficacy beliefs in math tasks (Marsh et al., 2019). This finding suggests that changes may differ at various specificity levels: the beliefs students have of their capabilities in certain tasks may fluctuate more than their beliefs of their general capabilities in a certain skill. However, more research is needed before making any conclusive interpretations.

1.2.6 Sources of self-efficacy shaping changes in self-efficacy

According to social cognitive theory, efficacy beliefs are considered to form and change in a triadic reciprocity process due to the effects of environmental, personal, and behavioural influences (Bandura, 1986). Furthermore, the four experiences that people gather in this triadic reciprocity are considered to be the key sources for their self-efficacy formation and development. These four information sources are mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states (Bandura, 1997). The information from these sources is cognitively processed, interpreted, weighted, and used to assess one's capabilities for the tasks at hand. Thus, the source experiences can be thought to be one's interpretations of the environmental, personal, and behavioural influences or messages. The following paragraphs describe the four sources in more detail.

Interpretations of past experiences (*mastery experience*) have been consistently shown to have the most powerful effect on students' self-efficacy (e.g., Byars-Winston et al., 2017; Usher & Pajares, 2008). Experiences of success are likely to increase self-efficacy for similar tasks, and experiences of failure, to undermine one's beliefs of what one can do. Although performance is closely related to the beliefs in one's capabilities, it should be noted that mastery is the foremost experience of success; thus, the same performance can be experienced as either a success or a failure. For example, the same math test performance can be interpreted as either a success or a failure.

Verbal and *social persuasions*, such as positive feedback and encouragements from parents, teachers, and peers, comprise another important source of self-efficacy. Positive feedback can support a student's self-efficacy; likewise, negative notions or feedback can lower students' beliefs of what they can do. It is important to note that this idea does not apply to the amount of feedback; rather, it is the students' experiences of encouragements that can alter their self-efficacy.

Vicarious experiences, namely observing how others (e.g., peers and teachers) perform, also inform students of their own capabilities. One's confidence in a task may be raised by seeing a peer – especially one perceived as similar to oneself – succeed in a similar task. Learning from models and forming beliefs of one's capabilities based on the performances of others were central in the early developments of social cognitive theory (Bandura, 1986). The influence of social models is assumed to be especially important when students have low confidence or little experience concerning the task in question (Bandura, 1997). However, empirically vicarious experiences relate only weakly or not at all to students' self-efficacy levels in general (e.g., Byars-Winston et al., 2017).

Interpretations of *physiological* and *emotional states*, such as anxiety, tension, and stress reactions, are also considered to affect students' sense of efficacy. Strong emotional reactions (such as anxiety) or bodily arousal (such as increased heartbeat or sweating) are likely interpreted as signs of incapability. However, the same reactions can be interpreted differently; for example, stress reactions can be interpreted as a positive sign related to the importance of the task or as a sign of failure and incapability of doing the task. In mathematics especially, emotional reactions (such as mathematics anxiety) are found to relate to students' perceived self-efficacy (e.g., Phan 2012b; Usher & Pajares, 2009; Usher et al., 2019).

A growing body of empirical research has confirmed that these four hypothesised sources of self-efficacy relate to beliefs about one's capabilities (e.g., Sheu et al., 2018; Usher & Pajares, 2008). The earlier literature, however, has some shortcomings. Despite the substantial cross-sectional evidence of the relationship between sources of self-efficacy and self-efficacy, little is known about whether the sources of self-efficacy actually shape self-efficacy development over time, as theorised by Bandura (1997). The dynamic association between the efficacy-building experiences and one's self-efficacy is a key assumption in reciprocal relations in social cognitive theory, and theoretically, the interactions between sources of self-efficacy and self-efficacy are assumed to be causal (Bandura, 1986, 1997). However, knowledge of these relations over time is scarce (for exceptions

Phan 2012a, 2012b). Phan (2012a, 2012b) examined how the level of the sources of self-efficacy predicted changes in self-efficacy in the contexts of math and English among students from Grades 3 to 4 (Phan 2012a) and in the context of math and science among students from Grades 5 to 6 (Phan, 2012b). The associations found between the sources of self-efficacy and the changes in self-efficacy varied largely between these two studies (positive, negative, or no relations were observed between the sources and changes in self-efficacy) as well as within and between different skill domains. Based on these results, it is difficult to form conclusions about the roles of sources of self-efficacy in predicting changes in self-efficacy. Phan's (2012a, 2012b) findings also run contrary to the cross-sectional findings reported in recent meta-analyses (e.g., Byars-Winston et al., 2017).

In addition, it has not been examined whether changes in sources of self-efficacy relate to changing beliefs of one's capabilities. There are some indications that students differ in the rate in which their efficacy-building experiences change over one school year (rank-order stabilities: .19 to .44; Phan & Ngu, 2016), which suggests heterogeneity in these changes. More knowledge is, however, needed about whether these diverse changes relate to changing beliefs about one's capabilities. This understanding could, in turn, inform practitioners about which kinds of experiences they should aim to offer students to support their beliefs and their learning.

Moreover, prior studies have focused on the average associations between each source of self-efficacy and self-efficacy development for the full sample. Children may, however, also differ with regard to the extent to which they experience these sources over time. It may be that children's varying exposures to efficacy-building experiences (Chen & Usher, 2013) lead to diverse changes in their self-efficacy. Accounting for individual variability in exposure to the sources of self-efficacy might also shed light on the inconsistent findings concerning the relationships between the sources of self-efficacy and changes in self-efficacy.

1.3 Self-efficacy in reading

1.3.1 Context of reading fluency

Reading is a fundamental skill associated with learning and participating in modern societies, and thus, it is essential for everyday life. Moreover, learning to read fluently is a hallmark of primary school education and a prerequisite for students to learn by reading. Reading fluency is determined as an automatised process of decoding and word recognition (LaBerge & Samuels, 1974). This automaticity of decoding and word recognition is assumed to free cognitive resources for understanding what is read (LaBerge & Samuels, 1974). Therefore, reading fluency forms the link between making meaning of and understanding text (Pikulski & Chard, 2005). A fluent reader reads quickly and accurately,

which makes understanding plausible. In transparent orthographies, such as Finnish, decoding accuracy is mastered very quickly (Seymour et al., 2003); however, the challenge lies in acquiring sufficient speeds in reading and automatization of decoding (Aro, 2004; Holopainen et al., 2001; Landerl et al., 1997). Variations in children's reading skills are especially observable in their reading rates (Seymour et al., 2003), and a slow reading rate is a universal characteristic of reading difficulties (Ziegler et al., 2003; Torppa et al., 2015). Developing fluent reading skills is essential as reading fluency is linked to later reading comprehension skills (Fuchs et al., 2001; Kim et al., 2010).

Becoming a fluent reader requires numerous encounters with words and texts, and the automaticity of reading is a process that develops gradually as the number of those encounters increases. In his self-teaching hypothesis, Share (1995) proposed that when children decode new words, every successful experience of making meaning out of letters and recognising a word strengthens orthographic representations. This acts as a self-teaching mechanism, as the frequently decoded words will be later recognised with more ease. These repeated encounters with words and texts should also occur with independent practice for a reader to become accurate and quick. Thus, this self-teaching requires engagement with reading activities, which especially in the early phase of skill acquisition, also requires persistent practice and considerable effort. The extent of effort expended by the child and their persistence in their reading activities are likely to be influenced by the beliefs they hold about their reading capabilities, that is, their reading self-efficacy (Galla et al., 2014; Komarraju & Nadler, 2013; Schnell et al., 2015).

1.3.2 Operationalisations of reading self-efficacy

Self-efficacy has been operationalised and measured in various ways in prior research focusing on children's reading self-efficacy. This relates both to the assessed specificity level of self-efficacy as well as conceptualisations of self-efficacy that often come close to or overlap with other constructs, such as self-concept. Importantly, the ways in which self-efficacy is measured may relate to the interpretations of children's beliefs about their reading capabilities, such as the strength and functional roles of their reading self-efficacy. For instance, it may be that children's general reading-related efficacy beliefs differ from their beliefs related to specific reading contexts and tasks. Therefore, the following section will look more closely the operationalisation of reading self-efficacy in prior research and classify the reviewed studies according to the targeted specificity levels described above, namely general, intermediate, and specific.

Most self-efficacy studies in reading contexts have assessed *general-level* self-efficacy beliefs, namely general academic self-efficacy (e.g., Galla et al., 2014; Hornstra et al., 2013; Liew et al., 2008; Mercer et al., 2011), or general reading self-efficacy (e.g., Lee & Zentall, 2017; Smith et al., 2012; Wigfield et al., 2004). Children were asked to rate their perceived competence in reading with statements such as "I am a good reader" (see the self-efficacy subscale of Motivation for Reading Questionnaire [MRQ] in Baker and Wigfield (1999)).

Such general-level conceptualisations of self-efficacy are used widely in reading motivation scales (e.g., self-efficacy subscales of MRQ, Baker & Wigfield, 1999; PRMQ, an abbreviated version of MRQ, Klauda, 2008; Young Reader Motivation Questionnaire [YRMQ], Coddington & Guthrie, 2009). In the general-level operationalisations suggested by Bandura (2006), children rate their confidence to perform and learn in reference to a particular domain (e.g., "How certain you are that you can learn reading?").

Less research has focused on children's more specific efficacy beliefs in reading. In some studies, students were asked to rate their confidence in tasks such as "Read one of your textbooks" (Shell et al., 1995), "Read out loud in front of class"(Carroll & Fox, 2017), or "Understand the main idea of a story" (Piercey, 2013), which can be understood to assess *intermediate-level* beliefs. Even fewer attempts have been made to assess efficacy beliefs in reading for the most *specific level,* namely in relation to concrete reading tasks. Schunk and Rice (1991, 1992, 1993) conducted small-scale studies in which students were asked to rate their confidence in correctly answering each reading comprehension question shown to them.

Therefore, our understanding of reading self-efficacy is based mostly on children's general-level efficacy beliefs. This may, however, affect the overall findings on children's reading self-efficacy as well as the currently available interpretations of the functional role of self-efficacy in reading contexts. Furthermore, the general-level conceptualisations of self-efficacy seem to have some limitations. First, the operationalisation of self-efficacy in the widely used reading motivation scales has strayed from the original theorisation of self-efficacy articulated by Bandura (1997). That is, self-efficacy has been operationalised at the item level as perceived competence (e.g., "I am a good reader") and with items focusing on social comparison (e.g., "I learn more from reading than most students in the class"). These operationalisations overlap with that of self-concept rather than focus on future capabilities and target self-referent evaluations, in line with the original conceptualization of self-efficacy. Use of such overlapping and incongruent operationalisations of self-efficacy (e.g., Bong & Skaalvik, 2003; Marsh et al., 2019) have also been repeatedly criticised by some researchers (Conradi et al., 2014; Klassen & Usher, 2010; Schunk & DiBenedetto, 2020). Second, when being interviewed about their capabilities as readers, children are found to describe their self-efficacy with specific situations in mind and not with regard to well-formed conceptualisations of their general ability in reading (such as "being a good reader"; Guthrie et al., 2007). Guthrie and colleagues (2007) proposed that these general level beliefs may develop later with increasing experience with texts and reading situations and may be integrated from the more specific views. Third, when asked about their general reading abilities, children may have different reading sub-skills in mind than those assumed or intended by researchers. Children placed emphasis on their capabilities to read fluently (Butz & Usher, 2015; Henk & Melnick, 1998) or on their word reading skills (Guthrie et al., 2007; Klauda et al., 2020) rather than their reading comprehension skills when they were interviewed about how they

formed their beliefs of their capabilities in reading. However, in most studies, reading comprehension was the outcome skill.

Variation in the operationalisation of self-efficacy may explain the inconsistent prior findings considering age- and gender-related differences in the strengths of students' reading self-efficacy. In studies considering general-level beliefs, younger students were found to have higher reading self-efficacy (Smith et al., 2012), whereas when more specific efficacy beliefs (i.e., intermediate level) were assessed, the opposite pattern was documented (Carroll & Fox, 2017; Shell et al., 1995). However, far-reaching conclusions cannot be made as the efficacy beliefs in different specificity levels were not examined in the same study. Similarly, the varying findings considering gender differences in the strength of self-efficacy of primary school students may partly relate to the studied specificity level of self-efficacy (Schunk & Meece, 2006). Girls were found to have higher reading self-efficacy than boys when general-level beliefs were assessed (Baker & Wigfield, 1999; Smith et al., 2012; Wigfield & Guthrie, 1997), whereas no gender differences were found when more specific efficacy beliefs related to reading tasks (i.e., intermediate level) were evaluated (Carroll & Fox, 2017; Muntoni et al., 2021; Piercey, 2013). When students made general-level evaluations of their capabilities, which were based on relative ability comparisons or perceived competence, they might have been more exposed to gender role stereotypes or expectations (such as "reading is for girls"; Martinot et al., 2012; Nowicki & Lopata, 2017) than when they made more specific evaluations of their capabilities in reading. Recently, these kinds of gender stereotypes were found to relate to children's reading self-efficacy (Muntoni et al., 2021). Following the gender stereotypes, in general, females are found to have higher self-efficacy in language-related areas, and males, in mathematics and science (Huang, 2013).

1.3.3 Relationship between self-efficacy and reading fluency

The widely shown positive effects of high beliefs in one's capabilities for learning and achievement (Bandura, 1997; Talsma et al., 2018) have also been revealed in the context of reading. Children with high self-efficacy are more likely to engage and spend more time on reading activities (Baker & Wigfield, 1999; Schiefele et al., 2012; Schüller et al., 2017; Wigfield & Guthrie, 1997), read more for enjoyment (Lee & Zentall, 2017), expend more effort (Galla et al., 2014), and practice more persistently than children with low self-efficacy. These outcomes, in turn, are assumed to have positive effects on children's reading skills and relate to their growing capabilities as readers. Moreover, high self-efficacy is already known to relate to higher reading achievement among primary school children (e.g., Hornstra et al., 2013; Hornstra et al., 2016; Smith et al., 2012; Solheim, 2011). The strength of this association, however, varies. Moreover, the current literature offers a scant understanding of the specific associations between reading self-efficacy and reading fluency development due to the following limitations.

First, previous research on the association between self-efficacy and reading achievement primarily focused on reading comprehension. The few studies

examining reading fluency as well indicated that high self-efficacy relates to higher levels of both reading fluency and reading comprehension for middle school students and those in higher grades (Guthrie et al., 2009; Ho & Guthrie, 2013; Mercer et al., 2011). Among younger children (aged 8 to 11 years) similarly, efficacy beliefs were positively linked to fluency but not to reading comprehension (Carroll & Fox, 2017). Moreover, the associations found between self-efficacy and reading fluency were rather strong (e.g., Carroll & Fox, 2017; Guthrie et al., 2009; Mercer et al., 2011), whereas rather weak associations were documented between self-efficacy and overall reading achievement (e.g., Liew et al., 2008; Smith et al., 2012). This indicates that the studied reading sub-skill might affect the strength of the association found between self-efficacy and reading achievement.

Second, only a handful of studies have longitudinally examined associations between self-efficacy and reading achievement. Although self-efficacy is supposed to affect achievement over time (Bandura, 1997), somewhat surprisingly, the existing empirical studies have shown that children's general academic efficacy beliefs or general reading-related efficacy beliefs do not predict their later reading achievements (Lee & Zentall, 2017; Liew et al., 2008; for an exception, see Lee and Jonson-Reid (2016)) or their reading development over time (e.g., Galla et al., 2014; Guthrie et al., 2007; Hornstra et al., 2013). In the only longitudinal study assessing this relationship in reading fluency, general *academic* self-efficacy was not found to predict reading fluency development across one school year among Grade 5 students (Mercer et al., 2011). However, in general, positive changes in self-efficacy are found to relate to positive changes in reading achievement (Galla et al., 2014; Hornstra et al., 2013; Hornstra et al., 2016). Thus far, none of the studies have examined whether children's reading self-efficacy explicitly predict their development in reading fluency.

Third, although the specificity of self-efficacy (i.e., the kinds of efficacy beliefs measured) seems to affect the relationship between self-efficacy and achievement (e.g., Talsma et al., 2018), this aspect has not been studied in detail in the context of reading. However, some evidence supports the assumption that children's general reading-related efficacy beliefs may relate to reading skills differently than their beliefs in specific reading tasks. Piercey (2013) studied different specificity levels of reading self-efficacy and found that the relationship between intermediate-level self-efficacy and reading achievement was stronger than that between general reading self-efficacy and reading achievement. However, to date, none of the studies have explicitly examined whether the beliefs at various specificity levels (i.e., more general and more specific beliefs) relate differently to reading achievement over time. According to the aforementioned studies (e.g., Lee & Zentall, 2017; Liew et al., 2008), general self-efficacy does not predict reading development. In contrast, when children's *beliefs about specific reading tasks* were assessed, self-efficacy was found to positively predict later reading achievement (Lee & Jonson-Reid, 2016). Similar findings have emerged for math: specific-level efficacy beliefs are more strongly associated with later math achievement than general-level beliefs (Phan et al.,

2018). These findings suggest that the beliefs at various specificity levels may be differently related to children's reading achievements, especially over time.

Last, little is known of the gender- and age-related differences in the association between self-efficacy and reading skills. Theoretically, efficacy beliefs may become more important predictors of actual performance over time (Bandura, 1997); however, the scant evidence pertaining to reading does not support this notion. Shell and colleagues (1995) found no evidence of the differing associations between self-efficacy and reading skills among students in Grades 4, 7, and 10. Likewise, in general, gender has not been found to moderate the relationship between self-efficacy and skills (Talsma, 2018). However, gender differences in the association between self-efficacy and skills have not been examined specifically for reading fluency, for which gender-differences in skill level are especially evident (Torppa et al., 2018).

1.3.4 Changes in reading self-efficacy

Thus far, knowledge about how efficacy beliefs in reading change and form is scarce, as prior research has not addressed changes in reading self-efficacy among primary school children. It may be that the beliefs related to reading skills are particularly likely to change during the primary school years, as reading skills develop rapidly during childhood. However, the only explicit evidence of changes in reading self-efficacy relates to secondary school students (Grade 7), whose self-efficacy was found to increase over one school year (Schöber, 2018). In addition, the relative positions between students' self-efficacy levels (i.e., rank-order) remained rather stable, indicating that the students' reading self-efficacy developed at the same pace. However, the shape and rate of this change in reading self-efficacy has not been examined. Moreover, it may be that not all children follow the same overall patterns of change; some may differ in the rate and direction of change and follow different change trajectories. This possibility remains unexplored. In related research focusing on self-concept, the level and rate of change of learners' self-concept in literacy was found to differ over time, even though self-concept generally declines as children progress through school (Archambault et al., 2010). Further, different individual and family predictors were found to be associated with distinct change trajectories (Archambault et al., 2010).

Knowledge about the four sources of self-efficacy that are considered to form and shape this self-efficacy development is still limited in reading context. Despite the increasing understanding about the efficacy-building experiences in other skill areas and older students (e.g., Byars-Winston et al., 2017), these findings may not directly translate to the reading context and children's experiences. Rather, the source experiences are found to differ somewhat between skill areas (e.g., Butz & Usher, 2015; Byars-Winston et al., 2017; Phan 2012a; Usher et al., 2019). However, some prior findings give insights into the efficacy-building experiences in reading (Butz & Usher, 2015; Guthrie et al., 2007; Henk & Melnick, 1998).

Guthrie and colleagues (2007) interviewed Grade 4 students about how they knew they were efficacious in reading and found that children's own performance, that is, being able to read difficult words or challenging parts of a story, as well as teacher and parent feedback were important influences on their reading self-efficacy. Similarly, in an earlier study by Henk and Melnick (1998), young readers reported that they judged their capabilities in reading based on their reading performance, which can be considered as a type of mastery experience. In a larger-scale study, Butz and Usher (2015) studied the sources of reading self-efficacy by asking Grade 4 to 8 students to report what led them to feel more confident in reading. They found students' responses to represent the four hypothesised sources of self-efficacy. The most frequently reported source was students' successful experiences in reading, that is, mastery experiences. Similarly, students explained that both verbal persuasions and vicarious experiences increased their confidence in reading. Students with high self-efficacy reported both these sources more often than those with low self-efficacy. A few students indicated that physiological and emotional states were sources of their reading self-efficacy. However, as discussed by Butz and Usher (2015) their way of inquiry may have focused students' attention more on certain source experiences, whereas others may remain unreported. On the one hand, students attention might have been drawn to external events rather than internal experiences (such as affective arousal), and on the other hand, they might have focused only on experiences that raised their self-efficacy but not on such that lower their self-efficacy such as negative arousal in reading situations. Accordingly, when Klauda et al. (2020) specifically asked students about their feelings regarding reading a challenging book, some stated that they felt nervous because they anticipated problems in decoding words.

While these above-mentioned studies have enriched our understanding of the sources used by students as indicators of their reading self-efficacy, less is known about how these source experiences change over time. More importantly, it is not known whether these experiences and changes in them shape reading self-efficacy development as theorised by Bandura (1997). Increased understanding of these dynamics is essential for applying the theory in practice and designing support to promote positive developments in children's efficacy beliefs. Applying quantitative approaches for studying sources of self-efficacy could broaden knowledge of the formation of children's efficacy beliefs, as quantitative and qualitative methods reveal partly different sources of self-efficacy (Usher et al., 2019). In addition, new understandings of the possibly varying formation processes of self-efficacy could be captured by applying a person-centred approach (Bergman & Trost, 2006; Gillet et al., 2019; Howard & Hoffman, 2018; Woo et al., 2018).

1.4 Aims of the research

This study aimed to increase understanding of the efficacy beliefs of children regarding their reading capabilities, especially reading fluency. Furthermore, to extend our understanding of how these beliefs change and how they relate to reading development, the hypothesised relations between reading self-efficacy (personal influences), reading achievement (behavioural influences), and sources of reading self-efficacy (environmental and personal influences), as theorised in social cognitive theory (Figure 2; Bandura, 1997), were examined over an 11-month study period. To fulfil these aims, three studies were carried out among primary school children from Grades 2 to 5.

Study I investigated whether different specificity levels of reading self-efficacy, as hypothesised by Bandura (1997), can be identified among primary school children and whether gender- or grade-related differences in the specificity of self-efficacy exist (Study I).

Study II examined the possible relationship between children's reading self-efficacy and reading fluency and its development. More specifically, the study explored whether the associations between the level of and the changes in reading fluency differ by the specificity level of self-efficacy.

Study III focused on the dynamics of change in reading self-efficacy and its hypothesised sources (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states). Both the variable and person-centred approaches were applied to investigate changes in self-efficacy. Consequently, associations between changes in sources of self-efficacy and change trajectories in self-efficacy were explored.

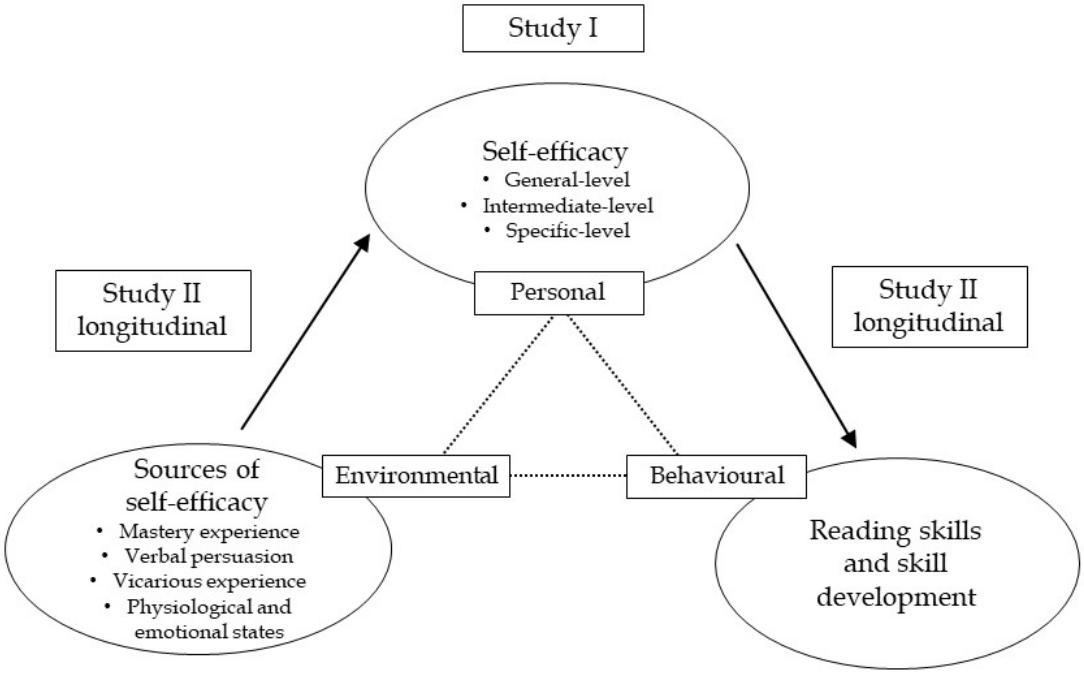

FIGURE 2 Modified representation of Bandura's (1986, 1997) self-efficacy model and parts of the model covered by Studies I to III

2 METHODS

2.1 Participants and procedure

Participants in all three studies (I to III) were 1327 children (48.08% girls) from 20 primary schools who took part in a longitudinal investigation (*Self-Efficacy and Learning Disability Interventions* Project, 2013–2015) focused on the children's self-efficacy as well as difficulties in reading and math. The children filled in questionnaires on their self-beliefs as well as their motivations and learning habits related to reading and math. Their achievements in reading and math were assessed. This study used a subset of these assessments focusing on reading self-efficacy and reading fluency. Municipality officials responsible for basic education were contacted to recruit volunteering schools and teachers for the project. A total of 20 primary schools and 75 classes from rural, suburban, and urban areas participated. The break-up of the participating students at the beginning of the study was as follows: Grade 2 (13.41%, n = 178), Grade 3 (35.49%, n = 471), Grade 4 (28.86%, n = 383), and Grade 5 (22.23%, n = 295) (M_{age} = 9.97 years, SD = 1.05; M_{range} = 7.84 to 12.83 years).

Trained research assistants supervised group-administered assessments (questionnaires and skill assessments) in the classrooms during regular school hours. Text reading tasks were conducted individually by the research assistants in a quiet location at school. Practice items were presented before each task. All the items on the questionnaires were read aloud by the research assistants to ensure that all the children could answer the questions irrespective of their reading levels.

The children were assessed three times during one school year (November 2013, January 2014, and May 2014) and once in the fall term of the next school year (September 2014). The studies presented in this thesis collected data from the November 2013 (T1), May 2014 (T2), and September 2014 (T3) assessments. Between January and May 2014, 5.8% of the studied children participated in reading fluency and self-efficacy interventions (for details of these interventions,

see Aro et al. (2018)). The effect of the reading fluency intervention (for 5.8% of the participating children) was controlled for in all the analyses of Study II. The same is true of the effect of the self-efficacy intervention (for 2.7% of the participating children) in Study III.

2.2 Measures and design

Table 1 provides an overview of the design, measures, and data analyses used in Studies I to III. Study I was a cross-sectional study, and Studies II and III utilised a longitudinal design. More detailed information of the measures can be found in the original articles.

Children's *reading self-efficacy* was measured using a questionnaire created for primary school children following Bandura's (2006) guidelines for constructing self-efficacy scales. The items specifically targeted confidence in mastering situations requiring reading fluency skills. Three different levels of specificity were assessed: specific-, intermediate-, and general-level reading self-efficacy. All the items began with the question stem, "*How certain are you that you can....*" The participants rated the strength of their confidence in mastering the given activities using a seven-point scale varying from "*I'm totally certain I can't*" (1) to "*I'm totally certain I can*" (7).

General-level reading self-efficacy was assessed with three items modified from the original Children's Self-Efficacy Scale (Bandura, 2006) to tap several aspects of reading fluency: self-efficacy for learning to read faster (rate), read with fewer mistakes (accuracy), and understand what has been read (comprehension). These items were chosen for the following reasons: accuracy is, by definition, one aspect of reading fluency (Kuhn & Stahl, 2003), and comprehension requires sufficient reading fluency to make understanding possible (LaBerge & Samuels, 1974). In the original scale (Bandura, 2006), the item related to reading was "How confident are you that you can learn to read?"; in this study, this item was extended to three items to cover aspects of reading fluency.

Intermediate-level reading self-efficacy was examined with three items, in which the children rated their self-efficacy levels for everyday reading activities requiring fluent reading (i.e., reading subtitles on TV, texts on the Internet, and a long book). Typical contexts for primary school-aged children that require fluent reading skills were selected. In Finland, all foreign-language TV programs have subtitles. To be able to read the subtitles, a sufficient rate of fluency is required, as they appear only for a short period of time on the screen. Furthermore, the ability to read subtitles is an important reading development milestone for many children as well as an activity that children frequently describe as one criterion to accomplish a mastery of reading. Likewise, to be able to read long texts, such as a long book, the reader must have sufficient fluency to be able to focus on meaning instead of code.

Specific-level reading self-efficacy (8 items) was assessed by presenting the children with 10 paragraphs of text of increasing lengths (from one sentence to a long passage). The children rated how confident they were to be able to read each presented paragraph aloud in 30 seconds. A 30-second period was first demonstrated to the children to ensure that they could understand the length of this time frame. Thereafter, each paragraph was presented on an overhead projector for a short time (5 seconds), allowing the children to visualise its length.

Sources of reading self-efficacy were assessed using a questionnaire adapted for the reading context from a previously validated questionnaire in math (Usher & Pajares, 2009). The four-factor structure representing the sources of self-efficacy (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states) was examined and found to fit the data well. Moreover, the structure was invariant across the chosen grade levels. The questionnaire consisted of 13 items in total, measuring mastery experience (e.g., "I have always been successful with reading"), verbal persuasion (e.g., "I have been praised for my reading skills"), vicarious experience (e.g., "I admire adults who are good readers"), and physiological and emotional states (e.g., "I feel tension in my body when I have to read."). The children answered the questionnaire using a seven-point Likert scale, ranging from 1 (*not true)* to 7 (*true*).

Reading fluency skills were assessed with three tests focusing on children's word-, sentence-, and text-level reading speed and accuracy. The tests were time-limited. Two of them were administered in groups (i.e., the word chain test, Lindeman, 1998; and the sentence verification task, Eklund et al., 2013), and one was administered individually (i.e., the text reading task; Salmi et al., 2011).

TABLE 1 Summary of the participants, variables, and methods used in Studies I, II, and III.

Study	Participants	Procedure	Variables	Statistical methods
Study I	The SELDI study *n* = 1327 (48.08% girls) Grade 2 (13.41%, *n* = 178) Grade 3 (35.49%, *n* = 471) Grade 4 (28.86%, *n* = 383) Grade 5 (22.23%, *n* = 295)	Cross-sectional (T1)	Reading self-efficacy (T1) • general level • intermediate level • specific level Reading fluency (T1) • word, sentence, and text levels Gender Grade level	Confirmatory factor analysis Multi-group invariance comparison Structural equation modelling (SEM)
Study II	The SELDI study *n* = 1327 (48.08% girls) Grade 2 (13.41%, *n* = 178) Grade 3 (35.49%, *n* = 471) Grade 4 (28.86%, *n* = 383) Grade 5 (22.23%, *n* = 295)	Longitudinal 11 months (T1, T2, T3)	Reading self-efficacy (T1) • general level • intermediate level • specific level Reading fluency change (T1, T2, T3) • word, sentence, and text levels Grade level Intervention status	Latent growth curve modelling Cholesky factorisation approach Multi-group invariance comparison Structural equation modelling (SEM)
Study III	The SELDI study *n* = 1327 (48.08% girls) Grade 2 (13.41%, *n* = 178) Grade 3 (35.49%, *n* = 471) Grade 4 (28.86%, *n* = 383) Grade 5 (22.23%, *n* = 295)	Longitudinal 11 months (T1, T2, T3)	Reading self-efficacy change (T1, T2, T3) • intermediate level Sources of self-efficacy change (T1, T2, T3) • mastery experience • verbal persuasion • vicarious experience • physiological and affective states Reading fluency (T1) • word, sentence, and text levels Gender Grade level Intervention status	Latent growth curve modelling Growth mixture modelling The Bolck–Croon–Hagenaars approach

2.3 Data analysis

All the analyses were performed using the MPlus software (versions 7.3–8.0, Muthén & Muthén, 1998–2017). In each of the studies, several preliminary analyses were conducted prior turning to the primary analyses. The multilevel structure of the data (the students were nested within 20 schools and 75 classes) was taken into account by first examining intra-class correlations (ICCs) for the studied variables. The ICCs were small at the class level, and small and non-significant at the school level, indicating that most of the variation occurred at the individual level, and only slight variations existed between classes or schools. However, the hierarchical nature of the data by class was taken into account by estimating unbiased standard errors using the TYPE = COMPLEX option in MPlus. The pattern of missing values in the data were analysed with Little's (1988) MCAR test, which showed that data were not missing completely at random in any of the studies. Missing data values (3.3%-14.5% of all values in Studies I-III) could be tracked to students' absence from school on the day of data collection, students moving to another school during the study, or single skipped items. The missing values were not found to be related to students' initial level of self-efficacy. To handle missing data, the full information maximum likelihood procedure, which uses all the information in the data without imputing missing values, was used in all the analyses (Enders, 2010). The invariance comparisons were conducted using the Satorra-Bentler scaled Chi-square test (Satorra & Bentler, 2001). Wald's Chi-square tests of parameter equalities were used to examine the differences between the parameters and to conduct pairwise comparisons in all three studies. Cohen's d was used as a measure of effect size for differences in means and Cohen's q as a measure of effect size for differences in correlations (Cohen, 1988).

In Study I, the specificity of reading self-efficacy beliefs was analysed using confirmatory factor analysis. Three competing factor models were constructed to examine whether reading self-efficacy consists of beliefs at different specificity levels. Further, to examine the association between the different levels of self-efficacy and reading fluency, structural equation modelling (SEM) was used. Multi-group invariance comparison tests were used to confirm the similarity of the structure of self-efficacy between genders and grade levels as well as to examine the invariance of the associations between self-efficacy and reading fluency, both between and within genders and grade levels.

In Study II, a second-order latent growth curve approach, namely the factor of curves model, was used to examine reading fluency development (Duncan et al., 2006; McArdle, 1988). Latent growth curve approach allowed for modelling both the intra-individual change in reading fluency and the inter-individual differences in that change. Furthermore, factor of curves model allowed for modelling the shared developmental processes in the first-order developmental processes (i.e., in different reading fluency measures). The unique relationship between reading self-efficacy, measured at different specificity levels, and

reading fluency development was examined using a hierarchical regression model within the SEM framework. A hierarchical regression model was chosen as the three factors representing the specificity levels of self-efficacy were multicollinear, and the aim was to examine their specific effect on reading fluency. Therefore, the Cholesky factorisation approach was applied (for details see de Jong & van der Leij, 1999) to separate the unique variance of each specificity level of self-efficacy. The level and change factors of reading fluency were regressed on the self-efficacy Cholesky components in hierarchical order following Banduras theoretical ideas of the hierarchy of the effects. First, the specific variance of specific-level self-efficacy was set to explain the level and change in reading fluency, then the specific variance of intermediate-level self-efficacy and finally the unique variance of general self-efficacy was set to explain the level and change in reading fluency. Differences in regression coefficients between the specificity levels of self-efficacy were examined using Wald's chi-square tests of parameter equalities (Muthén & Muthén, 1998–2012). Grade-level differences in the relationship between self-efficacy and reading fluency development were examined with multi-group invariance comparison tests.

Study III used both the variable- and person-centred approaches. First, changes in reading self-efficacy and sources of self-efficacy were examined with latent growth curve modelling (Muthén & Khoo, 1998). Latent growth curve model allowed for finding the best fitting model to represent the shape of change (linear, nonlinear) in reading self-efficacy and sources of self-efficacy over time. Second, person-centred trajectories of change in reading self-efficacy were identified using growth mixture modelling (GMM; Muthén, 2004). In GMM it is possible to allow the means of initial level and slope of reading self-efficacy vary across the trajectories. In GMM, different trajectory patterns of self-efficacy are estimated as representing sub-groups of children following the same pattern of change, and each individual is classified in these trajectories in a probabilistic manner. Various GMM solutions were searched by following previous guidelines (Marsh et al., 2009; Morin et al., 2011). Finally, the associations between the initial reading skill level and the self-efficacy trajectories as well as the associations with the levels of and changes in sources of self-efficacy and the self-efficacy trajectories were examined using the Bolck-Croon-Hagenaars (BCH) approach (Asparouhov & Muthén, 2018; Bakk & Vermunt, 2014). The BCH procedure conducts a weighted multiple group analysis, in which the measurement error related to the classification of students into the self-efficacy trajectories is considered by using weights that are inversely related to the classification error probabilities obtained from the GMM (Bakk et al., 2013). In this way, the BCH procedure can better take into account the uncertainty (i.e., classification error) in the group classification when adding predictors to the model. A manual three-step BCH procedure was used instead of automatic version as the predictor variables were latent factors (estimated growth curve models) and covariates were controlled for in the analyses.

More detailed information on the analyses can be found in the original articles.

3 OVERVIEW OF THE ORIGINAL STUDIES

3.1 Study I: Specificity of reading self-efficacy

Study I focused on the specificity of reading self-efficacy among primary school children in Grades 2 to 5. Bandura (1997) theorised that efficacy beliefs can be assessed at different specificity levels, and the main aim was to examine whether these different specificity levels of self-efficacy can be identified in primary school children. Based on previous research on older students (Bandura, 1997; Bong, 2001, 2002a; Bong & Hocevar, 2002) a hypothetical three-factor structure of reading self-efficacy comprising general-, intermediate-, and specific-level beliefs was formed. Two competing models based on the assumption that the children's beliefs may be less differentiated than those of older students was formed. Gender- and grade-related differences in the specificity of self-efficacy assessment were examined. Finally, the relationships between different specificity levels of self-efficacy and reading fluency were studied.

The results showed that the children's reading self-efficacy consisted of beliefs at various specificity levels, namely general-, intermediate-, and specific-level beliefs. Although the children's beliefs were separable by their specificity levels, the beliefs at various specificity levels correlated positively (these correlations varied from .67 to .39). The children's beliefs at the three specificity levels differed similarly among boys and girls and among the children from Grades 2 to 5. However, gender- and grade-related differences in the strength of self-efficacy were found, as boys showed higher levels of self-efficacy at the intermediate level than girls (although the effect sizes of these differences were small to moderate), and the younger children reported lower intermediate and specific levels of self-efficacy than the older children. Self-efficacy was positively related to reading fluency, indicating that the children who had high levels of reading self-efficacy were more fluent readers (these correlations varied from .34 to .52). The strength of the association differed according to the specificity level

of the self-efficacy measure (the effect sizes of the differences varied from 0.05 to 0.22), with intermediate-level beliefs showing the strongest association (r = .52, p < .001). Gender- or grade-related differences in the associations between self-efficacy and reading fluency were not found.

Overall, the findings confirm Bandura's (1997) theory of the specificity of self-efficacy among learners in early school years and in the relatively understudied context of reading fluency. Children seem to evaluate their own reading capabilities at varying levels of specificity; that is, they may feel self-efficacious in certain tasks but not in reading generally or vice versa. Moreover, our findings highlight that the specificity level at which self-efficacy is studied influences the association between self-efficacy and reading skills. This implies that the specificity of self-efficacy should be considered when examining young readers' efficacy beliefs and designing support for children in the areas in which they lack self-efficacy.

3.2 Study II: Reading self-efficacy and reading fluency development

This study focused on the relationship between reading self-efficacy and reading fluency development among children in Grades 2 to 5 using a longitudinal design. More specifically, the roles of self-efficacy beliefs, measured at three specificity levels (general, intermediate, and specific), in predicting reading fluency development over one year were examined. In addition, grade-level differences in the association between reading self-efficacy and levels of, and changes in reading fluency were investigated.

The results showed that self-efficacy related positively and similarly to reading fluency and its development across all grade levels. Following findings of Study I, the association was dependent on the specificity in which the self-efficacy was assessed. When the unique variance of each specificity level was taken into account, intermediate- and specific-level beliefs were found to relate positively to reading fluency, whereas general-level beliefs were not related. Only intermediate-level beliefs positively predicted reading fluency development, explaining 2.8% to 7.8% of the variance in the development. Students reporting higher intermediate level reading self-efficacy at the beginning of the year improved faster in their reading fluency across one year than those with lower levels of self-efficacy. Efficacy beliefs related to reading fluency by accounting overall for 34% to 47% of the variation in the children's reading fluency and predicted fluency development by explaining overall 5% to 8% of the variance in fluency development.

The findings of this study extended the results of Study I by showing that reading self-efficacy beliefs were related not only to reading fluency, but also to its development. This novel finding showed that the more confident the children were in their capabilities for everyday reading activities, the faster their fluency

skills improved. The findings also complement the current understanding of the relationship between self-efficacy and reading skills by demonstrating that the beliefs at different specificity levels have varying predictive power for children's reading development. These findings emphasise the importance of assessing self-efficacy at a level that closely corresponds to the skills being learned. Moreover, they point to the need to identify and address young readers who have low efficacy beliefs related to reading, so that their reading development can be supported.

3.3 Study III: A longitudinal analysis of self-efficacy and its sources

This study focused on the interplay between changes in reading self-efficacy and their hypothesised sources (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states). First, changes in self-efficacy were examined with a variable-centred approach. Second, by adopting a person-centred approach, varying trajectories of change in reading self-efficacy (i.e., differences in level, direction, and rate of change in self-efficacy) were examined. Third, the longitudinal dynamics between changes in the sources of self-efficacy and the varying trajectories of change in self-efficacy were investigated. In addition, the associations between the children's initial reading fluency levels and their subsequent self-efficacy development were examined.

The results of the variable-centred analyses indicated that the children's beliefs about their capabilities in everyday reading activities (i.e., intermediate level) increased over the 11-month study period. When person-centred analyses were used to examine varying trajectories of change, four distinct trajectories of change in reading self-efficacy were found. Two of the trajectories showed increasing self-efficacy – one with high initial self-efficacy ("*High Increasing,*" 75.8%) and the other with initially low levels of self-efficacy ("*Low Increasing,*" 8.8%). The third trajectory was characterised as relatively stable self-efficacy ("*Average Stable,*" 11.5%), and the fourth trajectory corresponded to low initial levels of self-efficacy which decreased over time ("*Low Decreasing,*" 3.6%).

Moreover, the children's self-reported exposures to the efficacy-building experiences and changes in these experiences over time were found to be related with these developmental trajectories. The children with initially high and increasing levels of reading self-efficacy reported more positive efficacy-building experiences (i.e., experiencing mastery in reading tasks, receiving positive feedback on their reading skills, and relating to peers with good reading skills) (the effect sizes varied from 0.05 to 2.50) and had higher levels of reading skills than the children with other trajectories (these effect sizes ranged from 0.47 to 1.90). The children in the two trajectories with low initial self-efficacy reported less mastery experiences and more negative emotional arousal. They also exhibited lower reading skills than those with high and average initial self-

efficacy. Moreover, persistently low self-efficacy was found to be related to declining exposure to social sources of self-efficacy over time (i.e., verbal persuasions and vicarious experiences).

The findings indicated substantial variability in the level, direction, and rate of change in the children's reading self-efficacy over time, highlighting the need to examine individual differences in self-efficacy development. As efficacy-building experiences and changes in them were found to vary in relation to changes in self-efficacy, attention should be paid to how readers perceive and interpret experiences that are assumed to build self-efficacy (i.e., learning experiences, feedback, and social persuasions). Children with persistently low self-efficacy may need continuous and more explicit social sources of self-efficacy support, such as targeted feedback and coping models, to have positive efficacy-building experiences and maintain their reading self-efficacy. Educational practices sensitive to the individual needs of students may be required to support self-efficacy. Moreover, changes in reading self-efficacy and their sources should be monitored over time.

4 GENERAL DISCUSSION

This thesis explored the dynamic relationships between personal, behavioural, and environmental processes as theorised in social cognitive theory (Bandura, 1997). In this study, the theory was implemented in the context of reading. In the original theory, the beliefs we hold about our capabilities, that is, efficacy beliefs, are recognised as central forces directing our learning behaviours and processes. The first aim of this study was to examine these beliefs in the context of reading by analysing whether efficacy beliefs differ by specificity level (i.e., by generality of the reading context) in line with the theoretical reasoning and empirical evidence from older students. Second, the associations between efficacy beliefs, assessed in three different specificity levels, and reading fluency, and its development were examined to complement understanding of the longitudinal associations between self-efficacy and skill development. Third, the changes in self-efficacy over an 11-month-long study period were explored with the variable as well as person-centred approaches to broaden the existing understanding of the possible individual variation in the formation of children's efficacy beliefs in reading. Furthermore, to better comprehend the developmental dynamics of this formation, the interplays between individual change trajectories and changes in hypothesised sources of self-efficacy (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states) were examined. To achieve these aims, three studies were carried out among primary school children in Finland from Grades 2 to 5. The following sections present a detailed discussion of the findings and their implications.

4.1 Does specificity of self-efficacy matter?

The first aim, in Study I, was to examine the specificity of children's reading self-efficacy using Bandura's (1997) theorisation of the three specificity levels of self-efficacy in an as yet unexplored context of reading skills in primary school children. The specificity levels of self-efficacy were further validated in Study II

by examining the specific relationships between the different specificity levels and reading fluency and its development.

The findings of both Studies I and II showed that the manner in which self-efficacy is measured (i.e., the level of specificity) may considerably affect the interpretations we make of children's beliefs and their functional roles in reading achievement. First, the children's reading self-efficacy were found to differ at various specificity levels, namely general-, intermediate-, and specific-level beliefs. This suggests that the children's general beliefs of their reading capabilities (i.e., "I believe I can learn to read faster") may differ from their beliefs related to specific reading tasks (i.e., "I believe I can read this text"). Moreover, the children's efficacy beliefs differed to these specificity levels similarly among boys and girls and across the studied grades. Consequently, at an age as early as 8 years, children's beliefs in reading may differ depending on the specificity of those beliefs. Although social cognitive theory does not explicitly define when these beliefs are formed and begin to influence behaviour, it is assumed that the beliefs of younger children are less differentiated than those of their older counterparts (Bandura, 1997). The children between Grades 2 and 5 showed no evident differences; rather, they exhibited the same specificity levels as those of adults (Bong & Hocevar, 2002).

Second, gender- and grade-related differences in the strength of self-efficacy (i.e., whether the children had high or low self-efficacy) were found to vary by the studied specificity level of self-efficacy. Measuring multiple specificity levels simultaneously allowed for a comparison of the differences in them between different age groups (i.e., between Grades 2 and 5), which was not attempted in previous studies. The older children were found to have higher level (i.e., stronger) specific- and intermediate-level self-efficacy but not higher general-level self-efficacy than the younger students. These findings suggest that the inconsistencies between previous reports (c.f. Carroll & Fox, 2017; Smith et al., 2012) can be explained by the studied specificity level. It is also logical to suggest that as students' skills develop, so do their beliefs of their skills at task-specific levels; however, this kind of trend might not be evident in more general beliefs which may resemble more stable trait-like beliefs (Bandura, 1997; Marsh et al., 2019). In addition, the common assumption that girls are more confident of their literacy skills (Huang, 2013) or that gender role expectations favouring girls in reading (Martinot et al., 2012; Nowicki & Lopata, 2017) are represented in their beliefs was not supported for Finnish primary school children. Rather, boys were found to have higher intermediate-level beliefs than girls, but no differences were noted in the other specificity levels. This quite unexpected finding favouring boys may relate to the fact that in intermediate-level students were asked to rate their self-efficacy in recreational reading activities, including digital reading, which might be more popular among boys (Brozo et al., 2014). These findings thus advocate that specificity of self-efficacy should be considered when interpreting differences in children's beliefs. However, the gender differences in this study as well as previous ones tend to be small. Focusing on these differences may shift our attention from more relevant factors partly associated with but not

exclusively related to gender, exposing children to low beliefs. Rather than focusing on gender, studying individual variation in self-efficacy across genders might be more interesting and fruitful for explaining and understanding mechanisms behind the differences in reading self-efficacy, as the findings of Study III suggest. At the very least, researchers should be careful when interpreting and translating these findings in the public context so as to avoid reinforcing unjustified gender expectations and stereotypes.

Third, the findings of Study II revealed that the beliefs at the three specificity levels showed varying associations with reading fluency and its development. Whereas the children's general efficacy beliefs did not relate to their reading fluency or its development, their specific self-efficacy related to their reading fluency, and their intermediate self-efficacy both to fluency and also to its development. In line with prior findings in adolescents and adults (e.g., Bong, 2001, 2002a; Pajares, 1996), the specificity was found to influence the associations between self-efficacy and skills and skill development also in children. This influence also extended to the reading context, where three different specificity levels are rarely considered together.

Fourth, this study was the first to show that reading self-efficacy is positively related to the development of reading fluency over time. The finding is somewhat contradictory of previous observations, in which general academic self-efficacy failed to predict reading fluency development among Grade 5 students (Mercer et al., 2011) as well as overall reading development (Galla et al., 2014; Hornstra et al., 2013). However, in the present study which focused explicitly on reading self-efficacy, the more specific intermediate-level self-efficacy predicted fluency development. Although children's general beliefs of their academic capabilities may not predict their reading development, the more specific intermediate-level beliefs related to applying reading capabilities in everyday reading tasks appear to be linked to their reading fluency development. Thus, considering the ways in which self-efficacy is being measured and conceptualised is important when interpreting research findings regarding the functional role of reading self-efficacy.

From both the theoretical and empirical perspectives, the finding that the beliefs children have about their capabilities in everyday reading activities especially relate to their reading development is of the utmost relevance. Achieving fluent reading skills is a key learning goal in primary school years and yet poses a challenge for many students. To find better ways to promote and support reading development, a refined understanding of the beliefs that relate to this development seems relevant. Low beliefs may further lead to negative learning paths, as children with low self-efficacy appear to avoid situations requiring them to read, give up challenging tasks and expend little effort (Baker & Wigfield, 1999). Moreover, the exposure to print is fundamental in reading development (Share, 1995, 2008). Better understanding of the role of efficacy beliefs in these kinds of developments may help to prevent the negative cycles that low beliefs may lead to.

Self-efficacy researchers have long been puzzled about the optimal correspondence between self-efficacy and achievement. It has been emphasised that the particular beliefs children have in mind when confronted with achievement tasks guide their behavioural engagement with those tasks and thus relate to their achievement behaviours (Bandura, 1997). However, there has been little consideration about what these beliefs are in the context of reading. In this study, self-efficacy for everyday reading tasks (i.e., at the intermediate level), that is, self-efficacy for carrying out reading tasks that likely require effort and persistence, predicted reading development. Somewhat surprisingly, the most specific beliefs were not related to reading fluency development even though they were related to the concurrent level of reading fluency. This finding, however, is in line with notions that over time, finer-grained beliefs may not hold strong predictive power (Marsh et al., 1997). This may be due to the fact that as task-specific beliefs, they may also change more rapidly and thus they do not directly relate to behaviours over longer periods of time.

Conversely, general beliefs were also not related to reading development, supporting Bandura's ideas (1997, p. 42) that

> …global beliefs lose predictiveness when the influence of specific beliefs is removed.

This was at the first time attested in this study as the unique variances of each specificity levels in reading (after taking into account the shared variance) were analysed separately. It is possible that general beliefs may contain more variation with regard to the skills children have in mind when responding as it may be more difficult for children to form a general view of their capabilities (see also Guthrie et al., 2007). These ideas are supported by the finding that general beliefs are found to be more biased or mis-calibrated than task-specific beliefs (Talsma et al., 2020). These findings, however, do not suggest that general beliefs are irrelevant in learning. For example, changes in general academic self-efficacy are found to link to overall changes in reading performance (Galla et al., 2014; Hornstra et al., 2013; Hornstra et al., 2016). Thus, although these findings provide implications for the measurement of self-efficacy, continued research efforts are needed in order to understand what kinds of beliefs affect children's learning behaviours and achievement (i.e., what is the optimal correspondence between self-efficacy and achievement), and how these beliefs are best captured. Moreover, it is obvious that there is no right way to measure self-efficacy. Rather, researchers should measure self-efficacy in various ways, depending on their research aims and goals, and interpret the findings accordingly. When the aim is to predict general behaviours or achievement, more general beliefs might be assessed. However, when more specific achievement and behaviours are to be predicted, more specific beliefs might be studied.

4.2 Diverse changes in self-efficacy and sources of self-efficacy

To complement current understanding and to help to clarify the inconsistent prior findings regarding changes in self-efficacy, both the variable- and person-centred approaches (see Bergman & Trost, 2006; Howard & Hoffman, 2018; Woo et al., 2018) were used to examine changes in self-efficacy in the present study. Further understanding of the formation of efficacy beliefs was gained by examining the experiences (i.e., the four sources of self-efficacy) that have been theorised to relate to diverse changes in children's self-efficacy. These developmental dynamics were examined over the above-mentioned 11-month period.

In general, self-efficacy was found to change significantly, and the children's beliefs in their reading capabilities to increase over the study period, supporting the only previous finding related to changes in reading self-efficacy among secondary school students (Schöber et al., 2018). That is, changes in reading self-efficacy were positive over a year rather than following the general motivational decline over school years documented in related self-constructs, such as self-concept and expectancies for success (e.g., Scherrer & Preckel, 2019; Wigfield et al., 1997). Theoretical postulations may offer one explanation for these differing changes in related self-constructs. Self-efficacy is considered to change through efficacy-building experiences, called sources of self-efficacy and the most powerful source being the interpretations of previous accomplishments (i.e., mastery experiences). This means that the beliefs are assumed to develop in tandem with growing abilities. Thus, over time, children likely become more confident of their capabilities as they procure more of these experiences. In related self-constructs, the motivational decline has been explained by the stage-environment fit theory (Eccles et al., 1993), which suggests an increasing mismatch between the needs of students and the environment over time. In addition, increasing social comparisons with the performance of others as well as dimensional comparisons with regard to achievement in other domains may lower one's self-perceptions in a particular domain (Marsh et al., 2019). Thus far, knowledge of the changes in self-efficacy is limited for making far-reaching conclusions, especially with regard to developmental changes over longer periods of time. In addition, the operationalisation of self-efficacy should be considered when interpreting the findings, as discussed later in this section.

In this study changes in children's reading self-efficacy were, for the first time, examined with the person-centred analyses. In this way new understandings about self-efficacy development could be gained. Namely, four different patterns of changes in children's reading self-efficacy emerged. Two of the trajectories were characterised by increasing self-efficacy over the study period—one with high ("*High Increasing,*" 75.8%) and the other with low ("*Low Increasing,*" 8.8%) initial self-efficacy levels, following variable-centred findings. Self-efficacy remained relatively stable for the children in the third trajectory ("*Average Stable,*" 11.5%), whereas those in the fourth trajectory ("*Low Decreasing,*"

3.6%) were characterised by low initial and even lower self-efficacy levels over time. The finding that all children do not follow the same patterns of change (rather, their self-efficacy develop differently) seems particularly salient. Focusing solely on average changes in self-efficacy with variable-centred methods would have hidden these diverse change trajectories. Moreover, the heterogeneity found in changes in children's self-efficacy increases our understanding of the formation of self-efficacy, as it shows that some students are more vulnerable to decreased confidence in their reading skills. This previously neglected heterogeneity in changes in self-efficacy may also explain varying prior findings among previous studies. More importantly, this knowledge about varying patterns of changes can be used to design instructional practices for those especially in need of support.

The various trajectories of change were observed when children's beliefs about their capabilities to successfully perform everyday reading tasks (i.e., at the intermediate level) were assessed. It has been suggested that more specific beliefs may change to a greater extent from day to day (i.e., be more state-like), whereas general beliefs may be more stable over time (i.e., exhibit more trait-like characteristics) (e.g., Marsh et al. 2019). In addition, task-specific judgments of one's capabilities seem to be more malleable (Unrau et al., 2018). In this study, changes were examined in one specificity level only, and if more general efficacy beliefs were studied, the findings related to the changes might possibly have differed. For example, in a previous study, all the change trajectories in SCA in literacy (Archambault et al., 2010), which is similar to the operationalisation of reading self-efficacy at the domain level in prior studies, were found to decline rather than increase over time. To increase our understanding of self-efficacy, it appears that more emphasis should be laid on which kinds of efficacy beliefs are being examined, as beliefs at different specificity levels may be apt to changes in disparate ways. Changes and fluctuations in children's beliefs might be better captured with task-specific measures.

Overall, the findings of Study III showed that changes in children's beliefs fluctuate according to efficacy-building experiences (i.e., sources of self-efficacy) and changes in these experiences over time. Importantly, this finding extends previous cross-sectional evidence of the relationship between self-efficacy and sources of self-efficacy (e.g., Sheu et al., 2018; Usher & Pajares, 2008) to the longitudinal interplay between these two. As the prior literature has not examined this theoretically assumed dynamic association, these findings provide novel insights into the formation and changes in self-efficacy in children. Confirming this dynamic interaction seems important for the application of the theory for learning basic skills, such as reading. More importantly, this study makes a unique contribution to self-efficacy research by revealing that children experience learning events, environments, the messages conveyed to them, and their emotional states differently, and that these varying experiences affect the development of their efficacy beliefs. By using the person-centred approach and longitudinal data, novel insights in the individual processes in which children's efficacy beliefs are being formed were gained. This variability may provide one

plausible explanation for inconsistent previous findings (Phan, 2012a, 2012b) concerning the associations between sources of self-efficacy and changes in self-efficacy.

Then, what kinds of experiences were related to the diverse changes in children's beliefs of their capabilities in reading? Children in the trajectory characterising high and increasing levels of self-efficacy reported more efficacy-building experiences and had higher reading fluency skills than their counterparts with other trajectories, which is in line with the previous cross-sectional evidence (Butz & Usher, 2015). These children experienced mastery in previous reading tasks, positive persuasions with regard to their reading skills, role models in reading, and low and continued diminishing negative arousal in situations that required them to read. Moreover, this positive interaction persisted over a year extending the prior correlational findings (Butz & Usher, 2015). That is, these children experienced positive sources of self-efficacy over time. By contrast, low levels of mastery experiences and positive feedback, as well as high negative arousal and low reading fluency skills characterised children in the two initially low self-efficacy trajectories. More importantly, although the children in these initially low self-efficacy trajectories did not differ in their initial levels of source experiences nor in their reading fluency skills, they showed disparate experiences of these sources over time. Thus, this work broadened the understanding of the role of the efficacy-building experiences over time by showing that the lack of social sources of self-efficacy support over time was the most harmful aspect for young children's self-efficacy development. That is, diminishing levels of perceived positive feedback, encouragements, and verbal persuasions with regard to their reading skills and experienced vicarious models over the year characterised the children who lost confidence in their reading capabilities.

The finding concerning the role of social encouragements is well understood in light of prior research in related achievement motivation theories, which has conveyed the importance of teacher support (Lazarides et al., 2019) and teachers' perceptions of students' abilities (Upadyaya & Eccles, 2015) in predicting changes in students' motivational profiles and their perceptions of reading ability. This study further informed us of children's own experiences of this support and, additionally, of the changes in their experiences of this support over time. However, it is not known why these children experienced the lack of this support: are they given less feedback and persuasions, or do they perceive the feedback they receive on their reading performance or vicarious models to be unencouraging? This may be particularly true for low-performing children who do not experience all the feedback and messages they receive as persuasive or encouraging but rather seem to ignore it (Vehkakoski, 2020). Some students may be generally less willing to receive feedback (Zumbrunn et al., 2016), which may relate to how they interpret and perceive that feedback. Thus, increased understanding of how students perceive and interpret feedback could help in developing more efficient means for supporting learners.

Similarly, the children whose beliefs in their skills decreased also experienced lack of vicarious models over time. It seems that all the children did not perceive reading models as being identifiable with their school classes and environments. This aspect may relate to the students' reference groups and learning environments, as these students also had lower reading skills. Low performing students may not identify themselves with the high or average performers in class. Therefore, learning environment may have significant effects for the vicarious models encountered by students as well as the perceived reference group, as discussed later. More knowledge of the subjective interpretations of the vicarious models is needed; that is, it is important to understand how children find and recognise these models. This knowledge could help to develop efficient means and practices to develop learning environments enhancing these experiences as well as support children to find and identify with these models. Moreover, diverse vicarious models (e.g., peers, parents, or teachers) may be important to different extents (Ahn et al., 2017; Usher & Pajares, 2008). Capturing the vicarious experiences of these students is challenging in that these experiences may be rather implicit, and thus, varying research methods may be required to identify them.

As per the hypothesis, mastery experiences remained high for children whose self-efficacy increased over time, and conversely**,** they remained low for those whose self-efficacy decreased over time. Ensuring experiences of success seems to be of the utmost importance for positive self-efficacy development. However, to widen our understanding of these experiences, it is crucial to understand what kinds of experiences children interpret as successes and failures in reading, and whether and how they differ in these interpretations. In accordance to prior operationalisation of mastery experiences, the children were asked to evaluate their perceptions of their reading skills and general views of their abilities to master reading. This operationalisation of mastery experience actually comes close to that of self-concept. To increase our understanding of children's interpretations of their performance and their experiences of success, also other ways and operationalisations to assess this source should be considered.

This study is among the first to examine the four source experiences in reading with a questionnaire, allowing the assessment of experienced levels as well as changes in these experiences over time. These findings also broaden researchers' understanding of students' experiences, as a younger sample of children was investigated in this research. It seems that when children are directly asked to rate their levels of source experiences, observations that complement and extend prior findings can be made. The first novel finding, namely that individual changes in children's source experiences relate to the formation of their reading self-efficacy, was possible as changes in these experiences could be assessed. According to the second novel finding, some source experiences, such as experiences related to negative emotional arousal, were more evident in this work than in prior research (Butz & Usher, 2015). It may be that some sources are better captured when direct statements are to be

rated. It might be easier for a child to give responses to specific statements and rate their levels of experiences (such as bodily arousals) as opposed to verbalising those experiences (see Marsh et al. (2005) for a discussion). Prior knowledge about the negative emotional arousal related specifically to reading has been limited (for exceptions, see MacDonald et al., 2021; Ramirez et al., 2019). The influential role of emotions in achievement situations (Pekrun, 2006) and the role negative emotions has been documented especially in the context of learning mathematics (see Barroso et al., 2020). Different methodological approaches seem to enrich our understanding of the emotional experiences in reading as well. In future, studying children's efficacy-lowering experiences specifically (e.g., failure experiences and negative feedback) (Usher et al., 2019) and experiences beyond the four sources of self-efficacy (Butz & Usher, 2015) might help researchers and practitioners to better understand children's experiences and design support for those with low beliefs in their capabilities.

4.3 Theoretical implications

This study has several theoretical implications. First, the findings extend and refine our understanding of the interactions between personal (reading self-efficacy), behavioural (reading fluency), and environmental (sources of self-efficacy) processes postulated in social cognitive theory in the context of reading and among primary school children (Figure 3). By showing that self-efficacy predicts reading fluency development, important extensions to our knowledge of how these beliefs affect learning over time could be made. The premise that the four sources are actually sources of self-efficacy as theorised and predict self-efficacy development was verified as changes in sources of self-efficacy and changes in self-efficacy were found to relate. In this way this study answers to the call for attention to the dynamic nature of motivation constructs, and to the bidirectional effects in their relations with achievement (Eccles & Wigfield, 2020; Schunk & DiBenedetto, 2020). The findings add to understanding of this dynamic by explicating the specific role that children's task-specific beliefs as well as their own experiences of learning environment have in learning.

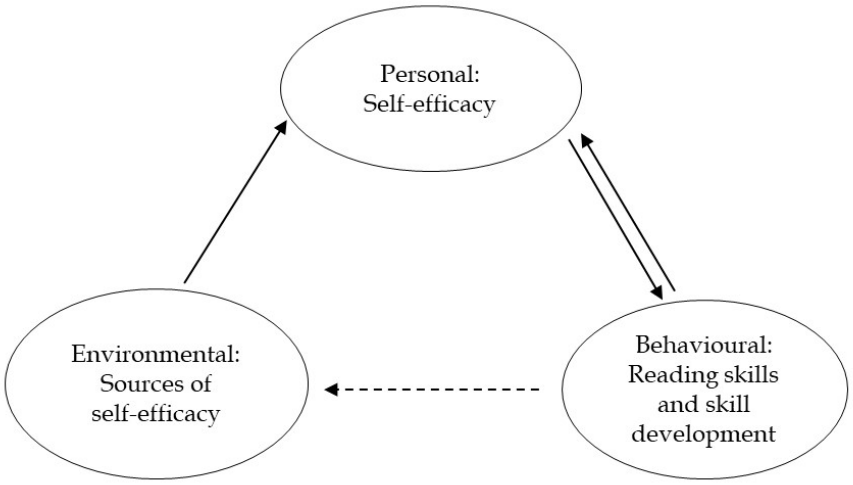

FIGURE 3 Interactions between personal, behavioural, and environmental influences examined in the present study of the triadic interactions described by Bandura (1986, 1997). The dashed line describes an indirect path.

Second, the findings highlight the added value of focusing on individual variability in self-efficacy formation. Although social cognitive theory suggests that learning processes are individual, most self-efficacy studies have focused on average associations and general-level variation. The novel findings that the formation of self-efficacy varies between children and that self-efficacy develops partly through different experiences refine theoretical understanding of the formation processes of these beliefs. These findings open up paths for further research on these individual formation processes of self-efficacy. These findings also highlight that when aiming to understand children's self-beliefs the individuality in the development should be considered. New methodological approaches examining these formation processes and the variations in them in real-time learning situations (e.g., experience sampling, Martin et al., 2020; intra-individual SEM, Malmberg et al., 2020) could be one avenue to extend our understanding of these individual processes.

Third, the findings strengthen the theoretical arguments of specificity of self-efficacy as well as the correspondence of self-efficacy and achievement as theorised in social cognitive theory (Bandura, 1997) to a new learning context and younger children. Moreover, by showing that the predictive utility of self-efficacy differs by the studied specificity level notably complements the theoretical understanding of how these beliefs affect over time (see Schunk & DiBenedetto, 2020). These findings substantiate the notions of operationalising self-efficacy as task-specific beliefs of one's capabilities (Bong, 2006; Schunk & DiBenedetto, 2020). Task-specificity, which is seen as the key distinctive characteristic between self-efficacy and related self-beliefs, seems to be important for the functional role of self-efficacy in learning. This increased understanding of the specific effects of self-efficacy in reading development can help to better recognise the possible varying role of diverse self-beliefs in the early phases of skill acquisition. Capturing those beliefs that may change and may be more

malleable is important also from the point of view of designing support and interventions for children's beliefs.

Fourth, the findings of this study enhance researchers' understanding of the early dynamics and formation of efficacy beliefs and especially of the variability in them, which can help shed light on the best ways to support positive self-efficacy development from early on. By showing that children as young as 8 to 9 years differ in their beliefs and source experiences, and that self-efficacy affects their consequent learning, the findings somewhat challenge the notion that young children are less capable of evaluating their beliefs and experiences than those with more developed self-appraisal and cognitive skills (Bandura, 1997; Harter, 2012). However, the theory needs further specification with regard to when these beliefs are formed and start to influence learning. Related research has shown the importance of reading self-concept already in kindergarten years (Viljaranta, et al., 2017). It should also be further studied how the diverse self-beliefs develop together and influence each other.

Finally, variations in children's own experiences of the information they receive in their environments were revealed by this work, supporting the idea that information received from the environment (i.e., feedback, models) is not the same as source experiences (Bandura, 1997). The same environmental input can be interpreted differently as children select, weigh, and interpret the information they gather in their environments. For example, as Bandura (1997, p. 81) proposed, beliefs might form a lens through which experiences are interpreted:

> …the extent to which people will alter their perceived efficacy through performance experiences depends upon, among other factors, their preconceptions of their capabilities.

Increased understanding of the variation in the formation processes of self-efficacy might be possible if knowledge of how and why children differ in their experiences and interpretations of the messages, they receive in their learning environments could be gained. In this mission, integrating the ideas of social cognitive theory and other achievement motivation theories, such as of expectancy value theory, together might be fruitful. For example, in expectancy value theory, the environmental and cultural influences (such as parents' role, school environment) and the processes through which they are assumed to affect motivation and achievement choices, are presented in more detail (see Eccless & Wigfield, 2020). The perceived environment, that is, children's own perceptions and interpretations, on the other hand, are considered in detail in social cognitive theory framework. One possibility would be to study the environmental influences (such as learning environment, observations of teacher behaviours, real feedback, and teacher–child interactions) and physiological reactions (such as autonomic nervous system reactions) and to compare and contrast how they are linked to the child's interpretations of these environmental and inner stimuluses. In other words, it would be interesting to see whether the child interprets, for example, the received feedback the way teachers and researchers assume they would interpret it. These interpretations may make the difference to

how the child sees her or his capabilities. The new approaches which enable studying and disentangling students' subjective experiences of and more objective characteristics of learning environments from each other (experience sampling method, see Moeller et al., 2020), could help in widening our understanding of the variation in children's experiences as well as in their beliefs.

Another possibility to acknowledge this variation would be to consider the individual characteristics of children, such as temperament and interpersonal skills, that may relate to the way children interpret feedback and their sensitivity to their environmental influences as well as to their inner messages (such as affective arousal). These individual characteristics are found to influence self-beliefs in studies using related theoretical frameworks, such as those implementing expectancy value theory. It has been suggested, for example, that children with an inhibited temperament have lower perceptions of their skills, which further mediates the association between their temperament and achievement (Viljaranta et al., 2020). Studying whether and how temperament affects source experiences and interpretations of learning situations and how these go on to form perceptions of students' capabilities could help researchers and practitioners to consider the diverse needs of students more comprehensively. Challenging the social cognitive view of the formation of self-efficacy through learning experiences, Waaktaar and Torgersen (2013) suggested that self-efficacy is highly genetically influenced. Considering these kinds of complementary approaches and integrating the understanding that comes from different theoretical frameworks together could extend our understanding of the formation of processes of children's self-beliefs in general. Although findings of this thesis provide important extensions to the social cognitive theory, much still needs to be learned about how the theory should be implemented and the new findings be applied during instruction to support learners more effectively.

4.4 Practical implications

The key highlight of this study with regard to practical implications relates to the importance of the beliefs that children have about their capabilities in reading for their learning as early as primary school. The findings thus suggest that educators, practitioners, and parents should be attentive to children's beliefs and aim to identify and support children with maladaptive beliefs.

First, this study extends the knowledge of efficacy beliefs in reading by showing that children hold multiple beliefs of their capabilities, which differ according to the specificity of those beliefs. Hence, children might feel efficacious in reading in general but not for specific reading tasks. Practitioners should be attentive to this variety in children's beliefs and try to understand the kinds of situations that lead students to believe or disbelieve in their skills while supporting their beliefs. The findings of the present study emphasise that teachers as well as parents should be especially sensitive to children's beliefs

related to their capabilities to perform everyday reading tasks. Moreover, the notion that children's beliefs develop differently over the year, with some children's beliefs of their capabilities tending to decrease, advocate the importance of monitoring these beliefs over time. One way to gain insights into children's beliefs would be to ask all children to complete a short self-efficacy questionnaire and thereafter place more emphasis on those children who score low by interviewing them for their experiences and observing their reading behaviours.

Supporting children's efficacy beliefs seems crucial as low efficacy beliefs were found to relate to lower reading skills and, furthermore, to slower reading development in the early years of schooling when reading fluency develops. Low beliefs might thus hamper all learning, as dysfluency in reading affects learning in most school subjects. Furthermore, low beliefs of one's everyday reading activities may be especially harmful if a child avoids activities that make them feel inefficacious, as reading skills develop in these everyday contexts and activities. This new understanding emphasises the need for self-efficacy support in educational practices at an early stage in order to tackle the negative effects of low efficacy beliefs on skill development. Conversely, positive development in reading fluency may spark reading enjoyment and engagement (van Bergen et al., 2020) and further encourage all learning. More knowledge is needed on how these beliefs affect children's learning behaviours as well as reading habits and engagement in school and home environments.

Although this particular study cannot inform us whether supporting these beliefs affects students' skills, some promising findings show that children's reading self-efficacy is malleable through intervention and related to corresponding changes in their skills (Aro et al., 2018; Unrau et al., 2018). Moreover, it seems that mere improvement in reading skills does not transfer to the improvement in beliefs of one's capabilities in low-performing students, at least during short follow-up periods (Aro et al., 2018; Morgan et al., 2008). Rather, some children may need more targeted efforts to support their positive self-beliefs, as discussed further below. High self-efficacy is found to help children to benefit also from reading fluency support more (Ronimus et al., 2020), which further substantiates the importance of considering children's self-efficacy when supporting their reading skills.

The finding of this study that changes in the source experiences are related to the changes in children's beliefs of their capabilities in reading over time is of the utmost relevance for instructional practice. This finding highlights the importance of fostering positive efficacy-building experiences of all children, but especially those with low beliefs and low skills. Teachers and parents have an essential role in enabling these experiences as well as acknowledging and helping children to interpret learning events positively. Some children seem to be trapped in a negative cycle, as their low levels of positive source experiences lead to lower beliefs of their skills, which is likely also related to lower skill development in the future. To stop and even prevent such a vicious cycle, researchers and practitioners should develop support methods promoting positive efficacy-

building experiences, positive self-efficacy, and reading fluency simultaneously (Aro et al., 2018). The bidirectional patterns of influence between self-efficacy and reading skills found in this study further support these implications. Overall, these findings suggest that when teachers monitor, evaluate, and assess students' developing skills they should be sensitive to the beliefs students have of their capabilities, student's experiences about learning (e.g., their interpretations of feedback and individual emotional reactions), and the fluctuations in both. In addition, parents should be mindful in encouraging their children and providing support for their learning (Song et al., 2015).

The variations detected in changes in children's self-efficacy indicate that self-efficacy should be monitored and supported in ways sensitive to diverse student needs at varying times. For some children, ongoing support may be needed (Aro et al., 2018). The findings of this work relating to the most vulnerable group of students, namely those with low beliefs and low skills, highlight the importance of social aspects of learning support, that is, the roles of feedback and persuasions as well as vicarious role models. The lack of social sources of self-efficacy support seems to be especially harmful to children who already perceive themselves as poor readers. Low-performing children seem to be less responsive to inexplicit positive feedback ("You can do it" or "Well done") (Vehkakoski, 2020), which seems understandable, since they might not perform as well as their classmates and may thus consistently experience failure. Rather than positive general feedback, providing explicit and targeted feedback linked to the child's effort and progress in learning, substantiated with concrete evidence of learning progress and efforts, might be one way to challenge the low perceptions of one's capabilities (Pajares, 2006; Schunk, 1992). Finland's national core curriculum (Finnish National Agency for Education, 2016) emphasises that children's positive views of themselves should be supported, encouraging feedback should be provided to reinforce students' trust in their own potential, and feedback and assessment practices should focus on the learning process rather than its outcomes. However, little is still known of how the ideas presented in the curriculum are implemented in schools, and whether teachers have the necessary knowledge and tools for realising these ideas in practice. The suggestions provided by this study regarding the experiences that might help students to build confidence in their skills as well as the ideas of the feedback practices teachers might use when aiming to cultivate their students' beliefs of themselves in reading, could provide some viewpoints. Furthermore, the ideas of social cognitive theory are easily adaptable to daily teaching practices.

Teachers would be well advised to be sensitive to whom students perceive as models and whether such models are available for them to identify with. Children with low self-efficacy might benefit more from identifiable coping models (Pajares, 2006; Schunk et al., 1985, 1987), namely those who have difficulties and make errors but can overcome and cope with their difficulties, than mastery models. In other words, they might benefit specifically from seeing others similar to them succeed (Usher & Pajares, 2006). Experiences of coping models could be offered through differentiation and small group working

practices. The reference group and comparisons with higher-performing classmates (i.e., the big-fish-little-pond effect, Marsh et al., 2008) are found to affect students' self-concepts; students in higher performing classes have relatively lower self-concepts (Marsh et al. 2008; Marsh et al., 2019). Although the big-fish-little-pond effect does not appear to directly influence children's efficacy beliefs (Marsh et al., 2019), it might have a role in the source experiences children gather in their learning environments. If the reference group performs well, the low-performing child may have difficulties in experiencing vicarious models as well as realising their own progress. Coping models and perceived reference groups might be one reason why low-performing students are found to have higher perceptions of their skills in special education classes than general classes (Kocaj et al., 2018). In addition, students are found to develop more positive reading self-concept when receiving special education support compared to those who do not receive it (Savolainen et al., 2018). Studying whether students' source experiences and self-efficacy differ in diverse learning environments could help to develop more optimal grouping practices and learning environments.

Experiences of success were found to be of the utmost relevance for building confidence in one's skills. Thus, differentiated reading instruction seems crucial, especially for the struggling readers to be able to experience success and witness their own skill development, albeit at a slower pace. This kind of support appears to be necessary, as low self-efficacy may lead to avoidance of challenging tasks and lack of effort or persistence (Galla et al., 2014; Schnell et al., 2015), which further diminishes the likelihood for mastery experiences in reading. Again, teachers' sensitivity to student's diverse needs seems essential. Children with low self-efficacy, however, might be especially challenging to assist, as they may hold the view that nothing can raise their self-efficacy (Usher et al., 2019). Therefore, it is essential to understand how responsive children with low beliefs are to support practices and interventions, and how they experience such supports. To support experiences of mastery, increased understanding of how the practices used, such as varying assessment and grading practices (Koenka, 2020; Koenka et al., 2019), affect children's self-beliefs is further needed.

Currently, technology-enhanced learning environments and distance learning challenge practitioners with regard to the ways to support students' learning. It seems timely to consider different possibilities to foster learners' confidence in succeeding in these environments as well as utilise the various opportunities these technologies offer, for example with regard to adaptivity. These environments hold promise for enabling increased individual monitoring and feedback of the learning. The implementation of such feedback systems should be carefully designed; utilising the theoretical and empirical bases of social cognitive theory of learning might be a fruitful approach here. With regard to adults, some promising findings show that support offered in online learning environments through the four sources of self-efficacy is beneficial for learning (Huang et al., 2020). More research on the optimal ways to support both learners'

skills and confidence in using those skills in new learning environments is needed.

4.5 Limitations of this study and suggestions for future research

This study has certain limitations that should be recognised when interpreting and generalising the findings. Moreover, these limitations shed light on the avenues for future research in self-efficacy. First, self-efficacy was studied in relation to reading fluency in all three sub-studies. While the results of this study are in accordance with the more substantial evidence in other skill contexts, the novel findings concerning the dynamic association between sources of self-efficacy and self-efficacy may not directly translate to other skill contexts. In addition, cross-cultural findings indicate that the social sources of self-efficacy in particular are evaluated differently, and consequently, may have varying roles in the formation of self-beliefs across cultures (Ahn et al., 2016; Usher & Weidner, 2018). These findings should thus be confirmed in other skill and cultural contexts too. In addition, this study was conducted in Finland and in a language context with a transparent orthography. Although reading fluency development is a common requirement for functional reading skill in all orthographies, the rate of reading development partly depends on the transparency of the orthography in question (for cross-linguistic comparisons, see Aro and Wimmer (2003) and Seymour et al. (2003)). Therefore, the particular time and age at which efficacy beliefs relate to fluency development might differ between varying orthographic contexts. Future research investigating the role of efficacy beliefs in reading fluency development in other languages would provide valuable information on these issues (for preliminary cross-sectional evidence, see Carrol and Fox (2017)).

It is also worth noting that although children's reading self-efficacy was related to their reading fluency development, this work did not explicitly study whether changes in self-efficacy induce changes in reading development. Thus far, there is no empirical consensus on the directions of the effects, namely whether skills enhance self-efficacy (as per the skill-development model) or whether self-efficacy enhances skills (in line with the self-enhancement model) (Calsyn & Kenny, 1977). Although the findings of this study support the self-enhancement model, the reciprocal effects were not directly examined, and thus, further research of these dynamics could amplify whether, for example, the directions of the effects change during development. Similarly, although longitudinal associations between changes in the sources of self-efficacy and self-efficacy were revealed, it was not confirmed whether changing these experiences would modify children's self-efficacy beliefs. Experimental intervention studies would thus be needed to inform us of the causal mechanisms of the effects among sources of self-efficacy, skills, and reading development (Aro et al., 2018). Increased understanding of the interactions between the environmental, personal, and behavioural processes, over longer development as well as changes and

interactions in the moment could help practitioners to design interventions to support positive learning processes in reading.

Moreover, it was beyond the scope of this study to examine the processes and mechanisms through which the beliefs possibly operate in reading skill development. Presumably children with high self-efficacy allocate more effort for reading tasks and spend more time with reading activities (e.g., Schiefele et al., 2012; Schüller et al., 2017). Therefore, future research should focus on the possible mediating processes between beliefs and skills in children.

Another limitation relates to the length of the follow-up period during which the changes in source experiences, self-efficacy and reading skills were examined. In this study, the children were followed up for a period of 11 months, with three measurement points. Although important notions regarding changes could be made, longer time periods are needed to capture developmental trends. On the other hand, more intensive data collection (with time series data or experience sampling, for instance, as described in Martin et al. (2020)) could offer a richer view about issues, such as how quickly can changes in pedagogical practices (differentiated tasks or supportive feedback) change children's experiences and their self-beliefs, and how likely are children to change their beliefs. Further, certain time points during the school year may be more important for the formation of self-beliefs than others (e.g., beginning of the school year and transitions to secondary school; for findings on competence beliefs, see Weidinger et al. (2018)). Thus, future studies should target these caveats. Better knowledge of these time points could inform researchers when efforts to support learner's beliefs might be especially beneficial.

This study focused on children's own beliefs and experiences in addition to their reading performance. Unfortunately, the factors relating to the social environments (such as school, classroom and teacher characteristics, pedagogical practices, or parenting styles) or socioeconomic backgrounds of the children were not explicitly considered. The variations in self-efficacy and reading skills due to the classes (i.e., ICCs) were found to be small, and therefore, they were not examined further. It should be noted, however, that special education classes were not considered in this study, which may relate to the low class-related variation. However, variations in environmental factors may especially affect the efficacy-building experiences children are exposed to in their environments. For example, class-related variations in the sources of self-efficacy might be examined in more depth in future studies. Although Finland has had rather small socioeconomic and demographic differences in reference to many other countries (e.g., Organisation for Economic Co-operation and Development, 2016), considering the role of socioeconomic differences in the formation of self-appraisals could inform us of whether this aspect should be considered to a greater extent in the Finnish context. For example, the vicarious models adolescents experience in their home environments partly vary depending on their socioeconomic backgrounds (Usher et al., 2019).

Some other important notions must also be considered as the participants of this study were children. The findings of this study show that with self-reports

we can get information of the variations in children's beliefs and experiences. The measures used to assess efficacy beliefs and experiences showed strong construct and criterion validity, and the constructs were assessed in a reliable and equivalent manner in younger and older children and between girls and boys (i.e., they were invariant; see Meredith (1993)). Furthermore, the items were designed to be age-appropriate, easy to understand and respond to, and efforts were made to ensure the ease of responding (e.g., every item was read aloud to the children). Although these issues increase the reliability of the findings and suggest that children are capable of evaluating their beliefs, some variation persists with regard to how children understand and respond to the scales. It is a challenging task for a child to report their experiences, as they need to memorise, weigh, and then generalise those experiences across times. It is likely that children recall the more recent experiences more easily. In future studies, behavioural measures (effort and persistence), interviews, and observations could be used together with survey data to complement understanding of children's experiences and beliefs and of the ways how they function in learning situations.

In line with previous findings, most children were highly confident of their skills and experienced high levels of positive efficacy-building experiences. Although it is encouraging that children have positive views of their capabilities, and slightly over-optimistic beliefs of one's skills could possibly lead to higher effort and better performance (Bandura, 1997; Pajares, 2006), for some children, overconfidence in their skills could cause negative consequences. Overconfidence, referred to as miscalibration of self-efficacy (Hattie, 2013; Klassen, 2002), can be harmful if it leads to maladaptive behaviours and disengagement, such as suppression of effort and persistence with reading tasks (e.g., "I don't' have to practice"). Mismatches between skills and beliefs can also lead to disappointments, frustration, and negative emotions in learning situations. Thus, although positive beliefs of one's capabilities seem beneficial, it is likely that for some students more accurate beliefs of one's capabilities might actually be more beneficial than overly optimistic beliefs. However, defining when and for whom self-efficacy is completely realistic or at the right "level" is a difficult empirical task (see for discussions Pajares, 2006; Talsma et al., 2019; Usher, 2015), and examining the (mis)calibration of children's beliefs was beyond the scope of the current study. Furthermore, there is no consensus on whether children are particularly likely to have miscalibrated self-beliefs or whether also adults are overly optimistic (Butler, 2005; Muenks et al., 2018). It is also not known to what extent and in what way large miscalibrations of one's capabilities are harmful for learning and performing. Thus, further research is needed to discover the most beneficial level of belief in one's capabilities with regard to learning, motivation, and psychological wellbeing, especially for children with low achievement levels.

Although self-efficacy was theoretically and conceptually differentiated from related constructs, such as self-concept, the empirical differentiation of these concepts was beyond the scope of the present study. A clearer

understanding of not only how these related self-beliefs link to each other, but also how they interact in affecting children's learning, engagement, and psychosocial well-being could help to support positive development. Studying different self-constructs together could also provide a better grasp of the formation processes of these beliefs. For example, in this way understandings of whether the development of more specific beliefs (such as self-efficacy) affects the development of more general beliefs (such as self-concept), as proposed by Bong and Skaalvik (2003) could be gained. A more explicit operational definition of self-efficacy in future research could help, on the one hand, to compare, and on the other hand, to integrate, the findings from different theoretical perspectives. This understanding could help in designing more comprehensive ways to promote positive developments in children's self-beliefs.

4.6 Ethical considerations

The data used in this study were collected as part of the Self-efficacy and Learning Disability Interventions (SELDI) study. The Ethical Committee of the University of Jyväskylä evaluated the research plan statement and the research procedures of this study, which were further modified using its suggestions for improvement. All the procedures used in this study followed the ethical principles prescribed by the Finnish National Board on Research Integrity (Finnish National Board on Research Integrity, 2009). The students participated voluntarily and written informed consent was obtained from their legal guardians. The participants were informed of the possibility to withdraw from the study at any time without negative consequences. Privacy and data protection were ensured by anonymising the research data, and the coding key was maintained separate from the data. The participants' privacy was guaranteed in all phases of the study. The data were stored in accordance with the guidelines of Ethical Committee of the University of Jyväskylä.

4.7 Conclusions

Overall, the findings of this work extend understanding of the functional role of children's beliefs concerning their capabilities in the context of reading fluency. The positive associations found between self-efficacy and reading development as well as the interactions between sources of self-efficacy and self-efficacy over time support the reciprocal interactions model introduced in social cognitive theory (Bandura, 1997). Children's beliefs of their capabilities seem to relate to their reading fluency and reading skills development. Furthermore, the development of such beliefs is guided through individual experiences, observations, and interpretations of learning events. In sum, the findings underline that learning is not merely a cognitive process of skill acquisition;

rather, it is also guided by the beliefs and experiences that children harbour. Not experiencing social sources of self-efficacy, such as encouraging feedback and vicarious models, seems especially harmful with regard to the formation of efficacy beliefs. This knowledge is important, especially to prevent the negative learning cycles that low self-beliefs and low skills may lead to.

SUMMARY IN FINNISH

Lukutaitoa tarvitaan nykymaailmassa lähes kaikkialla. Sujuva lukutaito, jolla viitataan lukemisen automatisoitumiseen (LaBerge & Samuels, 1974), mahdollistaa keskittymisen luetun sisältöön ja oppimiseen. Sujuvan lukutaidon saavuttaminen onkin keskeinen tavoite alakoulussa. Tällä hetkellä lasten lukutaidon kehityksestä ollaan kuitenkin huolissaan, sillä sekä lasten lukutaito, että lukemisen harrastaminen ovat laskussa (ks. esim. Ahonen, 2021). Lukutaidon kehitykseen vaikuttavista kognitiivisista tekijöistä on jo runsaasti tutkimusta. Myös ei-kognitiivisilla tekijöillä, kuten motivaatiolla näyttäisi olevan merkitystä tässä kehityksessä, vaikka tällaista tutkimustietoa on vasta niukemmin. Motivaatiotekijöistä taitojen kannalta merkityksellisimmäksi on useissa tutkimuksissa noussut minäpystyvyys, eli uskomukset, joita meillä on omista taidoistamme (Bandura, 1997). Myönteisten pystyvyysuskomusten on havaittu edistävän oppimista monin tavoin, muun muassa lisäämällä ponnistelua, sinnikkyyttä, oppimiseen kiinnittymistä ja oppimisella asetettuja tavoitteita. Tiedämme kuitenkin toistaiseksi varsin vähän siitä, millainen merkitys näillä uskomuksilla on lukemisessa, ja erityisesti lukemisen sujuvuuden kehityksessä alakoulussa. Teoreettisesti pystyvyysuskomukset kehittyvät neljän pystyvyyden lähteen kautta; (1) onnistumisten ja hallinnan kokemusten, (2) kannustuksen ja palautteen, (3) vertaiskokemusten sekä (4) tunnetilojen ja fyysisten reaktioiden tulkinnan kautta (Bandura, 1997). Pystyvyysuskomusten kehityksestä lapsilla sekä erityisesti siitä, miten pystyvyyden lähteet ovat yhteydessä tähän kehitykseen on kuitenkin niukasti empiirisiä seurantatutkimuksia. Lisäksi lasten pystyvyysuskomukset voivat kehittyä eri tavoin. Aiemmissa tutkimuksissa ei kuitenkaan ole hyödynnetty henkilökeskeistä tutkimusotetta, jonka avulla voitaisiin tarkastella mahdollisia yksilöllisiä eroja pystyvyysuskomusten kehityksessä sekä pystyvyyden ja pystyvyyden lähteiden välisissä kehityksellisissä yhteyksissä. Syvempi ymmärrys yksilöllisistä eroista auttaisi suunnittelemaan ja suuntaamaan tukea myönteisten uskomusten ja lukusujuvuuden kehitykseen täsmällisemmin.

Tämän tutkimuksen tavoitteena oli laajentaa aikaisempaa tietämystä siitä, millaisia uskomuksia lapsilla on omista taidoistaan lukijoina. Lisäksi tarkasteltiin sitä, miten nämä uskomukset liittyvät lukusujuvuuteen ja sen kehitykseen. Kolmanneksi, tavoitteena oli saada ymmärrystä siitä, miten nämä uskomukset muuttuvat, ja millaiset tekijät ennustavat erilaisia minäpystyvyyden kehityskulkuja. Tutkimuksen tavoitteena oli syventää aiempaa tietoa sosiaalisen oppimisen teoriasta a) tutkimalla pystyvyysuskomuksia ja pystyvyyden lähteitä aiemmin vähän tutkitussa lukusujuvuuden kontekstissa, b) keskittymällä alakouluikäisten lasten pystyvyysuskomuksiin, c) tutkimalla kehityskulkuja pystyvyydessä, lukusujuvuudessa ja pystyvyyden lähteissä yli ajan sekä d) hyödyntämällä henkilökeskeisiä tutkimusmenetelmiä pystyvyysuskomusten yksilöllisten kehityskulkujen tutkimiseen. Näihin tavoitteisiin vastattiin kolmessa osatutkimuksessa, joissa osallistujina olivat 1327 lasta vuosiluokilta 2.–5. Lasten pystyvyysuskomuksia, pystyvyyden lähteitä ja lukusujuvuutta mitattiin 3 kertaa 11 kuukauden

aikana osana laajempaa *Minäpystyvyys ja oppimisvaikeusinterventiot* (SELDI) -tutkimusta.

Ensimmäisen osatutkimuksen tavoitteena oli selvittää eriytyvätkö lasten pystyvyysuskomukset lukemisessa kolmen eri spesifisyystason (yleinen, keskitaso, spesifi) mukaisesti. Teoreettisesti pystyvyysuskomukset ovat tilanne- ja tehtäväsidonnaisia uskomuksia (Bandura, 1997), mutta empiiristä tutkimustietoa tästä on kuitenkin vain vanhemmilta oppilailta. Lisäksi tutkittiin eriytyvätkö tyttöjen ja poikien tai eri luokkatasoilla olevien oppilaiden pystyvyysuskomukset samalla tavalla. Konfirmatorinen faktorianalyysi osoitti, että lasten uskomukset eriytyivät eri spesifisyystasoilla (yleinen, keskitaso, spesifi). Sekä tyttöjen ja poikien että 2.–5.-luokkalaisten lasten uskomukset eriytyivät samalla tavalla. Tutkimuksen tulokset osoittavatkin, että uskomukset voivat olla erilaisia eri spesifisyystasoilla. Vaikka lapsi uskoisi omiin kykyihinsä lukemisessa yleisesti, hän ei välttämättä usko omiin kykyihinsä samalla tavalla tietyssä lukemisen tehtävässä. Lisäksi nämä erilaiset uskomukset olivat eri tavoin yhteydessä lukemisen sujuvuuteen vahvistaen aiempia tutkimuslöydöksiä vanhemmilla oppilailla. Vahvimmin lukutaitoon olivat yhteydessä arkielämän lukemistilanteisiin liittyvät pystyvyysuskomukset. Tutkimuksen tulokset lisäävätkin ymmärrystä siitä, millaisia lukemiseen liittyvät uskomukset ovat varhaisvaiheessa sekä siitä, millaisia uskomuksia olisi tärkeä tukea käytännössä.

Toisen osatutkimuksen tavoitteena oli tutkia, miten lukemiseen liittyvät psytyvyysuskomukset ovat yhteydessä lukemisen sujuvuuden kehitykseen. Lisäksi tavoitteena oli syventää ensimmäisen osatutkimuksen löydöksiä siitä, ovatko eriytyneet uskomukset (spesifisyystasot) eri tavoin yhteydessä sujuvuuden kehitykseen tutkimalla jokaisen spesifisyystason omaa yhteisvaihtelua lukusujuvuuden kanssa. Rakenneyhtälömallinnos osoitti, että pystyvyysuskomukset olivat yhteydessä lukutaitoon ja sen kehitykseen. Lisäksi nämä yhteydet olivat samanlaisia 2.–5-luokkalaisilla oppilailla. Kun jokaisen spesifisyystason omaa yhteisvaihtelua lukemisen sujuvuuden kehityksen kanssa tarkasteltiin, ainoastaan arkielämän lukemistilanteisiin liittyvät pystyvyysuskomukset (keskitaso) ennustivat sujuvuuden kehitystä (selittäen 2.8–7.8 % kehityksen vaihtelusta). Toisin sanoen, mitä enemmän oppilas uskoi omiin taitoihinsa arkielämän lukutilanteissa, sitä nopeammin hänen lukutaitonsa kehittyi. Aiemmissa tutkimuksissa minäpystyvyyden ei ole havaittu olevan yhteydessä lukutaidon kehitykseen, mutta nämä tutkimukset ovat kohdistuneet yleiseen akateemiseen minäpystyvyyteen. Tämän tutkimuksen tulokset tuovatkin tärkeää tietoa siitä, että lasten uskomuksia on tärkeä tutkia ja havainnoida tarkemmin myös lukemisessa. Tutkimuksen tulokset myös vahvistavat aiempia havaintoja siitä, että tiettyyn tehtävään tai tilanteeseen liittyvät uskomukset näyttävät olevan voimakkaammin yhteydessä samankaltaisessa tehtävässä suoriutumiseen kuin yleisemmät uskomukset.

Kolmannen osatutkimuksen tavoitteena oli tarkastella, miten lukemisen pystyvyysuskomukset kehittyvät. Lisäksi selvitettiin, miten minäpystyvyyden lähteet ja niissä tapahtuvat muutokset ovat yhteydessä pystyvyysuskomusten kehitykseen. Muuttujakeskeistä analyysimenetelmää (kasvukäyrämallinnos)

käyttäen saatiin selville, että lasten usko omiin kykyihinsä kasvoi vuoden aikana. Yksilöllisiä kehityskulkuja ryhmittelevällä kasvukäyrämallinnoksella tarkasteltaessa kuitenkin selvisi, että lasten pystyvyysuskomukset kehittyivät eri tavoin. Suurimmalla osalla lapsista (75.8%) oli myönteiset uskomukset omista taidoistaan ja uskomukset kehittyivät vielä myönteisimmäksi seurantajakson aikana, tai uskomukset itsestä pysyivät keskitasoisina (11.5%). Osalla niistä lapsista, joiden uskomukset omista taidoista olivat aluksi heikkoja, usko omiin kykyihin vahvistui seurantajakson aikana (8.8%), kun taas pienellä osalla lapsista usko omiin taitoihinsa heikkeni vuoden aikana (3.6%). Minäpystyvyyden lähteet ennustivat minäpystyvyyden kehitystä siten, että korkeampi lähteiden taso oli yhteydessä myönteisempään kehityskulkuun pystyvyysuskomuksissa. Myönteisellä kehityskululla olevilla lapsilla oli parempi lukutaito, enemmän myönteisiä kokemuksia onnistumisista, kannustavasta palautteesta, vertaiskokemuksista sekä vähemmän negatiivisia tunnekokemuksia seurantajakson aikana. Ne lapset, joiden usko omaan pystyvyyteensä heikkeni kokivat puolestaan vähemmän myönteisiä minäpystyvyyden lähdekokemuksia ja heillä oli heikko lukutaito. Nämä lapset kokivat myös vähemmän kannustusta ja myönteisiä vertaiskokemuksia tarkastelujakson aikana. Koska lasten uskomukset kehittyvät osin eri tavoin, sekä lasten pystyvyysuskomuksia että heidän kokemuksiaan oppimistilanteista olisi tärkeä seurata. Tutkimuksen tulokset korostavatkin lukemiseen liittyvien onnistumisten kokemusten takaamisen tärkeyttä, kannustavan palautteen merkitystä sekä positiivisten vertaismallien merkitystä myönteisten lukemiseen liittyvien uskomusten tukemiseksi. Lisäksi tulokset painottavat varhaisten tukitoimien tärkeyttä, sillä osalla lapsista kielteisiä kehityskulkuja esiintyy jo varhain.

Kaiken kaikkiaan tutkimuksen tulokset osoittivat, että lukemiseen liittyvät pystyvyysuskomukset ovat merkityksellisiä lukusujuvuuden kehittymisen kannalta jo alakoulun varhaisvaiheesta lähtien. Tutkimustulokset laajentavat näin aiemman kirjallisuuden löydöksiä pystyvyysuskomusten merkityksestä lukemissujuvuuden kontekstiin. Lisäksi lasten uskomukset näyttävät kehittyvän eri tavoin jo varhain, ja osa lapsista näyttää ajautuneen kielteiselle kehälle, jossa he kokevat vähän myönteisiä oppimista tukevia kokemuksia, heillä on heikko usko omiin kykyihinsä ja heidän lukutaitonsa kehittyy hitaammin. Tutkimuksen tulokset tarjoavat näin empiiristä tukea sosiaalisen oppimisen (Bandura, 1997) teorian perusajatukselle, jonka mukaan oppiminen tapahtuu vastavuoroisessa vuorovaikutuksessa yksilön, ympäristön ja käyttäytymisen välillä. Tulokset laajentavat aiempaa tietämystä näistä teoreettisista prosesseista osoittaen kehityksellisiä yhteyksiä niiden välillä. Lisäksi havainnot yksilöllisestä kehityksestä täydentävät käsitystä siitä, että pystyvyysuskomusten kehityskulut voivat olla erilaisia eri lapsilla. Jatkotutkimuksessa olisikin tärkeää kiinnittää huomiota sekä muutoksiin että yksilölliseen vaihteluun näissä ilmiöissä.

Tutkimuksen tulokset vahvistavat ajatusta siitä, että lasten myönteisiä uskomuksia omista kyvyistä on tärkeä tukea jo koulupolun alkuvaiheessa. Siksi lukemiseen liittyviä uskomuksia tulisikin tunnistaa ja niiden kehittymistä seurata. Myös Perusopetuksen opetussuunnitelman perusteissa (OPS, 2016) korostetaan

oppilaiden myönteisten itseen liittyvien käsitysten tukemista, kannustavaa palautetta sekä sellaisten arviointitapojen käyttöä, jotka keskittyvät oppimisprosessiin ja kannustavat oppilasta kehittymään. Tämän tutkimuksen havaintoja siitä, millaisten kokemusten kautta myönteiset uskomukset kehittyvät voidaankin käyttää hyväksi tukitoimia suunnitellessa. Näyttää siltä, että erityisesti lapset, joiden usko omiin kykyihinsä heikkenee, tarvitsisivat jatkuvampaa kannustusta ja myönteistä palautetta taidoistaan sekä myönteisiä vertaiskokemuksia. Jatkossa olisikin tärkeää kehittää tukitoimia, joissa tuetaan yhtä aikaa sekä lukemisen sujuvuutta että siihen liittyviä uskomuksia tarjoamalla myönteisiä pystyvyyttä tukevia kokemuksia — yksilölliset tarpeet huomioon ottaen.

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ORIGINAL PAPERS

I

SPECIFICITY OF READING SELF-EFFICACY AMONG PRIMARY SCHOOL CHILDREN

by

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Specificity of Reading Self-Efficacy among Primary School Children

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Abstract

We investigated the specificity of reading self-efficacy among second- to fifth-grade children in Finland (N = 1,327). Bandura (1997) theorized that efficacy beliefs can be assessed at different levels of specificity; however, empirical support for this view is scarce among young children. Efficacy beliefs targeting reading-related activities were assessed at three specificity levels (general, intermediate, and specific). Confirmatory factor analysis revealed that these specificity levels are separable, but correlated, and the structure was invariant across gender and grade level. Self-efficacy factors were positively associated with reading fluency, but the strength of these associations varied according to specificity level. Findings suggest that reading self-efficacy in primary grades can and should be assessed at different specificity levels according to varying research aims.

Keywords: Self-Efficacy, Reading, Elementary Schools, Beliefs, Reading fluency

Specificity of Reading Self-Efficacy among Primary School Children

Beliefs people hold about their capabilities and the outcomes of their efforts significantly influence their learning, motivation, and achievement (Bandura, 1997; Pajares, 1996; Schunk, 1991). In academic settings, *self-efficacy* refers to beliefs about one's perceived capability to perform given academic tasks at designated levels (Schunk, 1991). Self-efficacy affects performance in such tasks. Compared to students with low self-efficacy, those with a high sense of self-efficacy have been shown to set more ambitious goals and aims for learning (Bandura, Barbaranelli, Caprara & Pastorelli, 2001; Schnell, Ringeisen, Raufelder, & Rohrmann, 2015), use more effective cognitive strategies (Zimmerman, Bandura, & Martinez-Pons, 1992), self-regulate their learning better (Pintrich & De Groot, 1990), and invest more effort and persistence even in challenging tasks (Schnell et al., 2015). Thus, efficacy beliefs might be especially relevant for developing skills that require extensive training, effort, and persistence, such as reading fluency. Reaching automaticity in reading, that is, becoming capable of fluent and effortless decoding (LaBerge & Samuels, 1974), requires persistence and extensive repetition. In addition, with increasing fluency of decoding, the reader is able to focus more on the meaning of the text. In this way, fluency forms a bridge to reading comprehension, as suggested by Pikulski and Chard (2005). However, little research has been aimed at understanding the role of children's efficacy beliefs in the development of reading fluency.

Efficacy beliefs are context-specific and can be assessed at various levels of specificity (Bandura, 1997). Existing empirical evidence from work with adolescents and adults substantiates this notion (Bong, 2001, 2002a; Bong & Hocevar, 2002). However, few studies have aimed to reveal whether this is the case also among primary school children, who might have less differentiated beliefs as their metacognitive skills and self-knowledge are still developing (Bandura, 1997; Harter, 2012). Moreover, the relationship between self-efficacy and skills seems to differ according to the level of specificity at which self-efficacy is assessed (e.g., Bong, 2002a; Pajares & Miller, 1995; Usher & Pajares, 2009). Again, evidence of these differences is largely absent in research on younger children. In this study, we address these limitations by investigating whether the specificity of self-efficacy suggested by Bandura (1997) can be observed in young children. We do so in the context of reading fluency among a sample of Finnish primary school children.

Specificity of Self-Efficacy

Efficacy beliefs are domain-specific beliefs (Bong, 1997). Even within a single domain, such as reading, writing, or math, they vary in different contexts and in relation to particular subskills (Bruning, Dempsey, Kauffmann, McKim, & Zumbrunn, 2013; Shell, Colvin, & Bruning, 1995). In addition, efficacy beliefs vary in level (i.e., level of task demand), strength (weak or strong), and specificity (generality; Bandura, 1997). In the present study, we focus on the specificity of students' efficacy judgments in a domain-specific context: reading.

Bandura (1997) suggested that efficacy beliefs can be distinguished and measured at three levels of specificity: general, intermediate, and specific. The *general level* is a belief in one's personal efficacy, without a specification of the activities or the conditions under which they must be performed. The *intermediate level* refers to "a class of performances within the same activity domain under a set of conditions sharing

common properties" (p. 49). The *specific level* correspond to self-efficacy for a particular performance that takes place in a particular context. That is, children may hold varying beliefs of their capabilities in general (e.g., "I can learn to be good at math"), for certain competencies (e.g., "I can calculate how much money I have"), or for specific tasks (e.g., "I can solve this math problem").

Reading self-efficacy has been studied at different specificity levels, but the levels are not typically explicated. In the next section, we describe the different ways in which reading self-efficacy has been operationalized at the item level. Table 1 presents sample items used in previous studies conducted with primary school children. These items are classified according to the targeted specificity levels described above.

To measure *general level* self-efficacy, researchers typically ask students to evaluate their general confidence in performing well, with or without explicit reference to a particular domain (e.g., "I am a good reader," MRQ; Baker & Wigfield, 1999; see Table 1). In various studies on reading (e.g., Baker & Wigfield, 1999; Lee & Zentall, 2015; Smith, Smith, Gilmore, & Jameson, 2012; Wigfield, Guthrie, Tonks, & Perencevich, 2004), general level reading self-efficacy has been examined by using the self-efficacy subscale of the Motivation for Reading Questionnaire (MRQ; Baker & Wigfield, 1999), or the Children's Self-Efficacy Scale (Bandura, 2006). To evaluate self-efficacy at the *intermediate level*, researchers have asked students to judge their confidence in tasks such as "Read one of your textbooks" (Shell et al., 1995) or "Read out loud in front of class" (Carroll & Fox, 2017). The intermediate level has sometimes been labeled as task-specific (Bong, 2001, 2002a; Bong & Hocevar, 2002) or skill-specific (Shell et al., 1995). At the most *specific level* of self-efficacy, students are presented with concrete tasks and asked to judge their confidence of successfully completing them (see Table 1). For example, students have been shown reading comprehension questions and then asked to rate their confidence in correctly answering each question (e.g., Schunk & Rice, 1991, 1993).

Although the aforementioned studies show that reading self-efficacy can be measured at different levels of specificity, the previous studies have not precisely targeted the question of differentiation of self-efficacy by specificity level. In most reading self-efficacy research, self-efficacy has been examined at one specificity level within a given study (e.g., Carroll & Fox, 2017; Lee & Zentall, 2015; Wigfield et al., 2004). Because multiple levels of specificity have not often been simultaneously measured, little is known about whether reading self-efficacy is indeed differentiated in form and function. Furthermore, when various specificity levels have been assessed in the same study, the factor structure of self-efficacy has not been reported. For example, Piercey (2013) investigated several dimensions of reading self-efficacy among children in Grades 4-6, including self-efficacy for self-regulation in reading, general self-efficacy, test-specific self-efficacy, self-efficacy for academic reading, and self-efficacy for extracurricular reading. Although these dimensions represent both the general and intermediate levels that Bandura (1997) described, this particular study did not examine the factor structure of the various items used.

Existing empirical evidence regarding the specificity of self-efficacy has largely been based on studies of high school and college students, and in domains other than reading. Bong and her colleagues examined whether efficacy beliefs in domains such as math, English, and Korean, form separate factors based on the specificity level of underlying items (Bong, 2001, 2002a; Bong & Hocevar, 2002). Their analyses revealed that efficacy beliefs form distinct but correlated factors according to specificity levels, which they labeled as subject- (or course-), task- (or content-), and problem-specific

self-efficacy. These levels correspond roughly to the previously presented general, intermediate, and specific levels. Similar findings have been reported among younger students (seventh graders) in math (Phan, Ngu, & Alrashidi, 2017). Specificity levels of self-efficacy have been assessed simultaneously in other studies as well (e.g., Pajares & Miller, 1995; Usher & Pajares, 2009); however, the factor structure of self-efficacy scores at each level of specificity has not been reported.

Self-efficacy theorists have underscored the need to consider specificity level and its correspondence to performance (see Bandura, 1997; Bong, 2006; Pajares, 1996). Indeed, the relationship between self-efficacy and performance has been found to be stronger when the specificity of self-efficacy and performance measures match (see Talsma, Schüz, Schwarzer, & Norris, 2018). The few studies that have directly examined different specificity levels within the same study have found this association to be stronger when self-efficacy was assessed at a level of specificity corresponding to the skills being assessed (e.g., Bong, 2002a; Pajares & Miller, 1995; Usher & Pajares, 2009). For example, Pajares and Miller (1995) found that students' self-efficacy for solving specific math problems was more strongly associated to performing such math problems than was self-efficacy assessed at domain-general level, which was a better predictor of students' general math performance. In reading, intermediate level self-efficacy showed stronger relationship to reading achievement and amount of reading than did general self-efficacy (Piercey, 2013). These findings notwithstanding, there is a paucity of research on specificity and correspondence in the reading literature as well as among younger students. Most previous findings were obtained from adolescent and adult samples (e.g., Bong, 2002a; Pajares & Miller, 1995; Phan et al. 2017; Usher & Pajares, 2009).

Specificity of Young Children's Reading Self-Efficacy

Self-appraisal skills, like other cognitive skills, gradually improve with development as children get older (Bandura, 1997). In middle childhood, as a result of cognitive development, children's self-representations become more differentiated, which allows them to create self-representations that differ across domains and contexts; at the same time, these representations become more integrated (see Harter, 2012). These improving self-appraisal skills allow children to judge their own efficacy. The development of a sense of agency makes efficacy beliefs particularly important during this developmental period (Harter, 2012). According to social cognitive theory, self-efficacy develops in reciprocal interaction with one's environment and is dependent on how learners interpret mastery experiences, vicarious experiences, verbal and social persuasions, and their own physiological and affective states (Bandura, 1997). Young children have accumulated fewer experiences, but as they age and expand their learning environment from family to school, these efficacy-relevant experiences become more frequent.

Despite these understandings about how efficacy beliefs develop and change, little is known about the approximate age at which efficacy beliefs become differentiated in middle childhood. Studies in early primary school show that young children's efficacy beliefs can vary between different learning contexts (Wilson & Trainin, 2007) and situations (Määttä, Järvelä, & Perry, 2016). Previous studies also show increasing differentiation in other dimensions of self-efficacy: older students' (high-school and secondary) efficacy beliefs seem to be more subject-specific (Bong, 2001) and more

differentiated on the basis of the difficulty level (Street, Malmberg, & Stylianides, 2017) than are the beliefs of younger students (primary and middle school).

In the domain of reading, self-efficacy measures have been targeted typically at assessing general level beliefs (e.g., Lee & Zentall, 2015; Smith et al., 2012; Wigfield et al., 2004). Self-efficacy has often been conceptualized in ways similar to self-concept with items tapping perceived competence or relative ability comparisons (see Bong & Skaalvik, 2003). However, such general level measures may have some disadvantages. First, young children may evaluate their reading efficacy with specific tasks or situations in mind, even when asked about their general self-efficacy. For example, Guthrie et al. (2007) found that fourth graders did not describe their general reading ability but they seemed to have well-formed conceptualizations of their self-efficacy in reference to particular reading tasks. Children might similarly be answering generally-worded items by thinking of different reading subskills. General items do not typically point to specific subskills (e.g., "I am a good reader," MRQ). Furthermore, children have been found to describe their efficacy in reading in terms of their reading fluency skills (e.g., Butz & Usher, 2015; Henk & Melnick, 1998; Troyer, 2017) or word reading skills (Guthrie et al., 2007) rather than their reading comprehension skills. This suggests that when students consider their efficacy in reading, they place a good amount of emphasis on their ability to read fluently. In addition, general beliefs have been found to be less sensitive to change than specific reading efficacy beliefs in reading interventions (see Unrau et al., 2017).

Self-efficacy has been found to be positively related to primary school children's reading skills, but the strength of this relationship has been inconsistent. Some studies have found rather small associations between self-efficacy and reading skills (e.g., Liew, McTigue, Barrois, & Hughes, 2008; Smith et al., 2012), whereas others have found a stronger relationship (e.g., Carroll & Fox, 2017; Guthrie et al., 2009; Mercer et al., 2011). This is likely because both the self-efficacy measures and those used to assess targeted reading subskills have largely varied. Consequently, further research is needed before any conclusive claims about the relationship between self-efficacy and reading performance can be made. Moreover, the specificity of self-efficacy assessment may affect this relationship. Investigating reading self-efficacy at different levels of specificity in the same study could offer a more fine-tuned picture of children's reading self-efficacy and shed more light on the association between self-efficacy and reading skill.

Gender Differences in Reading Self-Efficacy

Some evidence suggests that girls and boys differ with regard to their self-assessments in the domain of reading. In general, studies have found girls and women to have higher self-efficacy in language-related areas (see Huang, 2013). However, findings specific to self-efficacy in reading self-efficacy have been mixed. Some studies have found that girls report higher reading self-efficacy than do boys (e.g., Baker & Wigfield, 1999; Wigfield & Guthrie, 1997; Smith et al., 2012); others have found no gender differences (Carroll & Fox, 2017; Piercey, 2013). A closer look at these studies suggests that girls and boys did not differ when they were asked to make fine-grained efficacy judgments, but gender differences did emerge when self-efficacy was assessed at a more general level. This might indicate that gender differences are more evident in general level assessments focusing on relative ability comparisons or perceived competence (Schunk & Meece, 2006). In addition, the studies in which gender

differences emerged targeted reading comprehension. Less is known about gender differences in self-efficacy in different subskills of reading. In Finland, which is the context of this study, gender differences in reading performance have been especially large and have favored girls (recent PISA findings, OECD, 2016). This might indicate that boys have less exposure to diverse reading experiences compared to girls. Thus, boys may also have fewer experiences on which to build their reading self-efficacy and might therefore differ in their self-efficacy for reading in primary school.

Reading Fluency

The present study focuses on self-efficacy in the context of reading, specifically on *reading fluency*. Reading fluency refers to automatized decoding and word recognition processes (LaBerge & Samuels, 1974). Fluent reading is defined as an accurate, rapid, and expressive skill (Kuhn & Stahl, 2003). Fluency is seen as the bridge to meaning making (Pikulski & Chard, 2005); when reading becomes automatized and fluent, the reader is better able to focus on text comprehension. Reading automaticity develops gradually, and with increased automaticity in decoding, cognitive resources are freed for understanding text (LaBerge & Samuels, 1974). Empirical evidence has shown that (early) reading fluency predicts later reading comprehension skills (e.g., Kim, Petscher, Schatschneider, & Foorman, 2010). In this study, we define reading fluency as automaticity of reading (combination of high accuracy and a good reading rate), which is a precursor to reading comprehension. Reading fluency is an especially central aspect of reading development in transparent orthographies, such as Finnish, where children typically master accuracy by the end of first grade (Seymour, Aro, & Erskine, 2003). However, many children still have difficulty achieving an automatized level of decoding and word recognition (Aro, 2004; Landerl, Wimmer, & Frith, 1997; Seymour, Aro, & Erskine, 2003). Furthermore, problems in rate of reading are often characteristic of reading disabilities (Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Körne, 2003).

Reading fluency is gained with practice and repetition. To become a fluent reader, a child needs the effort and persistence to independently practice reading in and out of school, as Share (1995) has proposed in his self-teaching hypothesis. Efficacy beliefs have shown a positive association to reading amount (e.g., Schüller, Birnbaum, & Kröner, 2017; Wigfield & Guthrie, 1997), reading enjoyment (Lee & Zentall, 2015), and effort expended in reading (Galla et al., 2014). Therefore, they have a plausible link to reading fluency. However, previous research showing the link between children's self-efficacy and reading in primary school (e.g., Liew et al., 2008; Lee & Jonson-Reid, 2016; Smith et al., 2012) has mainly focused on reading comprehension, rather than fluency, as an outcome. A few prior studies have shown self-efficacy to be positively related to reading fluency (i.e., operationalized as word, sentence or text reading speed and accuracy), but with the exception of the study by Carroll and Fox (2017), these efforts have focused on students in middle school and beyond (Guthrie, Coddington, & Wigfield, 2009; Ho & Guthrie, 2013; Mercer, Nellis, Martínez, & Kirk, 2011). Some evidence has shown that, in young children (8 to 11 years old), efficacy beliefs are related specifically to reading fluency but not to reading comprehension (Carroll & Fox, 2017). Achieving reading fluency skills is an important step in reading development; therefore, understanding how beliefs might relate specifically to reading fluency seems important. Furthermore, early beliefs about fluency may influence more generalized self-beliefs about reading later in a young person's development. Obtaining more

knowledge of young children's self-efficacy for reading fluently and determining how this relates to their actual reading abilities might help researchers and practitioners to support positive efficacy beliefs as well as fluency development.

The Present Study

The present study focuses on the specificity of self-efficacy among primary school children and its relationship to students' reading fluency. Our main research aim was to investigate whether different specificity levels of self-efficacy, as hypothesized by Bandura (1997), can be identified in primary school children. A hypothetical three-factor structure of reading self-efficacy (see Figure 1), in which the different specificity levels were correlated, was formed on the basis of previous research (Bandura, 1997; Bong, 2001, 2002; Bong & Hocevar, 2002). In past research, self-efficacy beliefs representing different levels of specificity have often been combined (e.g., Joët, Usher, & Bressoux, 2011; Solheim, 2011). We therefore compare this three-factor model to simpler one- and two-factor models based on the assumption that children's beliefs may not be as differentiated as those of older students. We also examine gender- and age-related differences in the specificity of self-efficacy assessment across Grades 2-5. Finally, we examine the associations between reading self-efficacy, measured at three levels of specificity, and reading fluency, to investigate whether the specificity of children's efficacy judgments show varying relations to their reading fluency. The associations were examined both between and within genders and grade levels. We hypothesized that the relationship between self-efficacy and reading fluency would be positive, in line with previous findings (e.g., Carroll & Fox, 2017; Mercer et al., 2011). However, we made no hypothesis regarding possible differences in the strength of the associations between self-efficacy at different specificity levels and fluency, given the lack of substantive research with this age group.

Method

Participants and Procedure

A total of 1327 children (48.08% girls) participated in the study, which was part of a longitudinal investigation (i.e., the Self-Efficacy and Learning Disability Intervention research project, 2013–2015) focused on children's self-beliefs and reading and math development. Volunteering schools and teachers were recruited for the study and a total of 20 primary schools from urban and semi-urban areas participated[1]. Students' participation was voluntary, and parents gave written informed consent for participation. The Ethical Committee of the first author's university evaluated the research procedure. Of the participants, 13.41% (n = 178; M_{age} =8.41 years, SD = .32) were in Grade 2, 35.49% (n = 471; M_{age} = 9.34 years, SD = 0.31) were in Grade 3, 28.86% (n = 383; M_{age} = 10.40 years, SD = 0.33) were in Grade 4, and 22.23% (n = 295; M_{age} = 11.38 years, SD = 0.33) were in Grade 5 (M_{age} = 9.97, SD = 1.05; range = 7.84 to 12.83 years).

At the end of the first semester of the school year, students were visited by trained research assistants during one regular class session. Students were asked to report their reading self-efficacy. They then took part in an assessment of their reading fluency (see below). Trained research assistants supervised the assessment. Practice items were used to familiarize the children with the response scale used. All

questionnaire items were read aloud to students to ensure that all children could answer the questions irrespective of their reading skill.

Measures

Reading self-efficacy. The reading self-efficacy questionnaire was developed according to Bandura's (2006) guidelines. Items specifically targeted reading fluency skills in primary school grades and were presented in Finnish. Researchers with expertise in reading development and in self-efficacy were consulted in item formulation. Three different specificity levels of self-efficacy for reading fluency were assessed: specific, intermediate, and general level (see Table 2). All items began with question stem, "*How certain are you that you can…".* Participants then rated the strength of their confidence for mastering given activities using a seven-point scale (1, "*I'm totally certain I can't*," to 7, "*I'm totally certain I can*"). An initial version of the self-efficacy questionnaire was piloted with a small group of students, and on the basis of those results, modifications were made to the response scale and wording of the items.

To assess *general level reading self-efficacy* (3 items), an item from the Children's Self-Efficacy Scale (Bandura, 2006) was modified to tap several aspects of reading fluency. Bandura's (2006) original item in the context of reading was, "How confident are you that you can learn to read?*"* but, because Finnish children can typically read by this age, we used three different items that asked students to rate their confidence for reading faster (rate), for reading with fewer mistakes (accuracy), and for understanding what they have read (comprehension). Accuracy is one component of reading fluency (Kuhn & Stahl, 2003), and comprehension, as noted above, requires sufficient fluency (LaBerge & Samuels, 1974).

Intermediate level reading self-efficacy (3 items) was assessed by asking students to rate their confidence for everyday reading activities that require fluent reading (i.e., reading subtitles on TV, texts on the Internet, and a long book, see Table 2). These contexts were selected because each is a typical context for primary school children and requires fluent reading skills. For instance, in Finland, all foreign-language TV programs have subtitles, which appear only for short period of time on the screen. Therefore, a sufficient rate of fluency is required. To be able to read the subtitles is an important milestone of reading development for many children, and also an activity that children frequently describe as a means of mastery in reading. Similarly, reading long texts, such as a long book, requires greater fluency for reading to be enjoyable and for the reader to focus on meaning instead of code.

To assess *specific level reading self-efficacy* (8 items), researchers presented students with 10 paragraphs of increasing length (from one sentence to a long passage). Students were asked to judge how confident they were in their ability to read each presented paragraph aloud in 30 seconds.[2] To ensure that students could understand this time frame, researchers first demonstrated a 30-second pause. Each paragraph was then presented on an overhead projector for a short time (5 seconds), so that students could visualize the length. The first two items were considered as practice items and were excluded from the final analysis.

Reading fluency. *Reading fluency* was assessed with three, time-limited tests: the word chain test, (Lindeman, 1998), the sentence verification test (Salmi, Eklund, Järvisalo, & Aro, 2011), and the text reading task (Salmi et al., 2011). These tests assessed the automaticity (speed and accuracy) of word-, sentence-, and text-level

reading fluency as well as silent and oral reading fluency. Children were instructed to perform each task as quickly and accurately as possible. The *word chain test* consisted of clusters of 2-4 words with no spaces between them (78 word chains in all). The task for the child was to read and separate the words with a vertical line as fast as they could. The test score reflected the number of correctly-identified words within 3.5 minutes. This test was group administered. *The sentence verification* task was a Finnish adaptation of the Woodcock-Johnson Reading Fluency task (Woodcock, McGrew, & Mather, 2001) and consisted of 70 easy and short factual statements (e.g., "Strawberries are red"). Students were asked to read the sentences and then to mark whether the given statement was correct or incorrect. The test score was the number of correct responses given within two minutes. This test was also group administered. In the *text reading* task, children read an informational and age-appropriate 251-word text aloud. The test score was the number of words read correctly within 1.5 minutes. Because this task involved reading aloud, this test was administered individually either in the same or following day as the class session. All reading fluency test scores were standardized within each grade level prior to the full sample analysis.

Statistical Analyses

All analyses were conducted using the MPlus software, version 7.3 (Muthén & Muthén, 1998–2012). Means and standard deviations for self-efficacy and reading fluency items were calculated by gender and by grade level. Pearson correlations among the variables were calculated for the full sample. To test the hypothesis that reading self-efficacy consists of beliefs at different specificity levels in primary school children, three competing confirmatory factor analysis (CFA) models were constructed. Initially, the hypothesized three-factor model (Model 1, Figure 1) was constructed, in which items GEN1-GEN3 were loaded on the general level reading self-efficacy factor, items INT1-INT3 on the intermediate level factor, and items SPES3-SPES10 on the specific level factor. All three factors were set to correlate with one another.

Three item parcels were used as indicators of the specific level self-efficacy in lieu of single items. The item parcels were formed so that each parcel consisted of varying levels of length: the first parcel (R1) included items SPES3 +SPES6 + SPES10, the second parcel (R2) included items SPES4 + SPES9, and the third parcel (R3) included items SPES5+ SPES7+ SPES8 (for the variable names see Table 2). The use of item parceling in place of individual items has several psychometric and estimation advantages (Little, Cunningham, Shahar, & Widaman, 2002). First, the multivariate normality assumption that underlies structural equation modeling is better met with item parcels than with individual items. Second, with item parceling, the number of items that have been measured to represent a construct can be reduced to an optimal just-identified level. Third, various indexes of model fit are expected to be more acceptable when parcels, rather than individual items, are modeled.

Two competing factors models were constructed to test the structure of self-efficacy. Model 2 was based on the assumption that reading self-efficacy is a unidimensional construct, and all items were set to load on one factor. A correlated two-factor model (Model 3) was then constructed, in which items GEN1-GEN3 loaded on one factor representing general efficacy beliefs, and items INT1-INT3 and items SPES3-SPES10 loaded on a second factor representing more fine-grained efficacy judgments. In addition, a second two-factor model (Model 4) was constructed, in which items GEN1-GEN3 and items INT1-INT3 loaded on one factor representing more

general beliefs, and items SPES3-SPES10 loaded on a second factor representing specific beliefs.

Responses to the self-efficacy items were somewhat skewed to the left (kurtosis range: 0.03 to 5.65, skewness range: -0.28 to -2.16). Therefore, the robust maximum likelihood estimator (MLR) was used in all analyses (Muthén & Muthén, 1998-2012). Data were nested within 20 schools and 75 classes. To determine the proportion of the variance in self-efficacy due to class and school, intra-class correlations (ICCs) were calculated. The ICCs for the self-efficacy variables at the class level were small to moderate ($ICC_{GENERAL}$ = .004 to .029, $ICC_{INTERMEDIATE}$ =.029 to .135, $ICC_{SPECIFIC}$ = .156 to .169). ICCs at the school level were close to zero ($ICC_{GENERAL}$ = .003 to .019, $ICC_{INTERMEDIATE}$ = .006 to .037, $ICC_{SPECIFIC}$ = .049 to .064). The ICCs for the reading fluency variables were also close to zero (ICC range: .01 to .11). The hierarchical nature of the data was taken into account by estimating unbiased standard errors using the TYPE = COMPLEX option in MPlus. The data set included 6.61% missing values. Little's (1988) MCAR test showed that data were not missing completely at random, $\chi^2(437) = 940.014$, $p < .001$. However, because the reason for missing values was either students' absence from school on the day of data collection or their choice to skip single items, the data were considered to be missing at random (MAR). Therefore, the Full-Information-Maximum-Likelihood (FIML) procedure was used in all analyses to handle missing data (Enders, 2010). The FIML uses all information in the data without imputing missing values.

The overall goodness-of-fit of the tested models was evaluated with the χ^2 test. The p value of χ^2 test should be greater than .05. However, as the χ^2 test is sensitive to a large sample size (N = 1327 in the present study) and due to the non-normality of the data, the following fit indexes were also used: Comparative Fit Index (CFI; Bentler, 1990), Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), Root Mean Square Error of Approximation (RMSEA; Steiger, 1990) with a 90% confidence interval, and Standardized Root Mean Square Error (SRMR; Hu & Bentler, 1995). Values smaller than 0.06 for RMSEA and 0.08 for the SRMR, and values higher than 0.95 for both the TLI and the CFI, were considered representative of a well-fitting model to the data (Hu & Bentler, 1999).

We next tested the superiority of the competing nested self-efficacy models (Models 1-4) by examining the Satorra-Bentler scaled χ^2 difference test (Satorra & Bentler, 2001). A significant χ^2 difference test denotes that the model with fewer degrees of freedom (i.e., fewer constraints) fits the data better, whereas a non-significant χ^2 difference test denotes that the model with greater degrees of freedom (i.e., more constraints) fits the data better.

After choosing the best self-efficacy model, we ran multigroup invariance comparison tests separately by gender and grade level. Group invariance was tested by comparing the fit of the baseline model (i.e., parameters of the model were freely estimated in all groups under investigation) to that of the constrained model (i.e., factor loadings constrained to be equal across the groups), using the Satorra-Bentler scaled χ^2 test (Satorra & Bentler, 2001). Given that the χ^2 test is sensitive to large sample sizes, we also used the change in CFI and RMSEA criteria (see McCallum, Browne & Cai, 2006; Cheung & Rensvold; 2002) to evaluate invariance. A change of less than or equal to -.01 in CFI (Cheung & Rensvold, 2002) and a change of less than +.015 in RMSEA (Chen, 2007) indicates that the hypothesis of invariance of factor loadings or intercepts should not be rejected, even though the χ^2 test might indicate a significant result. Gender and grade level differences in the latent means of self-efficacy factors were

examined using Wald's test (Muthén & Muthén, 1998-2012). Cohen's *d* was used as a measure of effect size of the mean differences (Cohen, 1988).

Finally, the relationship between the different levels of self-efficacy and reading fluency was examined using structural equation modeling. First, the factor structure of reading fluency was examined using CFA to determine whether the reading fluency measures indeed describe the same construct. Next, a model in which the different levels of self-efficacy and reading fluency were set to correlate was specified. Invariance in the strength of the associations between different specificity levels of self-efficacy and reading fluency was examined using multigroup invariance comparison tests separately both between and within genders and grade levels using the Satorra-Bentler scaled χ^2 test (Satorra & Bentler, 2001). Cohen's *q* was used as a measure of effect size for the differences in the correlations between level of self-efficacy measure and reading fluency (Cohen, 1988). Results are presented using standardized parameter estimates (i.e., the variances of the variables are fixed to one).

Results

Descriptive statistics for the observed reading self-efficacy and fluency variables are reported in Table 3 by gender and by grade level. In general, children reported high levels of reading self-efficacy. Intercorrelations among the self-efficacy and reading fluency variables for the full sample are presented in Table 4.

The Structure of Self-Efficacy in Reading

Table 5 presents the model descriptions and goodness-of-fit indexes for the competing self-efficacy models. The hypothesized three-factor model of self-efficacy (Model 1) fit the data well (χ^2 (24) = 59.038, $p < .001$). However, to confirm whether this fit the data best, we investigated three competing models. The unidimensional model (i.e., Model 2) did not fit the data well. Both of the two-factor models (Models 3 and 4) had a better fit than Model 2; however, they did not reach the fit values of Model 1. Also, the Satorra-Bentler χ^2 tests showed that the best approximation with the data was achieved with Model 1 (Table 5). The best-fitting three-factor model of self-efficacy, representing specific, intermediate, and general level self-efficacy, is presented in Figure 2. All factor loadings and error variances were statistically significant. Correlations between the factors were positive and moderately high. The highest correlation was between intermediate and general level self-efficacy ($r = .67$, $p < .001$). The lowest correlation was between specific and general level self-efficacy ($r = .39$, $p < .001$).

To confirm that the three-factor structure of reading self-efficacy was similar across gender and grade level, invariance comparisons were conducted. As shown in Table 6, factor loadings and intercepts could be set equal across genders and grade levels. The results suggest that the three-factor structure of reading self-efficacy is invariant between girls and boys and between students in Grades 2-5.

However, we did find differences in factor means between groups by gender and grade level (see Tables 6 and 7). Specifically, the mean of intermediate level self-efficacy differed between genders ($\chi^2(1) = 14.59$ $p < .001$) and grade levels ($\chi^2(9) = 111.94$ $p < .001$). Boys reported higher intermediate level self-efficacy than girls ($d = 0.25$), and older children reported higher intermediate level self-efficacy than younger children (means at each grade level differed at $p < .05$, $d_{range} = 0.21–0.74$, except for the mean between students in Grades 4 and 5)[2]. Mean differences by grade level were also

found in the most specific level of self-efficacy: older children reported higher self-efficacy than younger children (means at each grade level differed at $p < .005$, $d_{range} = 0.22–0.88$)[3]. The effect sizes of these differences were large between students in Grade 2 and older students, and small to medium between students in other grade levels. Covariances were invariant across gender ($\chi^2(3) = 2.02$ $p = .57$). However, factor variances differed slightly with girls showing more variance in their responses than boys ($\chi^2(3) = 9.43$ $p = .03$). Covariances and variances slightly differed between grade levels.

Associations Between Reading Self-Efficacy and Reading Fluency

To examine whether the self-efficacy factors were positively related to reading fluency as hypothesized, the correlations between self-efficacy factors and reading fluency were next calculated. Prior to this examination, the factor structure of reading fluency was examined and found to be satisfactory ($\chi^2(0) = 0$, $p < 0.001$; RMSEA = .00, CFI = 1.00; TLI = 1.00; SRMR = .00, i.e., the model was a saturated model). The factor loadings were statistically significant and high (standardized loadings .92, .88, .84) and the residual variances were statistically significant and positive.

The associations between each level of self-efficacy and reading fluency factor were added to the model. The model showed a good fit to the data ($\chi^2(48) = 106.30$, $p < .001$; RMSEA = .03, CFI = .99; TLI = .99; SRMR = .02). Associations between the different specificity levels of self-efficacy and reading fluency were all statistically significant (see Table 8.). The intermediate level self-efficacy had the strongest ($r = .52$, $p < .001$), and general level self-efficacy the weakest ($r = .34$, $p < .001$), association with reading fluency. However, the effect sizes of the differences were moderate between intermediate and specific level associations ($q = 0.22$), but small between intermediate and specific ($q = 0.17$) and general and specific ($q = 0.05$) level associations. Invariance comparisons indicated that the strength of the associations did not differ between girls and boys ($\chi^2(3) = 6.91$, $p = .07$), but small differences were found between grade levels ($\chi^2(9) = 21.46$ $p = .011$). However, after freeing the paths for Grade 2 children, the associations did not differ between students in Grades 3 to Grade 5 ($\chi^2(6) = 8.71$, $p = .19$). The associations between self-efficacy and reading fluency by grade level are reported in Table 9.

The strength of the associations between self-efficacy and reading fluency varied according to specificity level of self-efficacy within genders ($\chi^2(2) = 125.07$, $p < .001$), as well as within each grade level (invariance comparisons within all grade levels $p < .001$)[4]. The intermediate level self-efficacy showed a stronger relationship to reading fluency compared to the specific and general level for girls and boys ($q = .37$, $q = .12$) and especially for second graders ($q = .37$, $q = .37$), but also for students in Grade 3 ($q = .10$, $q = .28$), Grade 4 ($q = .18$, $q = .21$), and Grade 5 ($q = .13$, $q = .13$). The specific level self-efficacy showed a moderately stronger relationship to reading fluency compared to the general level within girls and boys ($q = .25$) as well as slightly stronger within all grade levels ($q_{range} = .01$-$.18$).

Discussion

The purpose of this study was to examine the specificity of efficacy beliefs among primary school children and to investigate their relationship to reading fluency. Our analyses revealed three distinct but correlated types of children's reading self-efficacy: general, intermediate, and specific. These findings suggest that children's

reading self-efficacy, at least in the Finnish context, consists of beliefs at various specificity levels. Some children may feel more efficacious for reading in general but may feel less so when confronted with an actual reading task. However, even though students' efficacy beliefs were distinguishable from one another, the beliefs at different specificity levels were positively correlated. Correlations between the self-efficacy factors were strongest between proximal levels of specificity. For example, general level self-efficacy correlated more strongly with intermediate than with specific level self-efficacy. In general, these findings support Bandura's (1997) theorizing that efficacy judgments are made at varying levels of specificity particularly in the context of children's primary school reading. These findings also corroborate previous empirical findings obtained with older students and in other domains (Bong, 2001, 2002; Bong & Hocevar, 2002). To our knowledge, this study is the first to demonstrate that, even among students as young as second grade, efficacy beliefs in reading are interrelated but separable with regard to specificity level. Children can therefore be assumed to evaluate their own reading capabilities at varying levels of granularity.

We also found that children's efficacy beliefs were differentiated based on the specificity level regardless of their age or gender. Nevertheless, small differences in the strength of self-efficacy were found. It was somewhat unexpected that boys reported higher reading self-efficacy at the intermediate level than did girls, as previous research has primarily suggested that girls report higher reading self-efficacy (e.g., Smith et al., 2012; see also Huang, 2013). This prior research, however, targeted general beliefs and focused on reading comprehension. Our findings suggest that gender differences vary according to the level of specificity at which reading self-efficacy is measured. It seems from our findings that boys feel more self-efficacious in digital reading activities than do girls. Some evidence has suggested that boys engage more in digital reading activities (see Brozo et al. 2014), which may lead them to experience digital reading differently. Even so, the effect sizes were small to moderate, suggesting fairly modest differences between girls and boys. More research is needed before making any conclusive claims.

We also found age-related differences in the strength of self-efficacy. As expected, younger children reported lower intermediate and specific level self-efficacy than did older children. Given that the reading tasks presented to students were similar for all students, it is reasonable to expect younger children to have lower self-efficacy, in line with their developmental stage. Previous findings concerning age-related differences in children are somewhat inconsistent. Some studies have reported that older children show higher reading self-efficacy (Carroll & Fox, 2017; Shell et al., 1995) whereas others have found a decrease in reading self-efficacy across the school-age years (Smith et al., 2012). Others have found a curvilinear pattern indicating a decrease in self-efficacy after Grade 3 followed by a gradual increase through Grade 6 (Hornstra et al., 2013). This previous work did not consider level of specificity in self-efficacy assessment, however. Our findings suggest that differences in the strength of self-efficacy depend not only on respondents' age, but also on the specificity level and context in which self-efficacy is being measured. Therefore, when considering developmental differences in the strength of self-efficacy, researchers should also consider these additional factors.

Consistent with few previous findings showing the association between self-efficacy and reading fluency (e.g., Carroll & Fox, 2017; Mercer et al., 2011), we found that self-efficacy was positively related to reading fluency. That is, children who believed in their capabilities to perform various reading tasks requiring fluent reading

skills were more likely to be fluent readers. Of the three levels of specificity we examined, we found that intermediate level self-efficacy showed the strongest association to reading fluency. In other words, the more children believed in their capabilities in reading activities related to daily life, the better their reading fluency skills were. General level beliefs were less related to reading skills, in line with the findings from previous studies (e.g., Piercey, 2013). The strength of the associations between self-efficacy and reading fluency differed according to the level of specificity of the self-efficacy measure, and these associations differed in girls and boys as well as in all grade levels. Thus, our findings highlight that the specificity level at which self-efficacy is assessed also influences the relationship found between self-efficacy and reading skills. Our findings mirror those obtained in research with older students and in different domains (e.g., Bong, 2002a; Pajares & Miller, 1995; Usher & Pajares, 2009) as well as recent reviews (Talsma et al., 2018). Bandura (1997) underlined the importance of studying self-efficacy at a level of specificity that corresponds to the performance outcome of interest. As he noted, "sensitive measures of efficacy beliefs link operative capabilities to the levels of challenge in particular domains of functioning" (Bandura, 1997, p. 38).

This study offers another noteworthy extension to previous research. Research on reading motivation has focused primarily on reading comprehension as an outcome of interest. We extend that to the relatively understudied facet of reading fluency. To our knowledge, only one study has examined the association between efficacy beliefs and reading fluency in children in classes below Grade 5 (i.e., Carroll & Fox, 2017). Our findings confirm this pattern by showing that efficacy beliefs relate to reading fluency in early primary school grades. Reading fluency may be a context in which efficacy beliefs play an important role, especially in primary school, where fluency is a skill children are actively developing and increasingly aware of as they are asked to read aloud.

In addition, fluency development is largely guided by independent reading practice (self-teaching hypothesis; Share, 1995). Efficacy beliefs, which are related to the willingness, persistence, and effort one devotes to practicing the relevant skill, might therefore be especially important in developing reading fluency. Our self-efficacy measure was specifically designed to assess students' efficacy beliefs about their reading fluency. Therefore, another explanation for the relatively strong relationship between self-efficacy and reading fluency might be that we asked children to rate their confidence in activities specifically requiring fluent reading skills. As discussed, when children evaluate their general level self-efficacy they may have different tasks and subskills of reading in mind, which might not align with the targeted reading skills being assessed. Thus, extending the previous research by studying self-efficacy with more specific measures, which also more explicitly target the specific subskills of reading, such as fluency, could enrich our understanding of children's efficacy beliefs and their relation to reading.

The findings of this study have implications for teachers and practitioners. Efficacy beliefs were found to be related to reading fluency as early as Grade 2, indicating the need for early interventions to support positive self-efficacy and to prevent the vicious cycle of low efficacy beliefs which can result in diminished reading practice. When the goal is to enhance reading fluency, supporting both self-efficacy and reading skills should be a priority. In addition, when teachers or practitioners are trying to understand and support the beliefs children hold about their capabilities as readers, it is important to consider the specificity level of efficacy beliefs. For example, students

may feel self-efficacious in some reading tasks but not in reading more generally; therefore, asking students to gauge their self-efficacy at varying levels of specificity could help teachers to more explicitly support students' positive beliefs in those areas in which they lack confidence. The findings of this study suggest that children could benefit from those who encourage them in life's daily reading tasks. Providing positive feedback and supporting students' perceived capabilities to handle daily reading activities, in addition to encouraging independent reading, might raise children's confidence in those activities that in turn support their reading fluency (Aro et al., 2018; Butz & Usher, 2015).

In the future, studying children's reading self-efficacy at different levels of specificity could provide a richer picture of the function of these beliefs given that efficacy beliefs at different levels seem to show varying relationships to achievement, learning, and motivation. We should carefully consider how to operationalize self-efficacy, the specificity of the beliefs, and their correspondence to the studied reading context (see also Conradi, 2014; Klassen & Usher, 2010; Pajares, 1996). Longitudinal designs exploring the stability and development of self-efficacy in terms of these varying specificity levels, as well as the developmental dynamics between self-efficacy and reading fluency would enable a deeper understanding of patterns in self-efficacy development. For instance, specific measures seem to be more sensitive to fluctuations in efficacy beliefs than general measures (Bong, 2002b; Phan et al., 2017, see also Unrau et al. 2017). Thus, studying efficacy beliefs at various specificity levels might better capture the developmental patterns in beliefs and in their relation to reading development.

We recognize some limitations in the present study. First, we studied the specificity of self-efficacy explicitly in the context of reading fluency; thus, the findings may not translate to other domains and skills. Children's efficacy beliefs may be less differentiated for unfamiliar skill areas and particularly those in which learners receive less feedback on their performance. Second, we did not study reading performance at different specificity levels as we did for self-efficacy. Just as self-efficacy in reading can be measured at different levels, so can reading competence (i.e., in specific tasks or more generally such as in reading habits). In this study the focus was reading fluency which is best assessed with specific measures. However, further research would benefit from studying the relationships between different levels of self-efficacy and different reading outcomes. Third, the present study was based on cross-sectional data. Therefore, this study gives a snapshot of the structure of self-efficacy. Longitudinal studies examining the self-efficacy at various levels of specificity would lead to a better understanding of self-efficacy development. Finally, beliefs differ in different contexts and in relation to specific subskills. Determining specificity levels in self-efficacy measures is not a precise science. We recognize that a certain degree of overlap might be present in the self-efficacy measures assessed here. Moreover, it is hard to completely separate comprehension and fluency at the item level, especially as the practical purpose of independent reading is always related to meaning, and not simply rapid and accurate decoding.

The results of this research contribute to the larger body of work on academic self-efficacy by demonstrating that reading efficacy beliefs are differentiated by level of specificity among learners who are in the early years of schooling and that the association between self-efficacy and reading fluency depends on the level at which self-efficacy is assessed. Thus, self-efficacy in young children should be studied with

the specificity of the construct in mind, as suggested by Bandura (1997) and other scholars.

Footnotes

[1] Finland continues to be a rather homogenous society in that socioeconomic and demographic differences are small compared to many other countries (see PISA 2015, at http://www.oecd.org/pisa). In the cities where this sample was collected, 95% of the population is Finnish speaking and the number of immigrants is low (3.2%). In addition, Finnish schools are relatively homogeneous: 96 percent of schools are publicly maintained (Official Statistics of Finland, 2017), and children attend the nearest public school to their home. In general in Finland, reading achievement varies little between schools and between classes (see PILRS, 2016 at http://timssandpirls.bc.edu/pirls2016/international-results/). In addition, the socioeconomic variation between schools is small (e.g. OECD, 2013). Given the provision of free, public education up to the university level, socioeconomic background variables tend to play less of a role in Finland than in many other countries.

[2] Supplemental material (the actual paragraphs) is available from the first author upon request.

[3] Results of the invariance comparison test across grade levels and effect sizes for all grade-level differences are available upon request from the first author.

[4] Effect sizes for all grade-level differences are available upon request from the first author.

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Table 1

Examples of Reading Self-Efficacy Items Used in Studies With Children

Specificity level	Example items	Measure	Examples of studies with primary or secondary school children
General level self-efficacy	• "Please rate how certain you are that you … *can learn reading, writing, and language skills*?"	Children's Self-efficacy Scale, Bandura, 2006	Bandura, Barbaranelli, Caprara, & Pastorelli, 2001
	• "*I know that I will do well in reading next year.*"	MRQ (Self-efficacy subscale), Baker & Wigfield, 1999	Lau, 2009; Wigfield et al., 2004; Baker & Wigfield, 1999
	• "*I am a good reader.*"		
	• "How confident are you that you can learn to be a good reader?"	-	Piercey, 2013
	• "In general, how confident are you in your abilities in reading?"		
	• "How good are you at reading?"	-	Smith, Smith, Gilmore & Jameson, 2012
Intermediate level self-efficacy	• "Indicate how sure you are that you … can read a letter from a friend/read the daily newspaper?" (task subscale)	-	Shell, Colvin & Bruning, 1995
	• "How confident are you that you can … understand all the words on a page in one of your schoolbooks? …read and understand the newspaper?"	-	Piercey, 2013
	• "Rate how certain you are that you can … read out loud in front of class?"	-	Carroll & Fox, 2017
	• "Can you figure out hard words when reading?"	-	Guthrie, Coddington, & Wigfield, 2009
Specific level self-efficacy	• Reading comprehension tasks presented for participants. • Students are subsequently asked to judge their capability of correctly answering those questions.	-	Schunk & Rice, 1991, 1993
	• Long reading passages followed by multiple problems. Students rated how confident they were to correctly solve problems presented.	-	Bong & Hocevar, 2002*

Note. Asterisk denotes high school student participants.

Table 2

Items in the Reading Self-Efficacy Scale

Reading self-efficacy	How certain are you that you can…	Cronbach's alpha
General level: SE for Learning to Read Fluently	…learn to read faster? (GEN1) …learn to read so that you make fewer mistakes? (GEN2) …learn to read so that you understand everything you read? (GEN3)	.79
Intermediate level: SE for Daily Reading Activities	…read all the subtitles of a TV program easily? (INT1) …read long texts on the Internet? (INT2) …easily read a long book? (INT3)	.70
Specific level: SE for Reading Specific Paragraphs	…read this paragraph aloud in 30 seconds? (8 paragraphs of varying lengths) (SPES3-SPES10)	.93

Note. Original items were presented in Finnish. SE = self-efficacy.

Table 3

Descriptive Statistics of Observed Variables by Gender and Grade Level

Variable	Girls (n = 638) M (SD)	Boys (n = 689) M (SD)	Grade 2 (n = 178) M (SD)	Grade 3 (n = 471) M (SD)	Grade 4 (n = 383) M (SD)	Grade 5 (n = 295) M (SD)
Self-efficacy[a]						
General SE 1	6.32 (1.11)	6.29 (1.04)	6.22 (1.31)	6.35 (1.10)	6.27 (1.09)	6.27 (0.99)
General SE 2	6.22 (1.10)	6.15 (1.10)	6.29 (1.09)	6.20 (1.10)	6.17 (1.13)	6.16 (1.06)
General SE 3	5.96 (1.21)	5.98 (1.10)	6.30 (1.01)	5.99 (1.18)	5.98 (1.27)	5.95 (1.16)
Intermediate SE 1	6.22 (1.34)	6.45 (1.10)	5.17 (1.93)	6.14 (1.40)	6.39 (1.15)	6.58 (0.92)
Intermediate SE 2	6.13 (1.32)	6.43 (1.01)	5.92 (1.57)	6.16 (1.31)	6.37 (1.08)	6.39 (1.06)
Intermediate SE 3	5.22 (1.70)	5.22 (1.62)	4.87 (2.12)	5.16 (1.70)	5.21 (1.68)	5.33 (1.53)
Specific SE 3	6.47 (1.15)	6.52 (1.07)	5.43 (1.98)	6.28 (1.34)	6.58 (0.94)	6.73 (0.80)
Specific SE 4	6.08 (1.45)	6.18 (1.32)	4.96 (2.14)	5.84 (1.62)	6.22 (1.21)	6.48 (1.03)
Specific SE 5	5.48 (1.68)	5.53 (1.66)	4.19 (2.24)	5.17 (1.87)	5.56 (1.57)	5.98 (1.30)
Specific SE 6	4.94 (1.82)	4.86 (1.88)	3.62 (2.22)	4.53 (1.94)	4.94 (1.80)	5.43 (1.60)
Specific SE 7	4.24 (1.95)	4.21 (1.98)	3.20 (2.16)	3.88 (2.00)	4.26 (1.93)	4.74 (1.83)
Specific SE 8	3.60 (1.94)	3.53 (1.97)	2.82 (2.10)	3.24 (1.99)	3.56 (1.89)	4.05 (1.88)
Specific SE 9	3.07 (1.87)	3.00 (1.93)	2.43 (1.95)	2.80 (1.91)	3.03 (1.84)	3.42 (1.91)
Specific SE 10	2.55 (1.82)	2.34 (1.78)	2.11 (1.93)	2.26 (1.77)	2.45(1.76)	2.70 (1.86)
Reading fluency						
Word reading[b]	93.33 (41.60)	83.34 (40.82)	44.73 (26.06)	72.78 (29.43)	99.50 (35.28)	123.53 (37.67)
Sentence reading[c]	30.47 (11.17)	29.02 (11.17)	18.21 (7.15)	26.38 (8.21)	32.52 (9.77)	38.29 (10.99)
Text reading[d]	114.64 (37.26)	109.95 (36.24)	77.08 (33.76)	104.39 (31.69)	120.29 (32.49)	135.73 (30.87)

Note. SE = self-efficacy. [a] 7-point scale. [b] Word chain test (Lindeman, 1998) max. score = 214. [c] Sentence verification test (Salmi, Eklund, Järvisalo, & Aro, 2011) max. score = 70. [d] Text reading task (Salmi et al., 2011) max. score = 251.

Table 4

*Intercorrelations Between Reading Self-Efficacy and Reading Fluency Variables for the Full Sample (*N = *1327)*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. General SE 1	-															
2. General SE 2	.60	-														
3. General SE 3	.46	.52	-													
4. Intermediate SE 1	.31	.29	.34	-												
5. Intermediate SE 2	.34	.37	.35	.50	-											
6. Intermediate SE 3	.31	.36	.33	.41	.41	-										
7. Specific SE 3	.21	.22	.18	.41	.38	.33	-									
8. Specific SE 4	.29	.26	.23	.43	.38	.38	.82	-								
9. Specific SE 5	.28	.27	.21	.42	.36	.40	.70	.84	-							
10. Specific SE 6	.28	.29	.21	.41	.32	.41	.59	.74	.88	-						
11. Specific SE 7	.28	.28	.22	.38	.31	.41	.50	.64	.79	.89	-					
12. Specific SE 8	.25	.28	.21	.31	.27	.38	.41	.54	.70	.81	.91	-				
13. Specific SE 9	.22	.25	.19	.27	.23	.33	.32	.45	.61	.71	.82	.90	-			
14. Specific SE 10	.16	.20	.18	.21	.17	.28	.22	.33	.47	.58	.68	.76	.86	-		
15. Word reading[a]	.20	.22	.15	.29	.23	.24	.26	.29	.30	.29	.29	.25	.23	.19	-	
16. Sentence reading[b]	.22	.24	.17	.31	.27	.28	.26	.29	.29	.28	.27	.25	.23	.19	.70	-
17. Text reading[c]	.22	.24	.17	.38	.28	.31	.27	.30	.32	.30	.30	.27	.26	.20	.64	.69

Note. All correlations are significant at $p < .001$. SE = self-efficacy. [a] Word chain test (Lindeman, 1998). [b] Sentence verification test (Salmi, Eklund, Järvisalo, & Aro, 2011). [c] Text reading task (Salmi et al., 2011).

Table 5

Fit Indices of the Competing Self-Efficacy Models and Comparisons of the Models

Model	χ^2	*df*	*CFI*	*TLI*	*RMSEA* 90%. C.I.	*SRMR*	Model comparisons	χ^2 difference test[a]
1. Three correlated first-order factors	57.53***	24	.99	.99	0.03 0.02–0.04	0.02	-	
2. One first-order factor	781.75***	27	.81	.74	0.15 0.14–0.16	0.15	1 vs 2	$\chi^2(3) = 311.72$***
3. Two correlated first-order factors	390.94***	26	.92	.89	0.10 0.09–0.11	0.11	3 vs 1 3 vs 2	$\chi^2(2) = 130.76$*** $\chi^2(1) = 196.89$***
4. Two correlated first-order factors	275.64***	26	.94	.92	0.09 0.08-0.10	0.06	4 vs 1 4 vs 2	$\chi^2(2) = 403.66$*** $\chi^2(1) = 78.35$***

[a] The model is improved if $p < .05$.
***$p < .001$.

Table 6

Invariance Comparisons of Specificity of Self-Efficacy of Reading by Gender and by Grade Level

Model	χ^2	*df*	*CFI*	*TLI*	*RMSEA* 90%. C.I.	*SRMR*	χ^2 difference test[a]	Δ*CFI* / Δ*RMSEA*
Invariance by gender								
1. Unconstrained	76.572	48	.994	.990	0.031 0.017-0.043	0.03	-	-
2. Factor loadings equal	93.454	54	.991	.988	0.034 0.022-0.045	0.04	$\chi^2(6)= 16.73$, $p = .010$	-0.003 / +0.003
3. Factor loadings & intercepts equal	113.333	60	.988	.986	0.037 0.027-0.048	0.05	$\chi^2(6)=27.16$, $p < .001$	-0.003 / +0.003
4. Factor loadings, intercepts & factor means equal	129.783	63	.985	.983	0.041 0.031-0.051	0.06	$\chi^2(3)=19.27$, $p < .001$	-0.003 / +0.004
5. Factor loadings, intercepts, factor means, & factor variances and covariances equal	142.08	69	.983	.983	0.041 0.031-0.050	0.11	$\chi^2(6)=12.31$, $p = .055$	-0.002 / +0.000
Invariance by grade level								
1. Unconstrained	179.992	96	.985	.977	0.052 0.040-0.064	0.04	-	-
2. Factor loadings equal	215.149	114	.982	.977	0.053 0.042-0.063	0.07	$\chi^2(18)= 34.99$, $p = .009$	-0.003 / +0.001
3. Factor loadings & intercepts equal	274.636	132	.975	.972	0.058 0.048-0.068	0.08	$\chi^2(18)=62.15$, $p < .001$	-0.007 / +0.005
4. Factor loadings, intercepts & factor means equal	365.495	141	.960	.959	0.071 0.062-0.080	0.11	$\chi^2(9)=69.20$, $p < .001$	-0.015 / +0.013
5. Factor loadings, intercepts, & factor variances and covariances equal	321.888	150	.969	.971	0.060 0.051-0.069	0.15	$\chi^2(18)=44.48$, $p < .001$[b]	-0.006 / +0.002[b]

Note. Where χ^2 difference test and ΔCFI / ΔRMSEA are reported, the model was compared to the previous, less constrained model.
[a]The model is improved if $p < .05$.
[b]Invariance comparison to Model 3.

Table 7

Wald Test Results Comparing Self-Efficacy Latent Means by Grade Level

	General Level Self-Efficacy		Intermediate Level Self-Efficacy		Specific Level Self-Efficacy	
Grade Comparisons	Wald	Cohen's *d*	Wald	Cohen's *d*	Wald	Cohen's *d*
Grade 2 vs 3	1.81	0.14	9.37**	0.40	18.29***	0.47
Grade 2 vs 4	3.17	0.19	17.43***	0.59	39.29***	0.63
Grade 2 vs 5	3.52	0.21	21.08***	0.74	71.67***	0.88
Grade 3 vs 4	0.38	0.05	6.07*	0.21	9.78**	0.22
Grade 3 vs 5	0.59	0.04	12.80***	0.36	42.59***	0.49
Grade 4 vs 5	0.03	0.01	1.98	0.14	12.31***	0.28

Note. SE = self-efficacy.
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 8

Correlations Between the Specificity Levels of Self-Efficacy and Reading Fluency for the Full Sample (N = 1327)

	Factor	1	2	3
1.	Specific level self-efficacy	-		
2.	Intermediate level self-efficacy	.60	-	
3.	General level self-efficacy	.39	.67	-
4.	Reading fluency[a]	.38	.52	.34

Note. All correlations are significant at $p < .001$.

[a]Reading fluency scores standardized within grade level.

Table 9

Correlations Between the Specificity Levels of Self-Efficacy and Reading Fluency by Grade Level

	Factor	1.	2.	3.	4.
1.	Specific level self-efficacy	-	.63 /.62	.37 /.40	.29 /.42
2.	Intermediate level self-efficacy	.53 /.41	-	.83 /.66	.59 /.50
3.	General level self-efficacy	.49 /.41	.69 /.75	-	.30 /.27
4.	Reading fluency	.42 /.41	.56 /.51	.39 /.41	-

Note. Correlations above the diagonal are for students in Grade 2 (n = 178) and 3 (n = 471), correlations below the diagonal are for students in Grade 4 (n = 383) and 5 (n = 295). All correlations are significant at $p < .001$.

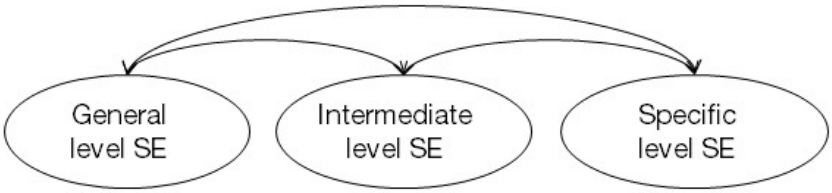

Figure 1. Hypothesized Three-factor Model of Reading Self-efficacy. SE = self-efficacy

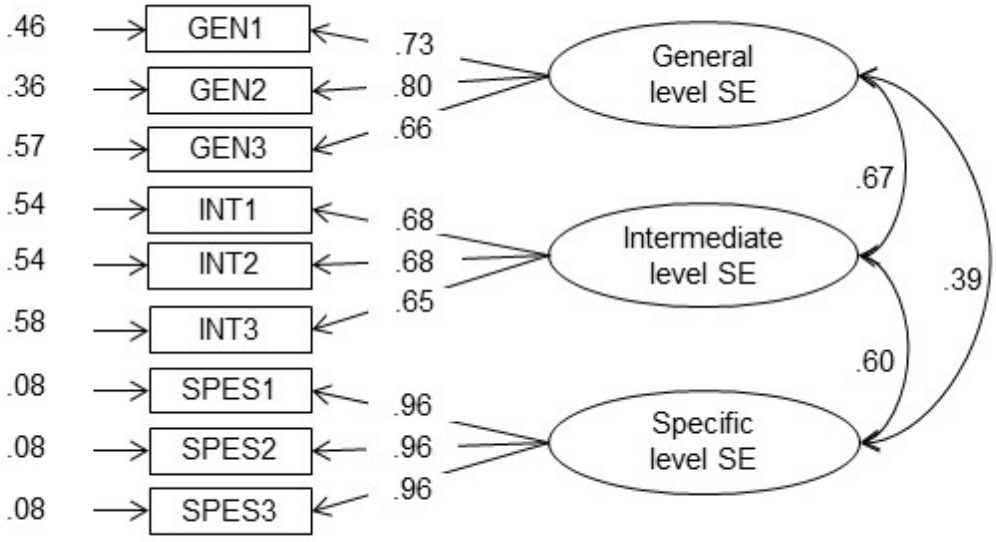

Figure 2. Three-factor Structure of Reading Self-efficacy. Standardized estimates are presented. All estimates are significant at $p < .001$. SE = self-efficacy.

II

READING SELF-EFFICACY AND READING FLUENCY DEVELOPMENT AMONG PRIMARY SCHOOL CHILDREN: DOES SPECIFICITY OF SELF-EFFICACY MATTER?

by

Pilvi Peura, Tuija Aro, Helena Viholainen, Eija Räikkönen, Ellen Usher, Riikka Sorvo, & Mikko Aro, 2019

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Reading self-efficacy and reading fluency development among primary school children: Does specificity of self-efficacy matter?

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ABSTRACT

Efficacy beliefs relate to effort and persistence devoted to learning. Therefore, efficacy beliefs might be especially important in achieving skills that require persistent practice, such as fluent reading. Although reading self-efficacy has been positively linked to reading comprehension, less is known about its relationship to reading fluency. The relationship between reading self-efficacy studied at three specificity levels and reading fluency development was examined among Finnish primary school students (N = 1327). The results showed that self-efficacy related positively to reading fluency and its development. The association was dependent on the specificity of the self-efficacy measure. Specific and intermediate self-efficacy were positively related to fluency, whereas general self-efficacy was not. Intermediate self-efficacy predicted fluency development. Findings indicate the need to identify and address low reading self-efficacy among children as young as Grade 2, as self-efficacy corresponds to the reading skills being learned.

1. Introduction

Self-efficacy, which refers to beliefs people hold about their capabilities to execute certain action or task (Pajares, 1996; Schunk, 1991) is known to influence actions in various ways (Bandura, 1997). Efficacy beliefs influence the choices people make, the goals they set for learning (Schnell, Ringeisen, Raufelder, & Rohrmann, 2015), effort they put forth (Galla et al., 2014; Komarraju & Nadler, 2013) and their persistence in tasks (Schnell et al., 2015). Therefore, efficacy beliefs might be especially important for development in skill areas requiring effort and persistent independent practice, such as reading fluency. However, existing studies offer a limited understanding of the relationships between self-efficacy and reading fluency development, because most studies in the field target reading comprehension. The few existent studies targeting reading fluency show positive associations between efficacy beliefs and reading fluency (e.g., Guthrie, Coddington, & Wigfield, 2009; Ho & Guthrie, 2013; Mercer, Nellis, Martínez, & Kirk, 2011); however, these studies have not accounted for learners' fluency development over time (for an exception, see Mercer et al., 2011). In addition, little is known about the relationship between self-efficacy and reading fluency development in the early school years, as most studies have targeted older children. In this study, we focus on the relationship between reading self-efficacy and reading fluency development among primary school children.

1.1. Development of reading fluency

A key challenge for teachers of students in primary school grades is to help learners develop fluent reading skills. Reading fluency is defined as an automatized decoding and word recognition process, which develops gradually (LaBerge & Samuels, 1974). Increasing automaticity during reading frees cognitive resources for understanding what is read (LaBerge & Samuels, 1974). Thus, reading fluency is seen as the bridge to making meaning out of text (Pikulski & Chard, 2005). Reading fluency development is especially important in transparent orthographies, like Finnish, where accuracy is mastered rather early (Seymour, Aro, & Erskine, 2003), but the challenge is to acquire a sufficient rate of reading and automatization of decoding (Aro, 2004; Holopainen, Ahonen, & Lyytinen, 2001; Landerl, Wimmer, & Frith, 1997). In addition, inter-individual variation in reading skills seems to arise especially in reading speed (Seymour et al., 2003), and difficulties in reading speed are seen as universal features of reading disabilities (Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Körne, 2003). Furthermore, early reading fluency development predicts later reading comprehension (Kim, Petscher, Schatschneider, & Foorman, 2010; see also Fuchs, Fuchs, Hosp, & Jenkins, 2001). Achieving fluent reading skills requires

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practice and numerous encounters with specific words and text types. Therefore, fluency development is largely guided by independent reading practice, as Share (1995) proposed in his self-teaching hypothesis. Good readers spend increasing time in reading activities whereas children struggling with reading read very little independently (Anderson, Wilson, & Fielding, 1988). To become fluent readers, children must engage in reading activities both in and out of school, practice reading persistently, and expend effort to improve. The beliefs children have about their capabilities in reading are likely important instigators of reading behavior, and may therefore also be related to the development of the processes related to reading fluency.

1.2. Assessing reading self-efficacy

Efficacy beliefs are theorized to vary in several ways: in level (levels of task difficulty), in strength (weak or strong), and in specificity (generality) (Bandura, 1977, 1997). Students' personal efficacy beliefs thus vary across different domains (Bong, 1997) and according to the subskills required to be successful in them (Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013; Shell, Colvin, & Bruning, 1995). Bandura (1997) proposed that efficacy beliefs are differentiated across three levels of specificity. The most general level refers to efficacy beliefs broadly without specifying particular activities or subtasks. The intermediate level consists of efficacy beliefs "in a class of performances within the same activity domain under a set of conditions sharing common properties" (Bandura, 1997, p. 49). The most specific level corresponds to efficacy beliefs about performing a particular task or under specific circumstances. Thus, children may hold varying beliefs about their capabilities for learning in general, for learning reading skills, for certain reading competencies, or for specific reading tasks.

The relationship between self-efficacy and performance will vary according to the level at which self-efficacy and performance are assessed and the degree to which they correspond (Bandura, 1997; Bong & Skaalvik, 2003; Usher, 2015). The relationship between self-efficacy and performance is stronger when self-efficacy and performance measures match (see Multon, Brown, & Lent, 1991; Talsma, Schüz, Schwarzer, & Norris, 2018). However, this body of research has included few studies of children (Talsma et al., 2018), and meta-analyses have not separated research findings according to the specificity level of self-efficacy but rather by the specificity of the performance measure (Multon et al., 1991). Most studies that have directly examined different specificity levels have reported that the association between self-efficacy and performance was stronger when the two were assessed at corresponding specificity (e.g., Bong, 2002; Pajares & Miller, 1995; Usher & Pajares, 2009; however, see Lent, Brown, & Gore, 1997 for an exception). A longitudinal investigation of Australian adolescents' math self-efficacy revealed that the relationship between self-efficacy and math skills varied according to the specificity level of self-efficacy; the more specific beliefs were shown to predict math achievement later (Phan, Ngu, & Alrashidi, 2018). The previous studies target mainly adolescents or young adults and contexts other than reading; however, the relationships between self-efficacy and performance may differ in other contexts and with learners in other age groups (see Pajares, 2007).

In previous reading studies of primary school children, self-efficacy has been mainly operationalized at the general level: general academic self-efficacy (e.g., Galla et al., 2014; Hornstra, van der Veen, Peetsma, & Volman, 2013; Liew, McTigue, Barrois, & Hughes, 2008; Mercer et al., 2011) or general reading self-efficacy (e.g., Lee & Zentall, 2015; Smith, Smith, Gilmore, & Jameson, 2012). Less research has been carried out on more specific efficacy beliefs in reading (i.e., at intermediate and specific levels), although some evidence has shown that the influence of children's reading self-efficacy on reading performance differs according to the level at which self-efficacy is measured (Piercey, 2013).

1.3. Relationship between reading self-efficacy and reading development

High self-efficacy has shown to be related to higher reading achievement among primary school children (e.g., Hornstra et al., 2013; Hornstra, van der Veen, & Peetsma, 2016; Smith et al., 2012; Solheim, 2011). However, this research has focused primarily on reading comprehension. The few studies focusing on reading fluency (defined as word, sentence, or text reading speed and accuracy) as an outcome have also indicated a positive relationship with self-efficacy. Most of these studies (except Carroll & Fox, 2017) have focused on middle school students and beyond (Guthrie et al., 2009; Ho & Guthrie, 2013; Mercer et al., 2011). However, Carroll and Fox (2017) found that, among younger children (8- to 11-year-olds), self-efficacy was positively related to fluency but not to reading comprehension. Others have found a positive association between self-efficacy and both reading fluency and comprehension among students in Grade 5 (Guthrie et al., 2009; Mercer et al., 2011) and Grade 7 (Ho & Guthrie, 2013). These findings suggest that efficacy beliefs might be differently related to reading fluency and comprehension in the early school years.

It also bears noting that the majority of studies suggesting a positive association between self-efficacy and reading have been cross-sectional. Longitudinal studies, on the other hand, have found small (Lee & Jonson-Reid, 2016) or no (Lee & Zentall, 2015; Liew et al., 2008) effect of self-efficacy on later reading achievement or on reading development (e.g., Galla et al., 2014; Guthrie et al., 2007; Hornstra et al., 2013). In general, positive changes in self-efficacy have been found to relate to positive changes in reading achievement (Galla et al., 2014; Hornstra et al., 2013; Hornstra et al., 2016). The only study, to our knowledge, that has explicitly examined whether self-efficacy predicts reading fluency development revealed that fifth-grade students' academic self-efficacy was positively related to reading fluency and comprehension but did not predict fluency development across one academic year (Mercer et al., 2011).

The relationship between self-efficacy and performance has been shown to vary according to the level of task specificity (Piercey, 2013; see also Talsma et al., 2018). Different relationships that have been observed between self-efficacy and reading achievement across different developmental periods might be partially accounted for by the operationalization of self-efficacy and/or achievement outcomes. Some studies have found rather small associations between self-efficacy and overall reading achievement (e.g., Liew et al., 2008; Smith et al., 2012), whereas others have found a stronger relationship between self-efficacy and reading fluency (e.g., Carroll & Fox, 2017; Guthrie et al., 2009; Mercer et al., 2011). In addition, findings regarding the predictive role of self-efficacy in reading development are inconclusive. Longitudinal studies have mainly focused on domain-general academic self-efficacy (e.g., Galla et al., 2014; Hornstra et al., 2013; Mercer et al., 2011) or general reading self-efficacy (Guthrie et al., 2007). Less is known about how more specific beliefs relate to reading development. The only study in which efficacy beliefs were found to predict later word reading or comprehension skills assessed self-efficacy for specific reading tasks (Lee & Jonson-Reid, 2016).

1.4. Age-related differences in the relationship between self-efficacy and skills

As self-appraisal skills develop and children gain additional information about their own efficacy as readers their beliefs become increasingly important predictors of their behavior (Bandura, 1997; Harter, 2012). Nevertheless, few studies have directly examined this relationship over time. Davis-Kean et al. (2008) found the relationship between self-efficacy and math performance to increase with age across Grades 1–12, but no differences were found between early (Grades 1–2) and late (Grades 3–5) primary school. Nor did researchers find evidence for considerable grade-level differences in the relationship between self-efficacy and reading between students in Grade 4, 7, and 10 (Shell

et al., 1995). Although efficacy beliefs have been found to be associated with reading achievement as early as the first years of schooling (Lee & Jonson-Reid, 2016; Liew et al., 2008), little information is available on age-related differences in the strength of the association between self-efficacy and reading development.

1.5. The present study

The general aim of the present study was to examine how reading self-efficacy is related to reading fluency development among primary school children in Finland. We used latent growth curve modeling to examine the relationship between self-efficacy, measured at three levels of specificity, and reading fluency development during one year. The following two research questions and hypotheses guided our investigation.

First, are efficacy beliefs, measured at three levels of specificity, differently related to the level of and change in reading fluency among primary school children? We expected a positive association between reading self-efficacy and reading fluency based on previous findings (e.g., Carroll & Fox, 2017). We hypothesized that self-efficacy would positively predict reading fluency development as high self-efficacy has been found to relate to higher effort (Galla et al., 2014) and reading amount (e.g., Schüller, Birnbaum, & Kröner, 2017), both of which supposedly foster fluency development. We hypothesized that the association between self-efficacy and reading fluency would vary according to the specificity level of self-efficacy consistent with empirical findings (Piercey, 2013; see also Talsma et al., 2018) and theoretical suggestions (Bandura, 1997). As there is some evidence that specific beliefs are associated more strongly with later skill level (Phan et al., 2018), we further assumed that the more specific self-efficacy judgments would be more strongly related to reading fluency development (see Fig. 1). Second, we asked, are there grade-level differences in how reading efficacy beliefs are related to the levels of and changes in reading fluency among primary school children? Given the lack of research on age-related differences among primary school children, we made no hypotheses for this question.

2. Method

2.1. Participants and procedure

Participants in the study were 1327 children (48.08% girls) from 20 primary schools who took part in a longitudinal investigation (Self-Efficacy and Learning Disability Intervention research project, 2013–2015) focused on children's motivation and reading and math difficulties. Volunteering schools from rural, suburban, and urban areas were recruited for the project via municipality officials responsible for basic education. The students participated voluntarily with written informed consent of their parents. The Ethical Committee of the first author's university evaluated the research procedure. Participating children were from Grade 2 (13.41%, $n = 178$), Grade 3 (35.49%, $n = 471$), Grade 4 (28.86%, $n = 383$), and Grade 5 (22.23%, $n = 295$) at the beginning of the study ($M_{age} = 9.97$ years, $SD = 1.05$; $M_{range} = 7.84$ to 12.83 years). From each school, 1 to 10 classes participated in the study with an average of 18 participating students per class.

Children were assessed two times during one school year (November 2013 (T1), May 2014 (T2)) and in the next autumn (September 2014 (T3)). Between January and May 2014, 5.8% of the participating children, who were among the lowest lowest-achieving group of children in reading, took part in reading fluency interventions (for details of the interventions, see Aro et al., 2018). The effect of the reading fluency intervention was controlled for in all analyses (i.e., the level of self-efficacy, the level and slope of reading fluency). Trained research assistants administered assessments in classrooms during regular school hours or individually in a quiet location. Practice items were presented before each task. All items on the self-efficacy questionnaire were read aloud by research assistants to ensure that all children could answer the questions irrespective of their current reading level.

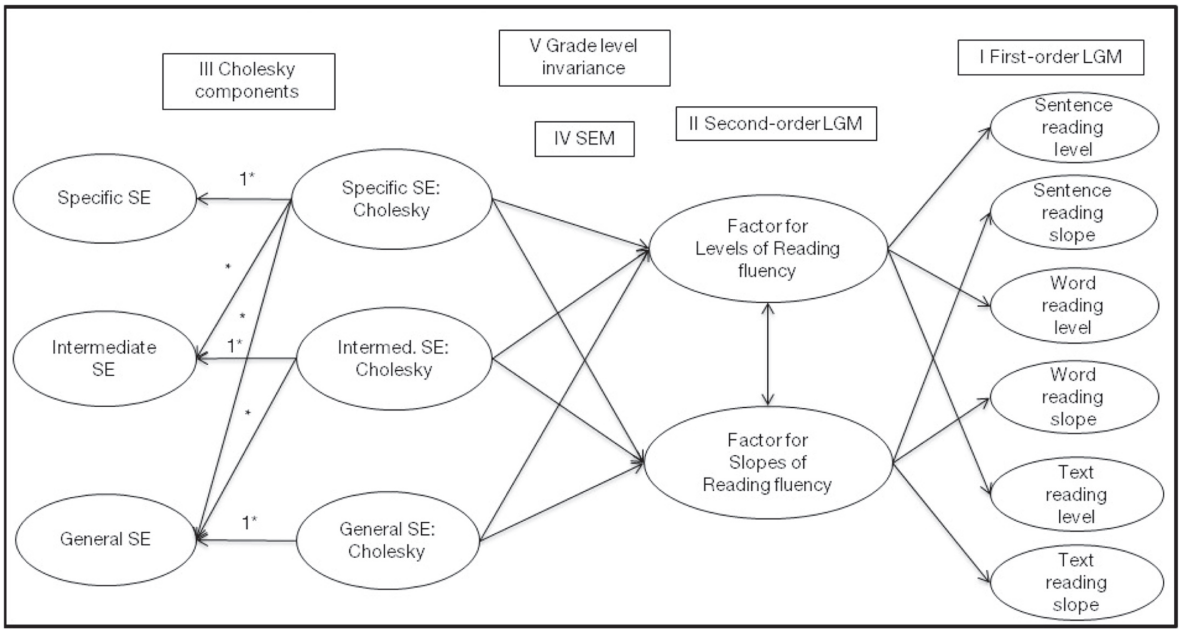

Fig. 1. Theoretical model of the relationships between self-efficacy and reading fluency development. SE = self-efficacy, SEM = Structural equation model, LGM = Latent growth curve model. 1* fixed to one, * freely estimated.

2.2. Measures

2.2.1. Reading fluency

Reading fluency tests were used to assess children's word-, sentence-, and text-level reading speed and accuracy. Reading fluency was assessed with three time-limited tests: two of them were administered in groups (i.e., the word chain test, Lindeman, 1998; the sentence verification task, Salmi, Eklund, Järvisalo, & Aro, 2011) and one was administered individually (i.e., the text reading task, Salmi et al., 2011). Parallel test versions for each of the three assessment points (T1-T3) were used (except for the Word Chain Test, in which two parallel test versions were used).

2.2.2. Word chain test (word reading)

The word chain test consisted of words that were written in clusters of 2–4 words with no spaces between them (78 word chains altogether). The task was to silently read and separate the words with a vertical line as fast as possible. The test score was the number of correctly identified words within 3.5 min. This test has been shown to have high scale reliability (Cronbach's alpha = 0.97; Lindeman, 1998). In our sample, correlations across the three time points were high (r = 0.84–0.87). The same test versions were completed at the first (T1) and last assessment (T3); however, due to the long time lag (11 months) between the assessments, any possible repetition effect was considered to be minimal.

2.2.3. Sentence verification task (sentence reading)

The sentence verification task, similar to the Woodcock-Johnson Reading Fluency task (Woodcock, McGrew, & Mather, 2001), consisted of 70 semantically simple and short statements. After silently reading each statement, a child was asked to mark whether the statement was correct or incorrect. The test score was the number of correct responses made within two minutes. This test has been shown to have high scale reliability (Cronbach's alpha = 0.94; Eklund, Salmi, Polet, & Aro, 2013). Correlations between tests conducted at the three time points in our study were high (r = 0.79–0.82).

2.2.4. Text reading

In the text reading task, children read as much text as possible aloud from an age-appropriate text within a 1.5-minute time span. The passage lengths varied from 251 to 261 words. A text reading score was calculated as the number of words read correctly within the time limit. Performances across different text versions have been shown to correlate highly (r = 0.93–0.97; Eklund et al., 2013). Again, correlations between tests conducted at the three times points in our study were high (r = 0.89–0.92).

2.2.5. Reading self-efficacy

A measure of reading self-efficacy created for primary school children was developed following Bandura's (2006) recommendations. Items specifically targeted reading fluency skills, and researchers with expertise in reading and in self-efficacy were consulted in formulating the items. Three different levels of specificity were assessed: specific, intermediate, and general-level reading self-efficacy (for details see Peura et al., 2018, items presented in Appendix A.). All items began with the question stem, "*How certain are you that you can…*". Participants rated the strength of their confidence in mastering given activities using a seven-point scale varying from "*I'm totally certain I can't…*" to "*I'm totally certain I can…*" To assess *general-level reading self-efficacy* (3 items), children were asked to rate their confidence in learning to read more fluently and more accurately and to understanding what they were reading. *Intermediate-level reading self-efficacy* (3 items) was assessed by asking students to rate their confidence for everyday reading activities that require fluent reading (e.g., "reading a long book"). To assess *specific-level reading self-efficacy* (8 items), children were shown eight paragraphs of increasing length and were asked to judge how confident they were that they could read each presented paragraph aloud in 30 s. To ensure that students could understand this time frame, researchers first demonstrated a 30-s pause with the help of visual dial. Each paragraph was then presented on an overhead projector for a short time (5 s) so that students could visualize the length of the paragraph. Reading self-efficacy factors emerged at three different specificity levels (measurement model fit: $\chi^2(24) = 59.04$, $p < .001$; RMSEA = 0.034; CFI = 0.99; TLI = 0.99; SRMR = 0.02, for details see Peura et al., 2018). Factor loadings ranged from 0.96 to 0.96 at the specific level, from 0.65 to 0.68 at the intermediate level, and from 0.66 to 0.80 at the general level. Residual variances were statistically significant and positive. Invariance comparisons indicated scalar measurement invariance (Meredith, 1993) across grade levels.

2.3. Statistical analyses

All analyses were performed using the MPlus program, version 7.3 (Muthén & Muthén, 1998–2012). Several preliminary analyses were conducted prior to answering our primary questions of interest. First, Little's (1988) missing completely at random (MCAR) test showed that data were not missing completely at random ($\chi^2(1738) = 2535.46$, $p < .001$). After further investigation, we determined that the reasons for missing data (5.34% of all values) could be tracked to students' absence from school on the day of data collection, students moving to another school during the study, or students skipping single-items. Therefore, data were considered to be missing at random (MAR). The Full-Information-Maximum-Likelihood (FIML) procedure was used to account for missing data (Enders, 2010). Maximum likelihood estimator with robust standard errors (MLR) was used as an estimator in all analyses. The multilevel structure of the data was taken into account by first examining intra-class correlations for reading fluency and the self-efficacy variables. The ICCs were small at the class level (Reading fluency.01–0.11, self-efficacy 0.01–0.17), indicating that most of the variation was at the individual level and little was between classes. There was some variation due to the class in terms of students' specific level self-efficacy (ICCs 0.16–0.17); however, as these items are considered easier for older students, this finding is explained by grade level (i.e., developmental) differences. Therefore, the hierarchical nature of the data (students nested in 75 classes) was taken into account by estimating unbiased standard errors using the COMPLEX option in MPlus.

We used a second-order latent growth curve approach, explicitly the factor-of-curves model, to examine reading fluency development (McArdle, 1988; see also Duncan, Duncan, & Strycker, 2006). This is a two-step modeling procedure. First, a latent growth curve model (LGM; Muthén & Khoo, 1998) for each reading fluency measure was built separately (see Fig. 1, Phase I). Factor loadings were fixed to 1 for each level factor. For each slope factor, factor loadings were set to correspond to a non-linear time scale (0,1, freely estimated). Next, a second-order LGM was formed (Fig. 1, Phase II) to examine whether the development in first-order LGMs are interrelated. Covariances between the first-order factors were fixed at 0. The level factors of the first-order LGMs were set to load on one factor (labeled as "Factor for Levels") and the slope factors of the first-order LGMs were set to load on another factor (labeled as "Factor for Slopes"). Factor for Levels and Factor for Slopes were allowed to correlate with each other.

The unique effects of each specificity level of self-efficacy on reading fluency level (Factor for Levels) and development (Factor for Slopes) were examined using hierarchical regression analysis within a structural equation modeling (SEM) framework. The starting point was the measurement model of specificity of self-efficacy in reading, which included three correlated factors. However, the factors representing the specificity levels of self-efficacy were multicollinear (range of correlations r = 0.37–0.69). In order to separate the unique variance of each specificity level of self-efficacy, the Cholesky factoring approach was applied (for details see de Jong & van der Leij, 1999) (see Fig. 1, Phase III). Cholesky factoring for the factors of self-efficacy was done so that the first Cholesky component (labeled as "Specific self-efficacy:

Cholesky") was set to explain all variance unique to the specific self-efficacy factor and the variance it shares with the intermediate and general self-efficacy factors. The second Cholesky component (labeled as "Intermediate self-efficacy: Cholesky") was fixed to explain the unique variance of the intermediate self-efficacy and the variance it shares with general self-efficacy factor. The third Cholesky component (labeled as "General self-efficacy: Cholesky") captured the remaining (i.e., unique) variance of the general self-efficacy factor. The Cholesky components were independent of each other (i.e., the correlations between the Cholesky components were fixed to 0).

Next, Factor for Levels and Factor for Slopes of reading fluency were regressed on the self-efficacy Cholesky components in hierarchical order (Fig. 1, Phase IV). The order in which Factor for Levels and Factor for Slopes are regressed on the Cholesky components is determined by the formation process of the self-efficacy Cholesky (see de Jong & van der Leij, 1999). First, Specific Self-Efficacy: Cholesky was set to explain Factor for Levels and Factor for Slopes of reading fluency. Then, Intermediate Self-Efficacy: Cholesky was set to explain the remaining variance of the Factors for Levels and Slopes of reading fluency (i.e., variance not explained by Specific Self-Efficacy: Cholesky). Finally, General Self-Efficacy: Cholesky was set to explain the remaining variance of Factors for Levels and Slopes of reading fluency. Differences in regression coefficients between the specificity levels of self-efficacy were examined using Wald's chi-square tests of parameter equalities (Muthén & Muthén, 1998–2012).

The goodness-of-fit of the tested models was evaluated with the χ^2 test. However, as the χ^2 test is sensitive to a large sample size ($N = 1327$ in the present study) and given the non-normality of the data, we also considered the Comparative Fit Index, CFI (Bentler, 1990), Tucker-Lewis Index, TLI (Tucker & Lewis, 1973), Root-Mean-Square Error of Approximation, RMSEA (Steiger, 1990) with a 90% confidence interval, and Standardized Root-Mean-Square Error, SRMR (Hu & Bentler, 1995). Values smaller than 0.06 for RMSEA and 0.08 for the SRMR, and values higher than 0.95 for both the TLI and the CFI are considered representative for a well-fitting model for the data (Hu & Bentler, 1999).

The invariance of the full SEM model was examined using multigroup invariance comparison tests by grade level (Fig. 1, Phase V). The invariance was tested by comparing the fit of the baseline model (i.e., parameters of the model were freely estimated in all grade levels) to that of the constrained model (i.e., Self-efficacy model, Cholesky loadings, and LGM models were constrained to be equal across the grade levels), using the Satorra-Bentler scaled χ^2 test (Satorra & Bentler, 2001). A statistically significant χ^2 difference test ($p < .05$) denotes that the model with fewer degrees of freedom (i.e., fewer constraints) fits better with the data, whereas statistically non-significant χ^2 difference test denotes that the model with greater degrees of freedom (i.e., more constraints) fits better with the data. However, because the χ^2 test is sensitive to large sample size, the CFI, RMSEA, and SRMR criteria (see Chen, 2007; Cheung & Rensvold, 2002; MacCallum, Browne, & Cai, 2006) were also used to examine the invariance of the models. A change smaller than −0.01 in CFI supplemented by a change of smaller than 0.015 in RMSEA and smaller than 0.03 in SRMR (Chen, 2007) indicates that the hypothesis of invariance of factor loadings or intercepts should not be rejected, even though the χ^2 test indicates a statistically significant result.

3. Results

3.1. Preliminary results: descriptive statistics and latent growth models of reading fluency

Means and standard deviations of the observed variables and the correlations between them, by grade level, are presented in Tables 1 and 2.

Prior to examining the relationship between self-efficacy and reading fluency we first investigated whether reading fluency changed for students within each grade level across one school year. Separate first-order LGMs were carried out by grade level for each of the three fluency measures of interest: word, sentence and text reading fluency. For each reading fluency measure, a model including initial level and nonlinear slope fit the data well (see Table 4 for fit indices). The means and the variances of the levels of word, sentence and text reading fluency suggested differences between students in the initial level of word, sentence and text reading fluency. The slope means indicated that students' word, sentence, and text reading fluency each improved over time. Variance of the slope for text reading indicated that the students differed in the pace at which their fluency improved over time, and this was true for students at all grade levels. In word- and sentence-level reading fluency, pace was similar between the students in Grades 3–5 (i.e. variances of slopes were not statistically significant). Only sentence reading fluency growth varied between students in Grade 2 (i.e. slope of sentence reading was statistically significant).

A second-order LGM was then constructed to examine whether the development in first-order LGMs could be represented by higher order reading fluency factors. The three initial fluency levels (i.e., intercept terms for word, sentence, and text fluency) were set to load on one factor (Factor for Levels), and the slopes reflecting fluency development in the three corresponding areas were set to load on another factor (Factor for Slopes). This model showed a good fit to the data (χ^2 (108) = 310.30, $p < .001$, CFI = 0.97, TLI = 0.97, RMSEA = 0.07, and SRMR = 0.05) indicating that the second-order factors represented the level and development in reading fluency well. Parameter estimates for the second-order factor model are presented in Table 5. Syntax for the final analysis is provided in the Supplementary material. The mean Factor for Slopes score indicated that students improved in their reading fluency over time. The variance of the Factor for Slopes was statistically significant for all grade levels indicating that students within each grade level differed in the pace of their reading fluency development.

3.2. Reading self-efficacy and reading fluency development

To answer our primary question of interest—to investigate the unique relationship between reading self-efficacy, measured at different specificity levels, and reading fluency development, a hierarchical regression model within the SEM framework was formed (the self-efficacy model was combined with the LGM-model, Fig. 1 Phase V). The reading fluency factors were regressed on the self-efficacy Cholesky factors in hierarchical order. This model showed a good fit to the data (χ^2 (589) = 1109.30, $p < .001$, CFI = 0.97, TLI = 0.96, RMSEA = 0.05, and SRMR = 0.06). To answer our research question regarding grade-level differences in the relationship between self-efficacy and reading fluency development, invariance testing was conducted. The invariance comparison (see Table 3) indicated that the full model could be set as equal between grade levels (i.e., LGMs, second-order LGM, Cholesky loadings, and regression paths). We now provide more specific findings relevant to each analysis.

To further assess the relationship between self-efficacy at different specificity levels and reading fluency development, a model was constructed in which the regression paths were set to be equal between the self-efficacy specificity levels. This model did not fit the data very well (see Model 3 fit indices in Table 3), and the χ^2 difference test indicated that the relationship between the specificity levels differed from each other. Wald's χ^2 tests further indicated that the relationship to reading fluency and development differed according to self-efficacy specificity levels (Wald's χ^2 tests significant at $p < .05$, see Table 6). Only the relationship between specific self-efficacy and reading fluency development and general self-efficacy and reading fluency development did not differ from each other. The final model, in which the relationships between different specificity levels and reading fluency differ, but are set to be equal across grade levels, is presented in Fig. 2. The

Table 1
Descriptive statistics of observed variables.

Variable	Grade 2 (n = 178)	Grade 3 (n = 471)	Grade 4 (n = 383)	Grade 5 (n = 295)
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Self-efficacy[a]				
General SE 1	6.22 (1.31)	6.35 (1.10)	6.27 (1.09)	6.27 (0.99)
General SE 2	6.29 (1.09)	6.20 (1.10)	6.17 (1.13)	6.16 (1.06)
General SE 3	6.30 (1.01)	5.99 (1.18)	5.98 (1.27)	5.95 (1.16)
Intermediate SE 1	5.17 (1.93)	6.14 (1.40)	6.39 (1.15)	6.58 (0.92)
Intermediate SE 2	5.92 (1.57)	6.16 (1.31)	6.37 (1.08)	6.39 (1.06)
Intermediate SE 3	4.87 (2.12)	5.16 (1.70)	5.21 (1.68)	5.33 (1.53)
Specific SE 3	5.43 (1.98)	6.28 (1.34)	6.58 (0.94)	6.73 (0.80)
Specific SE 4	4.96 (2.14)	5.84 (1.62)	6.22 (1.21)	6.48 (1.03)
Specific SE 5	4.19 (2.24)	5.17 (1.87)	5.56 (1.57)	5.98 (1.30)
Specific SE 6	3.62 (2.22)	4.53 (1.94)	4.94 (1.80)	5.43 (1.60)
Specific SE 7	3.20 (2.16)	3.88 (2.00)	4.26 (1.93)	4.74 (1.83)
Specific SE 8	2.82 (2.10)	3.24 (1.99)	3.56 (1.89)	4.05 (1.88)
Specific SE 9	2.43 (1.95)	2.80 (1.91)	3.03 (1.84)	3.42 (1.91)
Specific SE 10	2.11 (1.93)	2.26 (1.77)	2.45(1.76)	2.70 (1.86)
Reading fluency				
Sentence Reading 1[b]	18.21 (7.15)	26.38 (8.21)	32.52 (9.77)	38.29 (10.99)
Word Reading 1[c]	44.73 (26.06)	72.78 (29.43)	99.50 (35.28)	123.53 (37.67)
Text Reading 1[d]	77.08 (33.76)	104.39 (31.69)	120.29 (32.49)	135.73 (30.87)
Sentence Reading 2[b]	23.61 (8.89)	30.77 (9.35)	38.70 (10.43)	43.72 (11.72)
Word Reading 2[c]	64.43 (31.01)	97.59 (30.91)	125.93 (36.22)	145.49 (42.16)
Text Reading 2[d]	97.79 (38.77)	121.77 (35.16)	139.82 (35.22)	154.15 (33.54)
Sentence Reading 3[b]	26.85 (9.66)	33.53 (9.68)	40.64 (11.19)	45.49 (12.05)
Word Reading 3[c]	77.18 (33.34)	105.40 (33.13)	133.56 (40.17)	155.07 (40.98)
Text Reading 3[d]	102.89 (39.94)	126.44 (35.60)	142.89 (34.70)	155.67 (31.70)

[a] 7-point scale.
[b] Sentence verification test (Salmi et al., 2011) max. score 70.
[c] Word chain test (Lindeman, 1998) max. score 214.
[d] Text reading task (Salmi et al., 2011) max. score 251–261.

statistically significant associations between the self-efficacy factors and reading fluency are presented separately for each grade level.

Of the three self-efficacy factors, only specific- and intermediate-level self-efficacy contributed uniquely and positively to students' reading fluency levels (Fig. 2) indicating that the higher the specific and intermediate self-efficacy, the better the level of reading fluency. Depending on the grade level, specific self-efficacy explained 8.4% to 19.4% of the variation and intermediate self-efficacy 8.4% to 15.2% of the variation in reading fluency. The unique effect of general self-efficacy did not account for additional variation in the level of reading fluency after specific and intermediate self-efficacy were controlled. Altogether, self-efficacy factors accounted for 34% to 47% of the variation in children's level of reading fluency.

Of the three self-efficacy factors, only intermediate self-efficacy predicted reading fluency development (see Fig. 2): the higher the intermediate self-efficacy, the faster students' reading fluency improved. Neither the specific nor the general self-efficacy accounted uniquely for the variation between students in reading fluency development. Depending on the grade level, intermediate self-efficacy explained between 2.8% and 7.8% of the variation in the fluency development. Collectively, the self-efficacy factors explained 5% to 8% of the variation in reading fluency development.[1]

4. Discussion

The present study adds to the previous literature by examining the reading self-efficacy of Finnish primary school children at three different specificity levels and studying its relationship to a less studied measure of reading competence—namely, reading fluency, using a longitudinal design. Children's reading self-efficacy was assessed in three ways designed to explicitly detect the unique role of capability beliefs at different levels of specificity in predicting reading fluency development. The associations between reading self-efficacy and reading fluency were found to vary according to the specificity level of reading self-efficacy. Students with high specific and intermediate self-efficacy were more fluent readers than were students with comparably low self-efficacy, whereas general self-efficacy did not uniquely relate to reading fluency. Moreover, for students reporting higher intermediate self-efficacy at the beginning of the year, the pace of improvement in fluency across one year was faster than for students with lower levels of intermediate self-efficacy. In other words, the more children believed in their capabilities for everyday reading activities, such as reading a book, the faster their fluency skills improved. However, specific and general self-efficacy were not related to fluency development. Our findings thus extend research investigating the relationship between self-efficacy and reading performance by demonstrating that beliefs at different specificity levels have varying predictive power for children's reading development.

On the whole, these findings suggest that more specific efficacy beliefs (i.e., specific and intermediate beliefs) are more closely aligned with reading performance and consequently show a stronger connection to reading fluency and its development compared to more global reading beliefs. These findings parallel theoretical recommendations of matching the assessment of self-efficacy with the skills at hand (Bandura, 1997; Bong & Skaalvik, 2003). They also extend previous empirical findings obtained with adolescents and adults that revealed a stronger association between specific beliefs and performance than between general beliefs and performance (Bong, 2002; Pajares & Miller, 1995; Phan et al., 2018). However, contrary to our hypotheses, the

[1] Controlling for the effect of the reading fluency intervention from the level of self-efficacy as well as from the level and slope of reading fluency did not influence the results.

Table 2
Inter-correlations between the observed variables by grade level.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.GEN1	–	0.48/0.61	0.29/50	0.29/0.31	0.29/0.31	0.30/0.25	0.19/0.20	0.32/0.31	0.27/0.28	0.28/0.24	0.25/0.25
2. GEN2	0.65/0.70	–	0.32/0.51	0.29/0.29	0.39/0.39	0.38/0.31	0.21/0.24	0.20/0.30	0.23/0.29	0.25/0.29	0.22/0.25
3. GEN3	0.50/0.51	0.53/0.64	–	0.36/0.38	0.29/0.34	0.17/0.30	0.01*/0.30	0.09*/0.34	0.12*/0.27	0.11*/0.26	0.16/0.23
4. INT1	0.37/0.35	0.39/0.33	0.50/0.40	–	0.40/0.50	0.46/0.37	0.30/0.38	0.35/0.39	0.39/0.41	0.45/0.37	0.42/0.35
5. INT2	0.32/0.47	0.32/0.45	0.42/0.44	0.56/0.53	–	0.45/0.37	0.38/0.42	0.37/0.41	0.36/0.36	0.32/0.32	0.32/0.29
6. INT3	0.33/0.41	0.36/0.48	0.42/0.42	0.45/0.37	0.40/0.45	–	0.37/0.33	0.44/0.37	0.42/0.44	0.47/0.43	0.44/0.43
7. SPES3	0.24/0.32	0.29/0.33	0.30/0.27	0.31/0.47	0.22/0.36	0.30/0.31	–	0.84/0.83	0.73/0.69	0.64/0.58	0.53/0.48
8. SPES4	0.30/0.27	0.35/0.28	0.33/0.24	0.35/0.42	0.33/0.30	0.36/0.31	0.67/0.82	–	0.84/0.85	0.73/0.74	0.64/0.63
9. SPES5	0.30/0.34	0.33/0.37	0.28/0.26	0.34/0.29	0.27/0.34	0.33/0.43	0.59/0.61	0.78/0.81	–	0.86/0.87	0.77/0.79
10. SPES6	0.31/0.36	0.34/0.37	0.27/0.27	0.37/0.24	0.28/0.26	0.37/0.36	0.49/0.55	0.70/0.70	0.88/0.84	–	0.92/0.86
11. SPES7	0.34/0.32	0.38/0.35	0.32/0.23	0.39/0.19	0.31/0.24	0.40/0.32	0.44/0.43	0.64/0.59	0.80/0.76	0.90/0.90	–
12. SPES8	0.34/0.29	0.38/0.34	0.30/0.26	0.35/0.17	0.27/0.23	0.39/0.30	0.39/0.34	0.56/0.48	0.71/0.67	0.82/0.83	0.91/0.92
13. SPES9	0.25/0.21	0.33/0.27	0.28/0.23	0.28/0.10	0.23/0.18	0.36/0.25	0.32/0.23	0.46/0.36	0.60/0.57	0.70/0.72	0.80/0.83
14. SPES10	0.20/0.14	0.25/0.22	0.23/0.18	0.22/0.07	0.18/0.13	0.34/0.19	0.28/0.12	0.36/0.25	0.48/0.46	0.58/0.58	0.66/0.69
15. SR 1	0.28/0.30	0.31/0.29	0.23/0.27	0.37/0.28	0.28/0.22	0.31/0.32	0.30/0.23	0.31/0.25	0.31/0.32	0.30/0.30	0.32/0.28
16. WR 1	0.20/0.25	0.22/0.23	0.17/0.18	0.35/0.23	0.21/0.19	0.26/0.32	0.30/0.20	0.34/0.24	0.30/0.29	0.31/0.29	0.33/0.28
17. TEXT 1	0.22/0.36	0.30/0.28	0.24/0.25	0.46/0.37	0.31/0.21	0.36/0.31	0.29/0.30	0.38/0.32	0.34/0.37	0.34/0.33	0.37/0.29
18. SR 2	0.22/0.30	0.25/0.28	0.21/0.23	0.36/0.32	0.30/0.23	0.29/0.37	0.20/0.29	0.27/0.29	0.27/0.30	0.26/0.29	0.27/0.25
19. WR 2	0.22/0.25	0.22/0.24	0.16/0.16	0.34/0.25	0.22/0.16	0.27/0.31	0.23/0.24	0.29/0.26	0.25/0.28	0.26/0.30	0.26/0.26
20. TEXT 2	0.20/0.34	0.36/0.27	0.24/0.23	0.42/0.38	0.27/0.20	0.35/0.34	0.32/0.33	0.38/0.35	0.35/0.39	0.36/0.36	0.39/0.32
21. SR 3	0.24/0.36	0.24/0.31	0.26/0.18	0.42/0.33	0.31/0.21	0.35/0.35	0.26/0.29	0.31/0.31	0.31/0.34	0.32/0.31	0.35/0.26
22. WR 3	0.18/0.28	0.19/0.23	0.14/0.13	0.34/0.27	0.19/0.18	0.25/0.33	0.21/0.22	0.28/0.25	0.28/0.31	0.33/0.31	0.32/0.28
23. TEXT 3	0.26/0.35	0.32/0.27	0.25/0.23	0.44/0.41	0.28/0.22	0.38/0.34	0.34/0.32	0.40/0.36	0.36/0.38	0.36/0.35	0.38/0.31

	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
1.GEN1	0.16*/0.22	0.19/0.21	0.16/0.16	0.12*/0.18	0.14*/0.19	0.20/0.17	0.18*/0.20	0.10*/0.16	0.25/0.24	0.28/0.21	0.23/0.19	0.24/0.21
2. GEN2	0.21/0.23	0.18/0.23	0.09*/0.20	0.21/0.17	0.26/0.20	0.27/0.17	0.15/0.17	0.21/0.20	0.29/0.22	0.22/0.19	0.28/0.19	0.30/0.18
3. GEN3	0.13*/0.19	0.11*/0.16	0.15/0.16	0.01*/0.12	0.05*/0.14	0.07*/0.12	0.03*/0.10	0.07*/0.13	0.12*/0.11	0.07*/0.10	0.10*/0.13	0.10*/0.12
4. INT1	0.31/0.28	0.34/0.24	0.28/0.19	0.40/0.29	0.40/0.27	0.48/0.35	0.40/0.36	0.33/0.29	0.43/0.38	0.44/0.37	0.46/0.31	0.39/0.37
5. INT2	0.30/0.23	0.24/0.21	0.15/0.17	0.30/0.29	0.29/0.25	0.39/0.27	0.33/0.25	0.30/0.24	0.38/0.31	0.32/0.23	0.38/0.22	0.33/0.30
6. INT3	0.35/0.40	0.33/0.35	0.24/0.30	0.30/0.24	0.19/0.22	0.33/0.26	0.31/0.24	0.25/0.23	0.33/0.28	0.33/0.22	0.36/0.20	0.30/0.24
7. SPES3	0.47/0.38	0.44/0.26	0.29/0.17	0.29/0.30	0.24/0.34	0.28/0.32	0.30/0.28	0.26/0.30	0.29/0.34	0.27/0.31	0.25/0.25	0.21/0.32
8. SPES4	0.53/0.53	0.52/0.43	0.37/0.31	0.31/0.34	0.23/0.38	0.28/0.33	0.30/0.30	0.26/0.29	0.29/0.36	0.30/0.28	0.29/0.27	0.21/0.33
9. SPES5	0.68/0.71	0.66/0.61	0.48/0.46	0.26/0.34	0.26/0.36	0.26/0.36	0.24/0.34	0.23/0.30	0.26/0.38	0.29/0.31	0.31/0.28	0.19/0.35
10. SPES6	0.82/0.77	0.78/0.67	0.64/0.55	0.21/0.33	0.25/0.33	0.22/0.35	0.19/0.31	0.20/0.27	0.23/0.34	0.24/0.28	0.28/0.24	0.15/0.32
11. SPES7	0.90/0.90	0.85/0.81	0.73/0.66	0.19/0.28	0.24/0.30	0.20/0.33	0.18/0.32	0.19/0.25	0.20/0.33	0.23/0.27	0.28/0.25	0.11*/0.32
12. SPES8	–	0.86/0.91	0.75/0.75	0.13*/0.26	0.19/0.26	0.14*/0.31	0.08*/0.28	0.12*/0.22	0.11*/0.29	0.15*/0.25	0.18/0.20	0.07*/0.30
13. SPES9	0.90/0.92	–	0.85/0.85	0.15*/0.21	0.20/0.23	0.21/0.27	0.13*/0.25	0.19/0.20	0.18/0.27	0.16*/0.19	0.22/0.18	0.11*/0.25
14. SPES10	0.75/0.81	0.85/0.90	–	0.08*/0.17	0.13*/0.18	0.14*/0.20	0.05*/0.21	0.10*/0.15	0.08*/0.18	0.06*/0.12	0.10*/0.13	0.03*/0.18
15. SR 1	0.30/0.25	0.28/0.26	0.19/0.29	–	0.67/0.71	0.80/0.67	0.78/0.69	0.62/0.58	0.76/0.67	0.70/0.68	0.64/0.55	0.74/0.63
16. WR 1	0.29/0.25	0.25/0.26	0.19/0.27	0.73/0.67	–	0.77/0.62	0.71/0.57	0.77/0.78	0.76/0.61	0.68/0.56	0.79/0.74	0.73/0.60
17. TEXT 1	0.33/0.27	0.30/0.24	0.23/0.24	0.69/0.65	0.61/0.64	–	0.84/0.68	0.75/0.64	0.91/0.89	0.78/0.67	0.77/0.62	0.89/0.85
18. SR 2	0.26/0.22	0.25/0.18	0.17/0.16	0.79/0.74	0.65/0.63	0.70/0.64	–	0.73/0.60	0.84/0.70	0.85/0.75	0.76/0.56	0.80/0.67
19. WR 2	0.24/0.25	0.21/0.25	0.17/0.25	0.66/0.56	0.79/0.80	0.67/0.63	0.74/0.61	–	0.74/0.65	0.67/0.60	0.84/0.81	0.71/0.63
20. TEXT 2	0.35/0.29	0.28/0.27	0.20/0.26	0.65/0.58	0.58/0.58	0.90/0.89	0.69/0.61	0.65/0.62	–	0.77/0.69	0.78/0.61	0.92/0.64
21. SR 3	0.33/0.22	0.28/0.21	0.19/0.19	0.74/0.71	0.61/0.60	0.72/0.69	0.81/0.83	0.62/0.61	0.71/0.69	–	0.76/0.64	0.77/0.69
22. WR 3	0.28/0.24	0.20/0.24	0.15/0.24	0.59/0.57	0.75/0.81	0.65/0.65	0.65/0.65	0.81/0.81	0.65/0.63	0.65/0.69	–	0.75/0.61
23. TEXT 3	0.35/0.28	0.28/0.25	0.21/0.23	0.66/0.54	0.55/0.57	0.87/0.89	0.67/0.60	0.62/0.60	0.89/0.91	0.71/0.67	0.63/0.63	–

Note. Correlations above the diagonal are for Grade 2 and Grade 3 children separated by a slash (2/3) and correlations below the diagonal for Grade 4 and Grade 5 separated by a slash (4/5). GEN = General level self-efficacy, INT = Intermediate level self-efficacy, SPES = Specific level self-efficacy, SR = Sentence Reading Fluency, WR = Word Reading Fluency, TEXT = Text Reading Fluency.
All correlations are significant at $p < .001$, non significant marked as *.

Table 3
Invariance comparisons of the estimated models by grade level.

Model	χ^2	*df*	*CFI*	*TLI*	*RMSEA 90%. C.I.*	*SRMR*	χ^2 difference test	*ΔCFI/ΔRMSEA/ΔSRMR*
Invariance of the Self-efficacy and Latent Growth Model								
1 Unconstrained model	1109.296***	589	0.969	0.964	0.052 0.047–0.056	0.059	–	–
2 Self-efficacy model, Latent Growth Models, Cholesky loadings & regression paths set to be equal	1326.019***	641	0.957	0.953	0.058 0.054–0.063	0.088	χ^2 (52) = 210.02***	−0.01/0.01/0.03
3 Self-efficacy model, Latent Growth models, Cholesky loadings & regression paths in all specificity levels set to be equal	1441.662***	645	0.952	0.949	0.061 0.057–0.065	0.099	χ^2 (4) = 682.00***	−0.01/0.01/0.01

Note. In χ^2 difference test and *ΔCFI/ΔRMSEA/ΔSRMR* model compared to previous, less constrained model.
*** $p < 0.001$.

most specific level of self-efficacy (e.g., self-efficacy for reading specific paragraphs) did not predict reading fluency development, although these specific beliefs were related to students' initial level of reading fluency.

Researchers have attempted to answer the question, what is the optimal correspondence between self-efficacy and achievement? Marsh, Roche, Pajares, and Miller (1997) noted that when studied cross-sectionally, the associations between specific self-efficacy and skills seem to be strong; however, finer-grained beliefs may not show as strong a causal influence when outcomes are assessed longitudinally. Indeed, only a handful of investigations have focused on testing the differential effects of self-efficacy measured at different levels of specificity on academic performance over time. In the reading domain, these relationships have not been extensively investigated. One possibility is that judgments of one's efficacy for applying skills (as opposed to one's efficacy for learning the most basic skills) might relate more strongly to skill development. In the case of our findings, self-efficacy for carrying out reading tasks that presumably require greater effort and persistence for using one's skills (e.g., self-efficacy for everyday reading tasks) were most strongly related to the development of reading fluency.

Our results align with Bandura's (1997) assertions that when interpreting of the association between self-efficacy and skills, researchers and practitioners should carefully consider the level at which beliefs are assessed. Self-efficacy assessments at the most granular level may not be best for predicting longer-term outcomes. Furthermore, the relationships between different measures of self-efficacy and outcomes might differ in diverse contexts (see Pajares, 2007), so researchers should investigate this possibility with children in other cultural, geographic, and social locations.

Our findings offer support to the few previous findings showing a positive association between self-efficacy and reading fluency (Carroll & Fox, 2017; Mercer et al., 2011). These findings also shed light on the predictive role of self-efficacy on reading fluency development earlier than previously shown. To the best of our knowledge, this study was the first to examine the relationship between self-efficacy and reading fluency development in students younger than fifth grade. It is noteworthy that efficacy beliefs were found to predict fluency development similarly across all grade levels, and even among second graders, the youngest age group in our sample.

The age of the participants and their respective stage of reading

Table 4
First-order latent growth models of sentence, word, and text reading fluency by grade level.

	Grade 2		Grade 3		Grade 4		Grade 5		Model fit indices
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	
SR Intercept									
Mean	18.20***	0.54	26.39***	0.38	32.58***	0.50	38.35***	0.65	$\chi^2(0) = 0$[a]
Variance	51.59***	11.49	50.50***	7.23	82.51***	13.09	105.65***	18.36	*RMSEA* = 0.000
SR Slope									*CFI* = 1.000
Mean	5.22***	0.44	4.28***	0.34	5.64***	0.36	4.94***	0.52	*TLI* = 1.000
Variance	17.44**	5.58	6.79	4.49	10.78	8.03	24.15*	10.73	*SRMR* = 0.000
Covariance between I and S	−3.00	6.40	1.77	4.55	−0.37	9.09	−7.06	11.55	
WR Intercept									
Mean	44.37***	1.98	72.68***	1.37	99.76***	1.81	123.28***	2.21	$\chi^2(0) = 0$[a]
Variance	525.26***	90.09	651.71***	106.97	940.17***	146.56	1363.01***	175.65	*RMSEA* = 0.000
WR Slope									*CFI* = 1.000
Mean	19.27***	1.54	23.88***	0.99	24.42***	1.25	20.06***	1.61	*TLI* = 1.000
Variance	47.81	57.08	42.51	76.30	41.00	90.92	147.34	100.41	*SRMR* = 0.000
Covariance between I and S	94.47	2.56	49.51	84.19	84.67	100.23	−62.26	110.34	
Text Intercept									
Mean	76.56***	2.53	104.50***	1.47	120.57***	1.66	136.01***	1.79	$\chi^2(4) = 2.179$
Variance	1144.55***	112.21	1007.68***	55.63	1054.76***	73.81	933.98***	88.79	*RMSEA* = 0.000
Text Slope									*CFI* = 1.000
Mean	19.53***	1.27	17.61***	0.77	19.24***	0.83	18.47***	0.90	*TLI* = 1.003
Variance	137.16***	26.17	126.15***	21.17	117.22***	25.96	118.29***	20.04	*SRMR* = 0.018
Covariance between I and S	48.62	35.20	−29.66	0.23	−57.30	35.01	−36.10	25.55	

Note. SR = Sentence Reading Fluency, WR = Word Reading Fluency, Text = Text Reading Fluency, I = Intercept, S = Slope. Unstandardized estimates are presented.
[a] A saturated model.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 5
Parameter estimates of second-order latent growth model for reading fluency by grade level.

	Grade 2		Grade 3		Grade 4		Grade 5	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
I								
Mean	0^+	0^+	8.79***	0.61	15.28***	0.66	21.30***	0.79
Variance	37.28***	6.00	48.28***	4.12	66.37***	6.03	70.96***	8.58
By Loading 1 (SR)	1^+	–	1^+	–	1^+	–	1^+	–
By Loading 2 (WR)	3.46***	0.28	3.36***	0.13	3.64***	0.09	3.75***	0.09
By Loading 3 (Text)	5.39***	0.37	3.73***	0.14	3.17***	0.11	2.98***	0.09
S								
Mean	0^+	0^+	−0.19	0.62	0.68	0.69	−0.42	0.72
Variance	7.61*	3.06	7.13*	2.40	12.16*	2.36	12.51*	7.37
By Loading 1 (SR)	1^+	–	1^+	–	1^+	–	1^+	–
By Loading 2 (WR)	1.62*	0.62	2.13*	0.97	2.53***	0.59	1.92**	0.55
By Loading 3 (Text)	2.11**	0.66	1.85**	0.58	1.23**	0.59	1.13*	0.44
Covariance between intercept and slope	8.49**	2.56	1.87	2.22	4.04	3.07	4.07	3.81

Note. SR = Sentence Reading Fluency, WR = Word Reading Fluency, Text = Text Reading Fluency, I = Intercept, S = Slope. Unstandardized estimates are presented.
0^+ fixed to zero, 1^+ fixed to one.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

development might explain why our results differed from those obtained by Mercer et al. (2011) who studied fifth graders. In the early primary school years, children may be especially aware of their reading fluency skills as fluency is typically a "public" skill and therefore prone to the effects of social comparison and evaluation as well as easily verifiable for the child. Moreover, when children are asked to evaluate their self-efficacy in reading (with generally-worded items), they may have different subskills of reading in mind at different ages. When primary school children evaluate their reading self-efficacy they seem to emphasize their ability to read fluently (e.g., Butz & Usher, 2015; Guthrie et al., 2007; Henk & Melnick, 1998) rather than their reading comprehension skills. This could be one reason why Carroll and Fox (2017) found that reading self-efficacy was related to reading fluency but not to comprehension among 8- to 11-year-old children.

Furthermore, in previous studies where self-efficacy was found to be unrelated to reading development, general academic self-efficacy, not reading related self-efficacy, was assessed (Galla et al., 2014; Hornstra et al., 2013; Mercer et al., 2011). Alternatively, one's perceived efficacy for more specific reading tasks might better capture the various associations that exist between self-efficacy and reading development.

From a practical perspective, the findings from the present study point to a need to identify students in the early grades who have low efficacy beliefs related to reading. Although children were generally optimistic about their capabilities, lower efficacy beliefs related to lower skills and slower skill development. Low confidence, particularly in everyday reading activities, might have rippling effects on subsequent learning across disciplines because dysfluency in reading hampers learning in most school subjects. On the other hand, positive development in reading fluency may spark reading enjoyment and further encourage learning. Our findings underline the need for educators to be attentive to children's developing self-efficacy as these beliefs seem to relate to the course of learners' fluency development. Nevertheless, researchers should continue to investigate how best to assess efficacy beliefs in reading and how beliefs affect students' engagement. Further research should examine whether supporting self-efficacy would enhance reading fluency development and whether this occurs via increased effort, persistence and reading frequency. Teachers will also need strategies for supporting children's efficacy beliefs in authentic ways (Pajares, 2006).

5. Limitations and future directions

Although our approach to examining different specificity levels of self-efficacy and reading fluency development among primary school children provided interesting findings, number of limitations in the study should be considered. These limitations provide a path forward for research on self-efficacy and reading development.

First, we studied change in reading fluency over a one-year period with three time points. Studying fluency changes across a longer time period and more intensively could shed more light on the associations between self-efficacy and reading fluency development. Furthermore, quasi-experimental (intervention) studies examining whether changes in self-efficacy relate to changes in reading fluency could provide more insight about mechanism of change (see Aro et al., 2018). In addition,

Table 6
Wald test results comparing regression paths to reading fluency between the specificity levels of self-efficacy.

	Specific SE vs. Intermediate SE	Specific SE vs. General SE	Intermediate SE vs. General SE
	Wald	Wald	Wald
Regression paths to the Level of Reading Fluency	27.15***	5.80*	19.62***
Regression paths to the Slope of Reading Fluency	10.91**	0.57	4.78*

Note. SE = self-efficacy.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

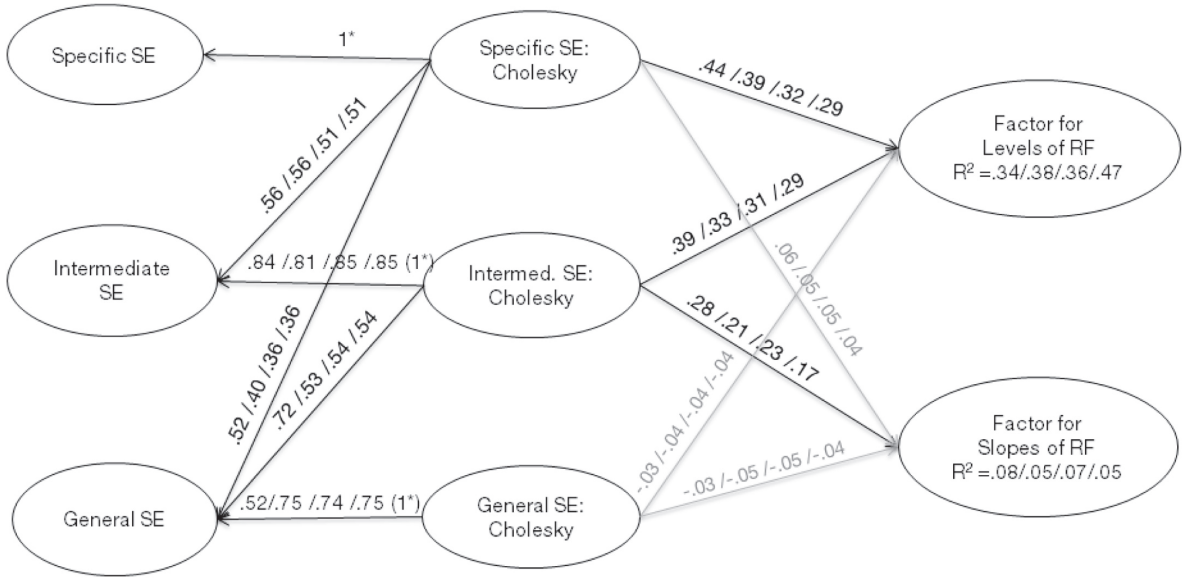

Fig. 2. The relation between specificity levels of self-efficacy and reading fluency development. Statistically significant standardized estimates ($p < .05$) are presented separately for each grade level (separated by slash, Grades 2/3/4/5) and are written in black (nonsignificant estimates written in grey). Fit statistics: χ^2 (622) = 1327.54, $p < .001$; RMSEA = 0.06; CFI = 0.96; TLI = 0.95. For the sake of clarity, the manifest indicators of the specificity levels of self-efficacy and reading fluency are not depicted in the Fig. 1* fixed to one. SE = self-efficacy, RF = reading fluency.

children had a 2.5-month summer holiday between our last two measurements, which seems to be the reason for the slower pace of development in reading fluency (non-linear development) between these last two measurement points. However, efficacy beliefs might be especially important during holidays, as they have been found to relate to children's leisure time reading activities (e.g., Schüller et al., 2017).

Second, the reading measures used in this study were all specific to reading fluency. Consequently, we do not know whether efficacy beliefs at different specificity levels would show varying associations to other reading subskills or to other reading behaviors. Third, delineating specificity levels of self-efficacy assessment and isolating the measurement of reading subskills is not a precise science; therefore, the measures we developed could account for some variability in our findings. Fourth, we did not include any cognitive background variables to control for children's readiness for reading development. Although previous studies have shown that self-efficacy is independently associated with fluency, even after controlling for the effect of those variables (Carroll & Fox, 2017), we acknowledge that controlling for cognitive background variables could diminish the associations found between self-efficacy and reading fluency development. Similarly, we did not control for sociodemographic background variables. Our study sample consists of Finnish children, and Finland has a relatively homogeneous population. Socioeconomic and demographic differences are small compared to many other countries (see PISA, 2015, at http://www.oecd.org/pisa). However, we acknowledge this as a limitation of our study.

Fifth, we analyzed the development of reading fluency but not that of self-efficacy. Future investigations might examine whether developments in reading fluency run parallel to developments in self-efficacy. Sixth, our study was conducted in the context of a transparent alphabetic orthography, and consequently, one might question whether the findings are generalizable to different language contexts. However, as novice-to-expert transition in reading is characterized by shift into rapid, effortless, unitized processing in all orthographies (Share, 2014), and reading fluency develops largely as a function of reading experience (Share, 1995), self-efficacy is likely to be related to reading fluency development in other linguistic settings (e.g., Carroll & Fox, 2017, with regard to English). The strength of the associations and the age at which efficacy beliefs have the strongest relationship to reading fluency development might vary in different linguistic contexts, as the rate of reading development seems to be related to the regularity of the orthography of a particular language (for crosslinguistic comparisons, see Aro & Wimmer, 2003; Seymour et al., 2003). The aforementioned studies show that the development of reading skill in English is slower and differs markedly from most alphabetic orthographies.

Our findings suggest that studying reading self-efficacy with measures specifically targeted to reading tasks can provide new information about the relationship between self-efficacy and reading achievement. Therefore, future studies would benefit from including self-efficacy assessments that target more specific levels than those commonly used in reading self-efficacy research. In addition, such specific measures might better capture fluctuations in self-efficacy. In the current study, self-efficacy was found to predict reading development even among second graders. Further research could examine at what age this association first emerges and when it dissipates. It bears noting, however, that special care should be taken when assessing younger children's self-efficacy by using items and response scales appropriate for children's developmental level (see e.g. Adelson & McCoach, 2010; Marsh, Debus, & Bornholt, 2005; Toland & Usher, 2016). It is likewise important to take into account the individual variation in children's self-assessments. Some children's efficacy beliefs might be more realistic and more strongly related to how their reading fluency develops, whereas others might offer overinflated judgments of their capabilities. For the latter, self-efficacy may have little role in predicting reading fluency development. Studying these relationships with person-oriented methods could shed more light on these issues and the accuracy of young children's answers.

Thus far, little is known about what makes young students feel self-efficacious in reading situations and how best to support positive efficacy beliefs. Intervention efforts targeting reading self-efficacy are few; however, preliminary evidence (see Aro et al., 2018) suggests that self-efficacy can be enhanced by targeting the four sources of self-efficacy

proposed by Bandura (1997). Some evidence suggests that children report somewhat different sources of their self-efficacy in reading than in math (Butz & Usher, 2015). Further research on how children form their reading self-efficacy (i.e., identifying the information or observations that most affect children's beliefs), would therefore be a helpful next step. To be able to better support positive efficacy beliefs researchers need a better understanding of how reading self-efficacy changes and develops, and therefore pinpointing the developmental milestones at which supporting these beliefs is most critical would be useful.

6. Conclusion

This study showed that children's efficacy beliefs are related to their reading fluency and fluency development, even as early as second grade. Our results add evidence that the relationship between self-efficacy and reading development for primary school children—those whose reading skills are at a prime developmental peak—likewise varies according to the level at which self-efficacy is assessed. This indicates the need to examine children's beliefs with specific reading situations and tasks in mind. Such assessments can help teachers identify those students with low self-efficacy and can help researchers better understand how children's efficacy beliefs relate to their growing abilities as readers.

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Appendix A. Items in the reading self-efficacy scale

Reading self-efficacy	How certain are you that you can… *(Translated items)*	Kuinka varma olet, että pystyt… *(Original items in Finnish)*
General level: SE for Learning to Read Fluently	…learn to read faster?	…oppimaan lukemaan nopeammin?
	…learn to read so that you make fewer mistakes?	…oppimaan lukemaan niin, että teet vähemmän virheitä?
	…learn to read so that you understand everything you read?	…oppimaan lukemaan niin, että ymmärrät kaiken, mitä luet?
Intermediate level: SE for Everyday Reading Activities	…read all the subtitles of a TV program easily?	…lukemaan kaikki TV-ohjelmien tekstitykset helposti?
	…read long texts on the Internet?	…lukemaan internetissä pitkiä tekstejä?
	…easily read a long book?	…lukemaan helposti paksun kirjan (esim. Harry Potter -kirjan)?
Specific level: SE for Reading Specific Paragraphs	…read this paragraph aloud in 30 s? (8 paragraphs of varying lengths)	…lukemaan näin pitkän tekstin ääneen puolessa minuutissa?

Note. SE = Self-efficacy.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.lindif.2019.05.007.

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III

TRAJECTORIES OF CHANGE IN READING SELF-EFFICACY: A LONGITUDINAL ANALYSIS OF SELF-EFFICACY AND ITS SOURCES

by

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Trajectories of change in reading self-efficacy: A longitudinal analysis of self-efficacy and its sources

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ABSTRACT

The beliefs children hold about their capabilities as readers are known to influence their reading achievement. The aim of this study was to extend previous work by examining trajectories of change in reading self-efficacy among primary school students (N = 1327) and the relations between the trajectories of self-efficacy and their hypothesized sources over 11 months. Using growth mixture modeling, we identified four trajectories of change in reading self-efficacy, involving increasing, stable, and declining trends. These trajectories of change in reading self-efficacy were associated with students' varying experiences with the four sources of self-efficacy over time. Higher levels of mastery, verbal persuasion, and vicarious experiences and lower levels of physiological arousal were related to positive developmental trajectories of self-efficacy. Students with declining experiences of social sources of self-efficacy (i.e., verbal persuasions and vicarious experiences) had decreasing self-efficacy trajectories. These findings point to the importance of considering the variability in changes in reading self-efficacy and the interplay between changes in self-efficacy and sources of self-efficacy during primary school years, as well as the importance of monitoring these changes over time.

1. Introduction

Efficacy beliefs, which refer to beliefs about one's own capabilities to execute certain actions or tasks, have been found to be significant predictors of effort (Galla et al., 2014; Schnell, Ringeisen, Raufelder, & Rohrmann, 2015) and achievement (Multon, Brown, & Lent, 1991; Talsma, Schüz, Schwarzer, & Norris, 2018). Researchers have shown that, in the context of reading, efficacy beliefs are important predictors of reading-related behaviors (e.g., Hornstra, van der Veen, & Peetsma, 2016; Smith, Smith, Gilmore, & Jameson, 2012). However, less is known about how efficacy beliefs in reading develop and change, particularly in the primary school years.

It is theorized that efficacy beliefs are formed by how people perceive and interpret information from four main sources: mastery experiences, verbal and social persuasions, vicarious experiences, and physiological and emotional states (Bandura, 1997). However, previous studies have primarily investigated the relationship between these sources and self-efficacy cross-sectionally (e.g., Joët, Usher, & Bressoux, 2011; Usher & Pajares, 2006). Little is known about how the hypothesized sources of self-efficacy and changes in students' exposure to these sources of information over time relate to longitudinal changes in self-efficacy. In addition, longitudinal self-efficacy research has taken a variable-centered approach (e.g., Hornstra, van der Veen, Peetsma, & Volman, 2013; Phan, 2012a). However, this approach does not account for the possibility that the direction of self-efficacy development likely varies significantly among children, as shown in person-centered research on children's self-concepts (Archambault, Eccles, & Vida, 2010). For some children, reading self-efficacy might increase; for others, it might decrease. The rate of change in self-efficacy likely varies too. These varying longitudinal changes in children's self-efficacy may be based on their varying exposure to efficacy-building experiences (i.e., sources of self-efficacy; see Chen & Usher, 2013).

In the present study, we address these gaps using both variable- and person-centered approaches (see Howard & Hoffman, 2018; Woo, Jebb, Tay, & Parrigon, 2018) to investigate the interplay between changes in reading self-efficacy and the hypothesized sources of reading self-

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efficacy among primary school children. A better understanding of these changes and their relations could help researchers to develop efficient means of support to promote positive development in children's efficacy beliefs in primary school.

1.1. Changes in self-efficacy

Efficacy beliefs are theorized to change more easily than more general motivational beliefs (e.g., self-concept; Bong & Skaalvik, 2003). However, the examination of how self-efficacy changes over time, especially during the primary school years, has been scant in the literature. The few previous studies pertaining to self-efficacy development among primary school children have focused on different research questions, methodological approaches, and time frames to investigate such changes. Studies exploring mean-level changes in self-efficacy found that children report increasing confidence in their capabilities over time (e.g., Hornstra et al., 2016; Phan, 2012a, 2012b), although the patterns of these changes differ. Some researchers reported that self-efficacy increased linearly across Grades 5–6 (Hornstra et al., 2016). Others found a nonlinear pattern of change in self-efficacy among students of Grades 3–6 across one school year (2012b; Phan, 2012a), whereas one study observed that self-efficacy first declined and then increased across Grades 3–6 (Hornstra et al., 2013).

Other researchers have assessed changes in the relative ordering of children's self-efficacy levels (i.e., rank-order stability) and have reported somewhat inconsistent results. On the one hand, Phan and Ngu (2016) found that the rank-order of Grade 6 students' level of math self-efficacy hardly changed over one year (stability coefficients = 0.64–0.79). On the other hand, Phan, Ngu, and Alrashidi (2018) found the rank-order of math self-efficacy to be fairly unstable (stability coefficients = 0.23–0.44) for Grade 7 students over the course of 9 months. These results indicate individual variability in the rate of change. Other researchers provided evidence that self-efficacy is less stable among younger (e.g., elementary-age) students than their older counterparts (i.e., secondary students), at least for math (Davis-Kean et al., 2008; see Talsma et al., 2018).

Most studies examining changes in self-efficacy over time focused on the average trend or variability in change in self-efficacy for the full sample. However, the previous findings suggest that changes in self-efficacy may not be similar for all children. Studies consistently show that children differ in the absolute level of self-efficacy (e.g., Butz & Usher, 2015) and that changes in their self-efficacy are positive over time (e.g., Hornstra et al., 2016; Schöber, Schütte, Köller, McElvany, & Gebauer, 2018). However, conflicting findings regarding the rate of change in self-efficacy (Phan & Ngu, 2016; Phan et al., 2018) and its shape (2012b; Hornstra et al., 2016; Phan, 2012a) suggest that children may also differ with regard to these aspects. In addition, the rate of change was found to differ slightly as a function of the observed characteristics of the individuals, such as gender (Hornstra et al., 2013). However, we are not aware of any previous studies examining this possible heterogeneity in the level, direction, and rate of change in self-efficacy simultaneously. Using a person-centered approach (see Bergman & Trost, 2006; Gillet et al., 2019; Howard & Hoffman, 2018; Woo et al., 2018), one can identify subgroups of children who may exhibit differential levels of self-efficacy and/or differential rates and directions in their self-efficacy development over time. Studying this heterogeneity could help to clarify the inconsistencies in the empirical research findings and enrich researchers' understanding of changes in children's self-efficacy. Moreover, it could help identify groups of children who may be more vulnerable than others to decreasing self-efficacy over time.

In this study, we examine changes in self-efficacy in the less studied context of reading—specifically in the context of reading fluency. The development of reading fluency (i.e., sufficient automaticity and speed of reading; LaBerge & Samuels, 1974) is a hallmark of primary school education and is required for children to make the shift from learning-to-read to reading-to-learn. Developmental changes in reading self-efficacy, to our knowledge, have only been examined by Schöber et al. (2018), who investigated changes across one school year among Grade 7 students. At the mean level, reading self-efficacy was found to increase across the school year, whereas the rank order of students' self-efficacy remained relatively stable.

Prior studies have not addressed changes in reading self-efficacy among primary school children, although this period can be assumed to be especially important for the development of self-referent beliefs (e.g., Harter, 2012). Indeed, changes in self-efficacy might be more likely to occur during the primary than the secondary school years (see Davis-Kean et al., 2008), particularly in reading, a domain in which learners' skills change and develop more rapidly during childhood. Moreover, efficacy beliefs developed in the primary years set the foundation for how reading skills develop as early as Grade 2 (e.g., Peura et al., 2019b; Peura et al., 2019a).

1.2. Reading skills and changes in self-efficacy

In social cognitive theory, efficacy beliefs are considered to be predictors of future behaviors (i.e., skills and performance; Bandura, 1986). In addition, the interpretations people make of their past performances are assumed to influence their efficacy beliefs. That is, efficacy beliefs and performance accomplishments are considered to affect each other reciprocally (see Talsma et al., 2018). Stronger skills and better performance enhance one's perceived capability, which in turn begets higher effort, engagement, and skill development.

Findings from cross-sectional studies support the positive relation between reading self-efficacy and reading fluency skills (e.g., Peura et al., 2019a; Carroll and Fox, 2017). In addition, students' initial level of reading performance has been found to positively predict their subsequent level of reading self-efficacy (Schöber et al., 2018) as well as changes in their self-efficacy (Hornstra et al., 2013). However, researchers have not yet examined how children's reading skills relate to different trajectories of change in reading self-efficacy over time. Presumably, children with stronger reading skills end up on a positive developmental path, whereby their successes raise their efficacy beliefs. Conversely, the efficacy beliefs of children with weaker reading skills might develop more slowly.

1.3. Sources of self-efficacy predicting changes in self-efficacy

A substantial body of cross-sectional research has shown that four hypothesized sources of self-efficacy affect learners' academic efficacy beliefs even though their roles may vary (see, e.g., Sheu et al., 2018; Usher & Pajares, 2008). The manner in which people interpret their past experiences (*mastery experience*) is the most powerful source of self-efficacy (see, e.g., Byars-Winston, Diestelmann, Savoy, & Hoyt, 2017; Usher & Pajares, 2008). Experiences of success increase self-efficacy for similar tasks. In addition, *verbal and social persuasions* received from others, such as teachers, parents, and peers, can raise or undermine self-efficacy. Positive feedback and encouragement from others can help students increase their confidence in their capabilities. Verbal persuasions have been found to increase early adolescents' confidence in reading to a greater extent than in math (Butz & Usher, 2015).

Observing how others perform (*vicarious experience*), especially those perceived as similar to oneself, also informs beliefs about one's own capabilities. Seeing a peer succeed may boost observers' confidence that they too might succeed in a similar challenge. Although peers' success is thought to build efficacy beliefs, empirically, the association has either been fairly weak or has not been found (see, e.g., Byars-Winston et al., 2017). This may partly relate to problems in operationalizing vicarious experiences (Usher & Weidner, 2018). The influence of social models on learners' self-efficacy may depend on learners' developmental stages or on the characteristics of the social model (e.g., whether the person is a peer, teacher, or parent; Ahn, Bong, & Kim, 2017). The fourth source of self-efficacy concerns how people feel and interpret their *physiological*

and emotional states (such as anxiety) when engaging in activities. For example, if feelings of stress and anxiety are interpreted as a lack of capability, self-efficacy is undermined. Emotional arousal has been found to be especially predictive of students' self-efficacy in math (e.g., Phan, 2012b; Usher & Pajares, 2009; Usher, Ford, Li, & Weidner, 2019).

Although the sources of self-efficacy are theoretized to predict self-efficacy development, only a few studies have empirically examined this longitudinally. Phan, 2012a, 2012b) found varying patterns in the associations between the sources of self-efficacy and changes in primary school students' self-efficacy. Among students in Grades 3–4, only mastery experiences were positively related to changes in English self-efficacy. Contradictory findings were observed in mathematics, where mastery experiences and emotional states were negatively related to changes in self-efficacy (Phan, 2012a). However, among students in Grade 5–6, verbal persuasions and emotional statespositively and negatively predicted, respectively, changes in mathematics self-efficacy, while mastery and verbal experiences were positively and negatively related to changes in science self-efficacy, respectively (Phan, 2012b). Phan (2012a) concluded that self-efficacy development is complex and nonsystematic. To complicate the picture, these findings differed from the cross-sectional relations between self-efficacy and its sources reported in previous studies (see, e.g., Byars-Winston et al., 2017).

Several factors may explain these inconsistent previous findings. First, previous studies have primarily focused on the average associations between each source of self-efficacy and self-efficacy development for the full sample (e.g., Phan, 2012a, 2012b), thereby overlooking possible individual variations in the associations between these variables. As students have been found to differ with regard to how strongly they rely on each source of self-efficacy when judging what they can do (see Chen & Usher, 2013), accounting for individual variability might reveal different results.

Second, it is also possible that the relationships between self-efficacy and its sources vary according to the particular skills being developed. Indeed, previous cross-sectional research has shown skill-specific variability in the sources of self-efficacy (e.g., Byars-Winston et al., 2017; Phan, 2012a; Usher et al., 2019). For instance, Butz and Usher (2015) found that half of the early adolescents in their study reported different sources of self-efficacy in reading and mathematics. A recent meta-analysis revealed that the four sources of self-efficacy predicted self-efficacy less in science, technology, engineering, and mathematics (STEM) domains than in non-STEM domains (Byars-Winston et al., 2017). In the few studies that have focused specifically on reading, students have reported that feedback from teachers and parents, as well as mastery experiences, influence their self-efficacy (Butz & Usher, 2015; Guthrie et al., 2007; Henk & Melnick, 1998).

We are aware of only one study that has investigated changes in the sources of students' self-efficacy over time. Phan and Ngu (2016) found that the rank order of Grade 6 students' efficacy-relevant experiences in math changed to a greater extent over one school year (rank-order stabilities = 0.19–0.44) than their math self-efficacy (rank-order stabilities = 0.64–0.79). Cross-sectional associations indicated that mastery experiences were related to math self-efficacy at every time point assessed, whereas the relationship between other sources and self-efficacy varied between time points. However, the reciprocal associations between the sources and self-efficacy were not examined over time, nor was the interplay between the changes in these sources and self-efficacy.

1.4. Aims of this study

In the present study, we seek to understand the dynamics of change in reading self-efficacy and its hypothesized sources (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states). In doing so, we hope to expand on previous research by examining varying trajectories of change in reading self-efficacy (i.e., differences in the level, direction, and rate of change in self-efficacy) and the interplay between the changes in self-efficacy and its sources over time. Furthermore, we focus on the less studied contexts of primary school students and their reading fluency skills.

The following research questions are examined:

(1) *How does reading self-efficacy change over time among students in Grades 2–5?*

We expect to find positive changes in reading self-efficacy over time (Hypothesis 1 (H1)) in line with findings showing increasing self-efficacy among primary (e.g., Hornstra et al., 2016; Phan, 2012a, 2012b) and secondary (Schöber et al., 2018) school students.

(2) *Are there heterogeneous trajectories of change in reading self-efficacy?*

We assume that children's trajectories of change in reading self-efficacy would be heterogenous in terms of level, direction, and rate of change (Hypothesis 2 (H2)), as previous studies have shown general variability in the development of self-efficacy among primary school students (Hornstra et al., 2013), and the findings regarding the rate (Phan & Ngu, 2016; Phan et al., 2018) and shape (Hornstra et al., 2013, 2016) of change have been inconsistent. However, we cannot present corresponding person-centered empirical evidence on which to base more explicit hypotheses concerning the possible initial self-efficacy levels, number, or directionalities of students' self-efficacy trajectories.

(3) *Are reading skills related to different trajectories of change in reading self-efficacy?*

As students' initial level of reading achievement have been found to positively predict self-efficacy development among primary school students (Hornstra et al., 2013) and the subsequent level of self-efficacy among Grade 7 students (Schöber et al., 2018), we hypothesize that higher levels of reading skills would be linked to trajectories with higher initial levels of self-efficacy and positively developing self-efficacy trajectories (Hypothesis 3 (H3)).

(4) *Are the levels of and changes in the sources of reading self-efficacy related to different trajectories of change in reading self-efficacy?*

As high levels of positive efficacy-building experiences have been found to be related to higher levels of self-efficacy (see Byars-Winston et al., 2017), we assume that higher levels of positive efficacy-relevant experiences (e.g., mastery experience, social persuasion, and vicarious experience) and lower levels of negative efficacy-relevant experiences

(adverse physiological and affective states) would be associated with positively developing self-efficacy trajectories (Hypothesis 4 (H4)). Correspondingly, we expect lower levels of positive sources of self-efficacy and higher levels of adverse physiological and affective states to be related to decreasing trajectories of self-efficacy (Hypothesis 5 (H5)). However, as the findings of the few previous longitudinal studies are inconsistent, we did not form more specific hypotheses.

2. Method

2.1. Participants and procedure

The participants of this study comprised 1327 children in Grades 2–5 (range = 7.84–12.83 years; $M = 9.97$, $SD = 1.05$) from 20 primary schools in Finland. This study is part of a longitudinal investigation that focuses on children's self-beliefs as well as reading and math development. Volunteering teachers were recruited for the project via municipality officials responsible for basic education. A total of 20 primary schools and 75 classes from rural, suburban, and urban areas participated.[1] The students participated voluntarily with the written informed consent of their legal guardians. The Ethical Committee of the first author's university evaluated the research procedure. Children's reading self-efficacy and sources of reading self-efficacy were assessed with questionnaires. Trained research assistants supervised the assessment. To ensure that all children could answer the questions irrespective of their reading skill, all the questionnaire items were read aloud. In addition, practice items were used to familiarize the children with the applied response scale. Survey administrations took place over three time points across two school years [Year 1: November (T1) and May (T2); Year 2: September (T3)]. Between T1 and T2, 2.7% of the children, who were among the lowest-achieving group of children in reading, participated in a reading fluency and self-efficacy intervention (for details of the intervention, see Aro et al., 2018). The effect of the intervention was controlled for in all the analyses.

2.2. Measures

Reading self-efficacy was measured with three items assessing children's confidence in mastering everyday reading tasks (e.g., *How confident you are that you can read a long book?*). These items were part of the scale created for measuring reading self-efficacy in primary school children. Bandura (2006) recommendations for measuring self-efficacy were followed when constructing the scale. The children responded on a seven-point scale varying from *I'm totally certain I can't* to *I'm totally certain I can* (α = 0.67–0.70; see Peura et al. (2019a) for details on the psychometric properties of the scale; the sample used in the cited work was the same as that in the present study). We elected to measure efficacy beliefs related to everyday reading practices in the present study, because they have been found to be the most predictive of reading fluency and its development (Peura et al., 2019b; Peura et al., 2019a).

Reading skills were assessed in terms of the children's word-, sentence-, and text-level reading speeds and accuracies in T1. The tests were time-limited: two of them were administered in groups (i.e., the word chain test, Lindeman, 1998; the sentence verification task, Eklund, Salmi, Polet, & Aro, 2013) and one was administered individually (i.e., the text reading task, Salmi, Eklund, Järvisalo, & Aro, 2011).

The *word chain test* (*word reading*) consisted of words written in clusters of 2–4 words with no spaces between them (adding up to 78 word chains altogether). The task was to silently read and separate the words with a vertical line as fast as possible. The test score was the number of words correctly identified within 3.5 min. This test is standardized and has been shown to have high scale reliability (α = 0.97, standardization sample, Lindeman, 1998).

The *sentence verification task* (*sentence reading*), similar to the Woodcock–Johnson Reading Fluency task (Woodcock, McGrew, & Mather, 2001), consisted of 70 semantically simple and short statements. After silently reading each statement, a child was asked to mark whether the statement was correct or incorrect. The test score was the number of correct responses made within 2 min. This test is standardized and has been shown to have high scale reliability (α = 0.94, split-half α = 0.97, standardization sample; Eklund et al., 2013).

In the *text reading* task, the children read an age-appropriate text for 90s and were instructed to read as accurately and as quickly as they could. A text reading score was calculated as the number of words read correctly within the time limit. Performance across different text versions has been shown to correlate highly (r = 0.93–0.97; Salmi et al., 2011). Performance in the text reading task correlated satisfactory with the word (r = 0.64) and sentence (r = 0.69) reading tasks. A sum score of the reading tests was used in the analysis, as previous examination showed that these tests satisfactorily measure the same construct, namely reading fluency (Peura et al., 2019a). The reading test scores were standardized within each grade level prior to analyzing the full sample.

The *sources of reading self-efficacy* were assessed using 13 items adapted for the reading context from a questionnaire previously validated in math (Usher & Pajares, 2009). The four-factor structure representing the sources of self-efficacy (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states) fit the data well ($\chi^2(58) = 144.39$, $p < .001$; root mean square error of approximation (RMSEA) = 0.03; comparative fit index (CFI) = 0.98; Tucker–Lewis (TLI) = 0.98; standardized root mean square residual (SRMR) = 0.03). The four-factor structure is presented in Appendix A. The invariances of the sources of the self-efficacy model were examined using multi-group invariance comparison tests by grade level, which are presented in Appendix B. The invariance comparisons indicated strong measurement invariance (Meredith, 1993) across grade levels. The children rated their mastery experiences (three items, e.g., *I have always been successful with reading*, α = 0.80–0.84), verbal persuasions (four items, e.g., *I have been praised for my reading skills*, α = 0.83–0.87), vicarious experiences (three items, e.g., *I admire adults who are good readers*, α = 0.77–0.81), and physiological and emotional states (three items, e.g., *I feel tension in my body when I have to read*, α = 0.80–0.85) using a seven-point Likert scale (1 indicating *not true* to 7 indicating *true*). The original items are presented in Appendix C. Higher scores for mastery experiences, verbal persuasions, and vicarious experiences referred to positive experiences, whereas higher scores on the physiological and emotional state subscales represented experiences of more adverse physiological arousal and emotional states.

[1] Sample selection procedure: The special education teachers in four municipalities in central and eastern Finland were given information about participation in this research project after the authors received permission from the municipality officials responsible for comprehensive schools. All interested special education teachers working in Grades 2–5 and teaching mainstream students were invited to join the study. The participating schools were located in rural, suburban, and urban areas. The study included small as well as big schools.Demographic information (pertaining to socioeconomic differences) in Finland: Finland continues to be a rather homogenous society in that socioeconomic and demographic differences are small compared to those observed for many other countries (see PISA 2015, http://www.oecd.org/pisa). Ninety-five percent of the population of each city that contributed to this study's sample is Finnish-speaking, and the number of immigrants in each of them is low (no more than 3.2% of the cities population). In addition, Finnish schools are relatively homogeneous: 96% of the schools are publicly maintained (Official Statistics of Finland, 2017), and children attend the public school nearest to their home. In addition, the socioeconomic variations between schools are slight (e.g., OECD, 2013). Given the provision of free public education up to the university level, socioeconomic background variables tend to play less of a role in Finland than many other countries.

2.3. Statistical analyses

All the analyses were performed using the MPlus software, version 8.0 (Muthén & Muthén, 1998, 2017) with the robust maximum likelihood estimator. The data set included 3.3–5.1% missing values at T1, 6.6–7.5% missing values at T2, and 10.9–14.5% missing values at T3. Little (1988) missing completely at random test showed that the data were not missing completely at random ($\chi^2(25062) = 28767.41$, $p < .001$). However, the data were considered to be missing at random, as the reasons for the missing values were tracked to students who moved to another school during the study, students' absence from school on the day of data collection, or single skipped items. Furthermore, the missing values were not found to be related to the students' initial level of self-efficacy. The full information maximum likelihood procedure, which uses all the information in the data without imputing missing values, was used to handle missing data in all the analyses (Enders, 2010). The students were nested within 20 schools and 75 classes. To examine the proportion of the variance in self-efficacy due to school and class, intraclass correlations (ICCs) were calculated. The ICCs by school were small (0.01–0.04) and nonsignificant. The ICCs by class were small (0.05–0.09) and significant; however, when the grade level was controlled for, no significant class-related variation in self-efficacy was observed. To consider the hierarchical nature of the data by class, we used the TYPE = COMPLEX option in MPlus to estimate unbiased standard errors.

Changes in reading self-efficacy over three time points (Research Question 1) were examined with latent growth curve modeling (LGM; Muthén & Khoo, 1998). Linear and nonlinear shapes of change were explored to find the best fitting model. Gender, grade level, and intervention status were included as covariates in the self-efficacy model by allowing them to influence latent growth factors (i.e., intercept and slope).

The overall goodness-of-fit of the estimated LGMs was evaluated with the χ^2 test. However, as the χ^2 test is sensitive to a large sample size, and given the non-normality of the data, we also considered the CFI (Bentler, 1990), TLI (Tucker & Lewis, 1973), RMSEA (Steiger, 1990) with a 90% confidence interval, and SRMR (Hu & Bentler, 1995). Values higher than 0.95 for both the TLI and the CFI and smaller than 0.06 for RMSEA and 0.08 for the SRMR were considered representative of a well-fitting model to the data (Hu & Bentler, 1999).

The trajectories of change in reading self-efficacy were identified using growth mixture modeling (GMM; Muthén, 2004; Research Question 2). Our work followed the guidelines provided by van de Schoot, Sijbrandij, Winter, Depaoli, and Vermunt (2017) for reporting on latent trajectory studies. Means of the initial level and slope of reading self-efficacy were allowed to vary across trajectories. GMM classifies each individual in these trajectories in a probabilistic manner. We estimated various GMM solutions for up to seven trajectories. The appropriate number of trajectories was selected based on the goodness of fit of the estimated models, classification quality of the solution, and interpretability of the solution (following the guidelines noted in Marsh, Ludtke, Trautwein, and Morin (2009) and Morin et al. (2011)). Given our large sample size ($N = 1327$), very small data-specific trajectories without practical significance and that were unlikely to be replicated could have emerged. Therefore, the trajectory solutions that resulted in the extraction of at any trajectory that included<1% of all students were not considered. The goodness of fit values of the GMMs were evaluated according to the following criteria: log likelihood ratio (LLR); Bayesian information criterion (BIC; Schwartz, 1978), sample size-adjusted BIC (aBIC; Yang, 2006), and the Lo–Mendell–Rubin (LMR; Lo, Mendell, & Rubin, 2001) and Vuong–Lo–Mendell–Rubin (VLMR; Lo et al., 2001) likelihood ratio (LR) tests. Lower values of the LLR and information criteria (BIC and aBIC) indicate better model fits. For LRM and VLMR, a significant p value provided by the test indicates a better fitting model than that with one class less. Further, we evaluated the classification quality by examining the Entropy index and average latent class probabilities, in which values close to 1 indicate a distinct classification (Celeux & Soromenho, 1996). An average latent class probability of greater than 0.7 for all groups is recommended (Nagin, 2005).

Next, the associations between the initial reading skill levels and self-efficacy trajectories were examined (Research Question 3) using the Bolck–Croon–Hagenaars (BCH) approach (Asparouhov & Muthén, 2018; Bakk & Vermunt, 2014) implemented in Mplus. The BCH procedure estimates a weighted multiple group analysis to examine the differences between the self-efficacy trajectories as a function of students' initial reading levels. The measurement error related to the classification of students into the self-efficacy trajectories was considered using weights that are inversely related to the classification error probabilities obtained from the GMM (Bakk, Tekle, & Vermunt, 2013). We used the automatic BCH method (Asparouhov & Muthén, 2018).

The overall differences in the level of reading between the self-efficacy trajectories were examined using LLR tests (Satorra & Bentler, 2010). Wald tests were used to examine pairwise comparisons between the trajectories. Cohen's *d* was used as a measure of the effect size of the mean differences between the trajectories (Cohen, 1988). Effect sizes ranging from 0.10 to 0.30 are considered as small effects, 0.30 to 0.50, as intermediate effects, and 0.50 and higher, as strong effects (Cohen, 1988).

Finally, the association of the self-efficacy trajectories with the levels of and changes in the sources of self-efficacy (i.e., mastery experiences, verbal persuasions, vicarious experiences, and physiological and emotional states) were examined (Research Question 4). First, LGMs (Muthén & Khoo, 1998) were built to investigate the changes in each source of self-efficacy over the three time points. Similar to the procedure followed to construct LGMs of self-efficacy, both linear and nonlinear shapes of the changes were explored to find the best fitting model. Gender, grade level, and intervention status were included as covariates in all sources of self-efficacy LGMs by allowing them to influence latent growth factors (i.e., intercept and slope). The BCH approach was used to examine the associations between the self-efficacy trajectories and the LGMs of the sources of self-efficacy. We used the manual BCH method (Asparouhov & Muthén, 2018) instead of the automatic version for two reasons. First, our predictor variables were latent variables (i.e., four sources of self-efficacy) produced by the LGMs. Second, we wanted to control for gender, age, and intervention status in the analyses. In addition, reading skill level at T1 was controlled for. It is not possible to include latent predictors in the automatic version of the BCH method. Moreover, multiple control variables cannot be considered simultaneously. The overall differences in the means of the level and changes in the sources of self-efficacy between the self-efficacy trajectories were examined using likelihood ratio tests. Wald tests were used to examine pairwise comparisons between the trajectories. Cohen's *d* was considered as a measure of the effect size of the mean differences between the trajectories (Cohen, 1988).

3. Results

The means, standard deviations, and bivariate correlations for all the study variables are presented in Table 1.

3.1. Changes in reading self-efficacy over time: variable-centered approach

To address our first research question, we investigated changes in reading self-efficacy using LGMs. The model including the initial level and linear slope fit the data the best (see the first row of Table 2 for estimates and fit statistics of the reading self-efficacy model). The variance of the *level* of reading self-efficacy suggested that students differed in their initial levels of reading self-efficacy. The positive mean of the *slope* indicated that students' average reading self-efficacy levels increased over the study period as hypothesized (H1). However, differences were noted between the students in terms of the rate of change:

Table 1
Means (M), Standard Deviations (SD) and correlations between the study variables.

	Mean	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Reading self-efficacy T1	5.87	1.15	–														
2. Reading self-efficacy T2	5.92	1.12	0.59	–													
3. Reading self-efficacy T3	6.06	1.04	0.53	0.61	–												
4. Mastery experience T1	5.72	1.23	0.47	0.40	0.35	–											
5. Mastery experience T2	5.72	1.21	0.41	0.48	0.42	0.62	–										
6. Mastery experience T3	5.69	1.27	0.38	0.44	0.44	0.53	0.67	–									
7. Verbal persuasion T1	4.85	1.60	0.16	0.14	0.16	0.38	0.29	0.24	–								
8. Verbal persuasion T2	4.50	1.75	0.12	0.16	0.23	0.25	0.34	0.30	0.57	–							
9. Verbal persuasion T3	4.49	1.79	0.10	0.13	0.21	0.20	0.27	0.35	0.50	0.67	–						
10. Vicarious experience T1	4.75	1.74	.03[a]	.02[a]	.05[a]	0.20	0.11	0.13	0.56	0.38	0.31	–					
11. Vicarious experience T2	4.19	1.93	.00[a]	0.07	0.11	0.12	0.19	0.18	0.39	0.56	0.46	0.56	–				
12. Vicarious experience T3	4.18	1.88	−.04[a]	0.06	0.12	0.09	0.13	0.24	0.34	0.47	0.55	0.49	0.70	–			
13. Physiological and emotional states T1	2.00	1.44	−0.29	−0.20	−0.23	−0.26	−0.22	−0.23	.02[a]	−.01[a]	−.03[a]	0.12	0.09	0.09	–		
14. Physiological and emotional states T2	1.74	1.30	−0.26	−0.26	−0.21	−0.23	−0.29	−0.25	−0.09	−.04[a]	−.05[a]	−.01[a]	0.08	0.06	0.43	–	
15. Physiological and emotional states T3	1.75	1.32	−0.24	−0.20	−0.19	−0.23	−0.31	−0.30	−.05[a]	−.06[a]	−.01[a]	.00[a]	0.08	0.09	0.42	0.60	–
16. Reading level T1[b]	76.41	27.30	0.37	0.39	−0.07	0.77	.22[a]	0.60	.16[a]	.21[a]	.04[a]	−0.38	−0.43	−.21[a]	−0.48	−.04[a]	.11[a]

Note. $N = 1327$. All correlations statistically significant at $p < .05$, except non-significant correlations marked with [a].
[b]Reading scores standardized within grade level.

self-efficacy increased more sharply for some students than for others. The covariance between the level and slope of self-efficacy was small but negative, indicating that the higher the self-efficacy at the beginning of the study, the slower the rate of improvement in reading self-efficacy over time.

3.2. *Changes in reading self-efficacy over time: person-centered trajectories*

To answer the second research question, we examined the different trajectory patterns in reading self-efficacy by estimating various GMM solutions reflecting up to seven trajectories (see Table 3 for the fit statistics of the different trajectory solutions). None of the estimated GMM solutions received consistent support from the fit indices and information criteria. The information criteria (BIC and aBIC) continued to decrease as the number of trajectories increased. However, the decrease decelerated slightly in the aBIC after the four-trajectory solution and in the BIC after the three-trajectory solution. Both the LMR and VLMR tests favored a four-trajectory solution over its three-trajectory counterpart ($p < .05$). Moreover, in models with more than four trajectories, the number of students in some trajectories became very small (i.e., including <1% of all the students). Furthermore, the additional trajectories did not reveal any new patterns of growth; they differed only slightly by the level of self-efficacy. Entropy was high in all solutions. Average latent class probabilities were high (greater than 0.82) in the four-trajectory solution. Based on these findings, we chose to proceed with the four-trajectory solution.

The results for the four distinct trajectories of change in the children's reading self-efficacy (i.e., means of the level and slope of self-efficacy by self-efficacy trajectory) are presented in Table 4. The trajectories are graphically illustrated in Fig. 1. Most (75.8%) of the children belonged to the trajectory labeled as "High Increasing." The children in this group had high self-efficacy at the beginning of the follow-up, which improved slightly thereafter. In the second trajectory, labeled as "Average Stable" (11.5%), the children reported rather high self-efficacy at the beginning of the study (although this value was lower compared to that of the children in the "High Increasing" trajectory), and their self-efficacy did not change significantly over the study period. The two other trajectories were labeled as "Low Increasing" (8.8%) and "Low Decreasing" (3.6%). Both these trajectories were characterized by relatively low self-efficacy at the beginning of the study. Whereas students in the "Low Increasing" trajectory reflected improvement in their self-efficacy throughout the study, those in the "Low Decreasing" trajectory showed decreasing levels of reading self-efficacy. Our hypothesis that the trajectories of change would be heterogenous was thus confirmed (H2).

3.3. *Initial level of reading skills in relation to reading self-efficacy trajectories*

Our third research question examined whether the children's initial reading level were related to their reading self-efficacy trajectory. The estimated mean reading skill level by each self-efficacy trajectory are reported in Table 5. The LR test revealed significant differences in the reading skill level of the children in each of the four self-efficacy trajectories. Pairwise comparisons between the trajectories (see Table 5) indicated that the children in the "High Increasing" trajectory had better reading skills than those in the other trajectories (i.e., "Average Stable" with $d = 0.47$ vs. "Low Increasing" with $d = 1.64$ and "Low Decreasing" with $d = 1.90$). In addition, the children in the "Average Stable" trajectory had a better initial reading skills than those in the "Low Increasing" ($d = 1.18$) and "Low Decreasing" ($d = 1.43$) trajectories. The reading skills of the children in the "Low Increasing" and "Low Decreasing" trajectories did not differ ($d = 0.26$). These effect sizes, which ranged from intermediate to strong (Cohen, 1988), provided support for our hypothesis that children with different initial reading

Table 2
Latent growth curve models of reading self-efficacy and sources of reading self-efficacy.

	Intercept		Slope		Covariance between Intercept and Slope	Model fit indexes[b]
	Mean	Variance	Mean	Variance		
Reading self-efficacy[a]						Linear model
Estimate	5.86***	0.89***	0.09***	0.11***	−0.13*	$\chi^2(1) = 2.11$
SE	0.05	0.10	0.02	0.04	0.05	CFI = 1.00, TLI = 0.99
Sources of self-efficacy[a]						
Mastery experience						Non-linear model
Estimate	5.73***	1.51***	−0.02	0.65 ***	−0.58***	$\chi^2(2) = 0.01$
SE	0.04	0.07	0.03	0.07	0.05	CFI = 1.00, TLI = 1.00
Verbal persuasion						Non-linear model
Estimate	4.86***	2.55***	−0.34***	1.34***	−0.93***	$\chi^2(2) = 0.94$
SE	0.07	0.10	0.04	0.09	0.07	CFI = 1.00, TLI = 1.00
Vicarious experience						Non-linear model
Estimate	4.75***	3.03***	−0.52***	1.73***	−1.18***	$\chi^2(2) = 2.71$
SE	0.08	0.09	0.05	0.10	0.08	CFI = 1.00, TLI = 1.00
Physiological and emotional states						Non-linear model
Estimate	1.99***	0.89	−0.21***	0.27	−0.09	$\chi^2(1) = 1.21$
SE	0.05	0.42	0.04	0.42	0.44	CFI = 1.00, TLI = 1.00

Note. [a]Scales for all variables ranged from 1 to 7. [b]Model fit indexes correspond to the competing latent growth models. Non-linear model of self-efficacy, $\chi^2(1) = 13.41$, CFI = 0.97, TLI = 0.91; Linear models for mastery experience, ($\chi^2(1) = 0.03$, CFI = 1.00, TLI = 1.00); verbal persuasion, ($\chi^2(1) = 18.28$, CFI = 0.98, TLI = 0.95); vicarious experience, ($\chi^2(1) = 36.39$, CFI = 0.96, TLI = 0.89); and physiological and emotional states, ($\chi^2(1) = 7.99$, CFI = 0.97, TLI = 0.92).
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 3
Summary of Fit Statistics for Different Growth Mixture Models of Reading Self-Efficacy.

Number of trajectories	LLR	BIC	aBIC	VLMR *p*-value	LMR *p*-value	Entropy	Trajectory sample sizes based on posterior probabilities
1	−4988.001	10076.660	10032.189	–	–	–	–
2	−4792.607	9707.443	9653.442	0.0000	0.0000	0.93	103/1223
3	−4679.482	9502.762	9439.231	0.1170	0.1256	0.90	138/81/1107
4	**−4619.543**	**9404.454**	**9331.393**	**0.0324**	**0.0360**	**0.87**	**164/995/48/119**
5	−4563.505	9313.949	9231.359	0.0881	0.0961	0.88	16/43/157/130/980
6	−4523.834	9256.176	9164.056	0.2836	0.2977	0.88	45/130/956/152/16/26
7	−4499.192	9228.461	9126.811	0.3284	0.3384	0.86	30/36/914/17/129/76/124

Note. LLR = log-likelihood ratio; BIC = Bayesian information criterion; aBIC = sample-size adjusted Bayesian information criterion; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test; LMR = Lo-Mendell-Rubin likelihood ratio test. Estimates of the chosen four factor solution are bolded.

Table 4
Estimated Proportion of Students, and Mean Level and Slope of Reading Self-Efficacy Latent Growth Curve Model, by Self-Efficacy Trajectories.

	Reading Self-Efficacy Trajectories			
	High Increasing	Average Stable	Low Increasing	Low Decreasing
Trajectory *n* (estimated proportion of students)[a]	1007 (75.9%)	153 (11.5%)	121 (9.1%)	45 (3.4%)
Average posterior probability	0.96	0.83	0.82	0.93
Level mean	5.75***	5.05***	3.11***	3.68***
Slope mean	0.37***	−0.14	1.22***	−0.57**

*$p < .05$, **$p < .01$, ***$p < .001$.
[a]Values obtained from classification of students based on their most likely trajectory membership.

skill levels would differ by reading self-efficacy trajectories (H3).

3.4. Changes in sources of self-efficacy in relation to reading self-efficacy trajectories

To answer our final research question, two phases of analysis were conducted. In the first phase, we examined changes in the sources of self-efficacy. We conducted LGMs separately for each of the sources of self-efficacy (mastery experience, verbal persuasion, vicarious experience, and physiological and emotional states). The fit indices and estimated parameters of the LGMs are presented in Table 2 (i.e. means and variances of the level and slope for each source of self-efficacy). A model including the initial level and a nonlinear slope fit the data well for each source of self-efficacy (see Table 2). On average, mastery experience did not change during the study period. However, statistically significant variability was observed between the students with regard to the level of mastery experience as well as the rate of change. Verbal persuasion, vicarious experience, and physiological and emotional states showed declining patterns over the study period. In terms of physiological and emotional states, this indicated that the students experienced less adverse physiological arousal and emotional states (e.g., anxiety) in reading over time. In addition, the students differed in the rates at which their sources of self-efficacy declined over the study period. For mastery experience, verbal persuasion, and vicarious experience, higher initial levels were related to faster rates of decline over time. However, in physiological and emotional states, the rate of decline was similar for all the students and unrelated to the initial levels of arousal reported by them.

In the second phase, which is pertinent to answering our primary question of interest, we examined whether the initial levels of and rates of changes in the sources of self-efficacy differed according to the students' reading self-efficacy trajectories (i.e., the four trajectory patterns described above). The estimated means of the level and slope of each source by self-efficacy trajectory are reported in Table 5 and are graphically illustrated in Fig. 2. All the LR tests were significant at $p < .01$, indicating that the students' self-efficacy trajectories differed as a function of the initial level and mean rate of change for each source of self-efficacy (Table 5). In other words, both the initial levels of the

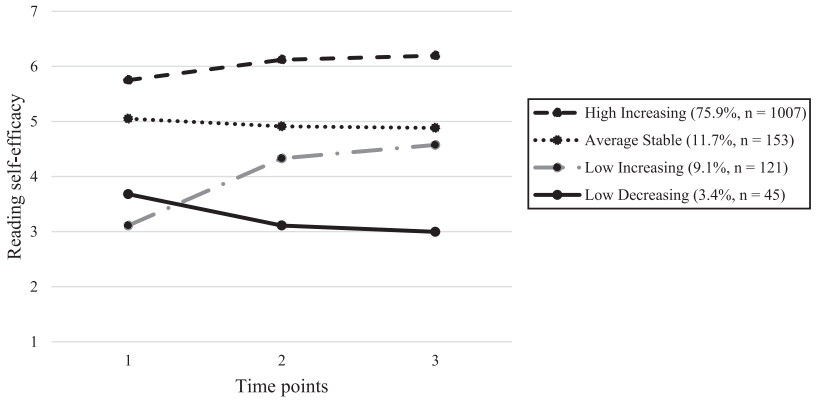

Fig. 1. Self-Efficacy Scores by Self-Efficacy Trajectories between Time Points T1–T3. *Note.* Self-efficacy trajectory groups were labeled as High Increasing, Average Stable, Low Increasing and Low Decreasing.

Table 5
Estimated Means of Level and Slope of Sources of Self-Efficacy and of Level of Reading by Self-Efficacy Trajectories: Comparisons between Self-Efficacy Trajectories conducted via BCH method.

		Self-Efficacy Trajectories				
	Log-likelihood ratio test	High Increasing (1)	Average Stable (2)	Low Increasing (3)	Low Decreasing (4)	Comparisons between Self-Efficacy Trajectories[c]
Reading level[a]						
		0.17***	−0.12	−0.85***	−1.00***	4, 3 < 2 < 1
Sources of Self-Efficacy						
Mastery experience[b]	$\chi^2(6) = 155.10$***					
Level		6.15**	5.39***	4.53***	4.53***	4, 3 < 2 < 1
Slope		0.33	0.55*	0.34*	−0.09	4 < 2
Verbal persuasion[b]	$\chi^2(6) = 50.74$***					
Level		6.31***	5.74***	5.46***	5.60***	4, 3, 2 < 1
Slope		−0.24	−0.33	−0.16	−0.86*	4 < 1, 3
Vicarious experience[b]	$\chi^2(6) = 18.29$**					
Level		6.12***	5.75***	5.73***	5.86***	2 < 1
Slope		−0.42	−0.55	−0.18	−0.94**	4 < 3
Physiological and emotional states[b]	$\chi^2(6) = 51.76$***					
Level		2.05***	2.31***	2.89***	3.53***	1, 2 < 4, 3
Slope		−0.50**	−0.31	−0.64**	−0.89**	4 < 2

Note. [a]Reading test scores standardized within each grade level prior to the analysis. [b]Scale from 1 to 7. In physiological and emotional states, higher scores refer to more adverse physiological arousal. [c]Pairwise comparisons based on Wald's test. Only significant comparisons are presented.
*$p < .05$, **$p < .01$, ***$p < .001$.

students' exposure to efficacy-relevant information and the manner in which their exposures changed over time were related to the students' reading self-efficacy trajectories. The results for the variables controlled in each model are reported in Appendix D.

Next, we focused on the differences in the levels of sources of self-efficacy reported by the students in each of the four self-efficacy trajectories. Pairwise comparisons between the trajectories indicated that the children in the "High Increasing" trajectory had higher initial levels of mastery experiences and verbal persuasions than those in the other trajectories (the trajectory comparisons are presented in Table 5, and the Wald tests for pairwise comparisons, in Table 6). In addition, the children in the "High Increasing" trajectory reported more vicarious experiences compared to those in the "Low Increasing" trajectory, and they had lower initial levels of physiological and emotional states compared to the students in the "Low Increasing" and "Low Decreasing" trajectories. The children in both the low self-efficacy trajectories (be it "Low Increasing" or "Low Decreasing") reported similar initial levels of exposure to each source of self-efficacy. The effect sizes reflecting the differences in the initial level of each source of self-efficacy as a function of the children's self-efficacy trajectories ranged from intermediate to strong (Cohen, 1988). These effect sizes (see Table 6) pointed to substantial differences in the children's initial exposures to each of the four sources of self-efficacy, which relate to corresponding increases or decreases in the children's reading self-efficacy over time. These findings were in line with our hypotheses (H4 and H5).

Last, we examined the differences in the rates of change (i.e., slopes) in the sources of self-efficacy over time as a function of the students' self-efficacy trajectories. The average rate of change in the mastery experiences differed only between the "Average Stable" and "Low Decreasing" self-efficacy trajectories (see Table 6 for the Wald tests for pairwise comparisons and effect sizes). The children in the "Average Stable" trajectory reported increasing mastery experiences over the study period, whereas those in the "Low Decreasing" trajectory reported no significant change in perceived mastery experiences. However, these children in "Low Decreasing" trajectoryreported diminishing verbal persuasions over the study period compared to children in either of the increasing self-efficacy trajectories. Similarly, the children in the "Low Decreasing" trajectory reported decreasing vicarious experiences over the study period in comparison to those in the "Low Increasing" trajectory. Only one significant difference emerged between the self-

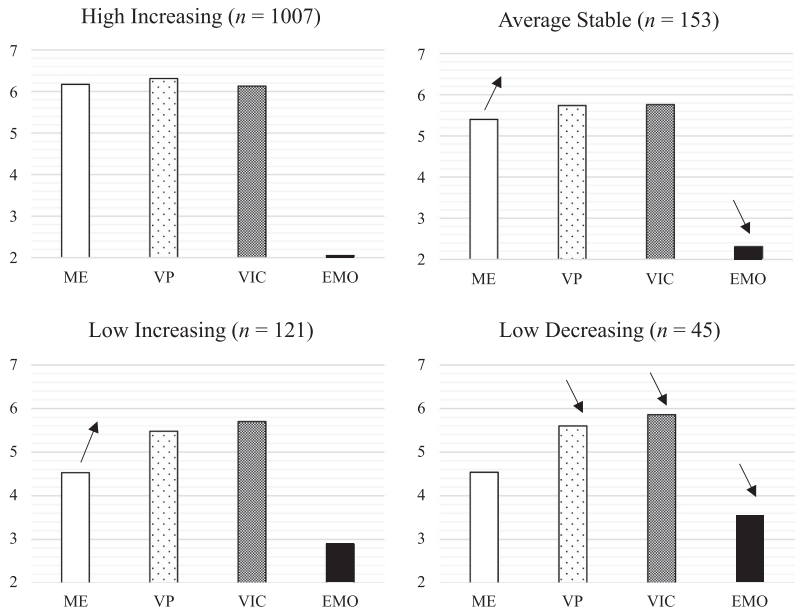

Fig. 2. Estimated Mean Levels of Each Source of Self-Efficacy by Self-Efficacy Trajectories over Three Time Points. *Note.* Arrows represent significant change over time in the sources of self-efficacy. Arrows pointing upward represent an increase over the study period and arrows pointing downward represent a decrease over the study period. ME = Mastery experience, VP = Verbal persuasion, VIC = Vicarious experience, EMO = Physiological and emotional state.

Table 6
Effects Sizes based on Pairwise Comparisons of the Estimated Means of Level and Slope of Sources of Self-Efficacy by Self-Efficacy Trajectories.

Trajectory Comparisons[a]	Mastery experience		Verbal persuasion		Vicarious experience		Physiological and emotional states	
	Wald	Cohen's *d*	Wald	Cohen's *d*	Wald	Cohen's *d*	Wald	Cohen's *d*
Level								
1 vs 2	20.23***	**0.39**	9.85**	**0.21**	4.09*	**0.12**	2.58	0.44
1 vs 3	48.83***	**0.83**	11.63***	**0.31**	2.58	0.13	17.43***	**1.40**
1 vs 4	39.60***	**0.82**	5.51*	**0.26**	0.77	0.09	19.95***	**2.50**
2 vs 3	7.41**	**0.44**	0.89	0.10	0.01	0.01	5.64*	**0.96**
2 vs 4	8.97**	**0.44**	0.16	0.05	0.10	0.04	12.15***	**2.04**
3 vs 4	0.00	0.00	0.16	0.05	0.14	0.04	3.20	1.08
Slope								
1 vs 2	1.35	0.12	0.23	0.05	0.43	0.06	2.13	1.13
1 vs 3	0.00	0.02	0.16	0.05	1.23	0.12	0.54	0.79
1 vs 4	2.79	0.31	5.93*	**0.34**	3.64	0.26	2.54	2.29
2 vs 3	0.52	0.14	0.42	0.10	1.80	0.09	2.19	1.92
2 vs 4	3.94*	**0.43**	2.57	0.29	1.49	0.31	5.41*	**3.40**
3 vs 4	1.41	0.29	5.02*	**0.39**	5.61*	**0.40**	0.77	1.50

[a]Self-efficacy Trajectories: 1= "High Increasing", 2 = "Average Stable", 3 = "Low Increasing", 4 = "Low Decreasing". Significant effect sizes are bolded.
*$p < .05$, **$p < .01$, ***$p < .001$.

efficacy trajectories with regard to the students' physiological and emotional states over time: the children in the "Low Decreasing" trajectory reported diminishing negative physiological and emotional states in comparison to those in the "Average Stable" trajectory. Overall, the intermediate effect sizes (Cohen, 1988) indicated that changes in the children's self-efficacy over time depended partly on the differences in their longitudinal exposures to efficacy-relevant experiences (see Table 6).

4. Discussion

This study extends previous research on self-efficacy development by examining how efficacy beliefs form and change in the early stages of learners' school careers. We examined self-efficacy and its hypothesized sources among primary school children and focused on beliefs about reading fluency, which is a less studied context in the field of self-efficacy research. More specifically, we examined how reading self-efficacy changes over time using both variable-centered and person-centered analyses. By adopting a person-centered approach with longitudinal data, we identified differing trajectories of reading self-efficacy development and examined how changes in the sources of self-efficacy relate to these trajectories. In addition, we examined the association between children's initial reading fluency levels and their subsequent self-efficacy development.

4.1. Increase in reading self-efficacy over time

The results from our variable-centered analyses indicated that reading self-efficacy was not a stable characteristic among our primary school students. Rather, the children's reading self-efficacy changed

over a 11-month study period that spanned 2 grade levels. We were pleased to see that, in general, the children's beliefs about their capability to read fluently increased over the study period. This finding is similar to that reported for secondary school students' reading self-efficacy (Schöber et al., 2018) and is in line with research conducted with primary school children in other contexts (e.g., Hornstra et al., 2016; Phan, 2012a, 2012b).

4.2. Distinct trajectories of change in reading self-efficacy

Our person-centered analyses offered a more nuanced understanding of children's self-efficacy development by permitting us to model differences in the level, direction, and rate of change in self-efficacy for each student (see Bergman & Trost, 2006; Howard & Hoffman, 2018; Woo et al., 2018). Four distinct trajectories of change in reading self-efficacy emerged from the data. The children in two of the trajectories showed increasing self-efficacy over the study period—one trajectory was characterized by high initial self-efficacy levels, and the other, by low initial levels. A third trajectory was characterized by average initial levels of self-efficacy that remained relatively stable over time. A fourth self-efficacy trajectory, and that with the smallest number of children, was characterized by low initial self-efficacy levels, which decreased over time. This last pattern of decline in reading self-efficacy, although characteristic of a minority of the studied children, is nevertheless worth paying particular attention to, as discussed below. Notably, the variability in the children's self-efficacy development that we modeled in this study would have remained hidden if we would have conducted mean-level and variable-centered analyses only.

Our results depict changes in the children's beliefs about their capabilities to successfully perform everyday reading tasks. We found substantial variability in changes in self-efficacy, showing both increasing and declining trajectories at this level of measurement specificity, which followed the operationalization of self-efficacy as a task-specific judgment of one's capabilities (Bandura, 1997; see also Schunk & DiBenedetto, 2020). Previous studies have primarily examined either reading self-efficacy at a domain/general level (e.g., *I'm a good reader*) in a cross-sectional manner (e.g., Lee & Zentall, 2015; Smith et al., 2012; Wigfield, Guthrie, Tonks, & Perencevich, 2004) or longitudinally (in one case only; Schöber et al., 2018). When a more general level of specificity in reading ability beliefs is used, researchers have reached somewhat different conclusions. For example, the developmental trajectories in children's ability self-concepts in literacy were shown to decline from Grades 1–12, although the rate of decline differed (Archambault et al., 2010). Some researchers have suggested that task-specific self-efficacy may be more sensitive to change than domain-general self-efficacy (Marsh et al., 2019; see also Unrau et al., 2017). That is, specific efficacy beliefs are more prone to change from day to day (i.e., more state-like) compared to more general beliefs, which tend to be stable over time (i.e., more trait-like). The relationships between specificity of measurement and changes in self-efficacy over time warrant further investigation.

4.3. Dynamic interplay between sources of self-efficacy and self-efficacy

The children's reported exposure to the efficacy-building experiences and their changes over time were found to vary according to fluctuations in their self-efficacy. Thus, our findings not only confirm but also extend those reported in cross-sectional studies, which indicate that the sources of self-efficacy and self-efficacy are related (see, e.g., Sheu et al., 2018; Usher & Pajares, 2008) by pointing to the dynamic interplay of these variables. Our findings are well understood in light of Bandura (1997) social cognitive model of reciprocal determinism (see also Schunk & DiBenedetto, 2020). As Bandura explained, "the extent to which people will alter their perceived efficacy through performance experiences depends upon, among other factors, their preconceptions of their capabilities" (p. 81).

Not surprisingly, the children with initially high and increasing levels of reading self-efficacy reported more efficacy-building experiences than those with other trajectories. These high-self-efficacy students reported experiencing mastery in reading tasks, receiving positive feedback on their reading skills, seeing other good readers, and experiencing low and further diminishing negative affective arousal in reading situations. Similar patterns have been observed in cross-sectional studies in the context of science, math, and reading (Butz & Usher, 2015; Chen & Usher, 2013). Furthermore, our findings revealed that the children's high levels of positive efficacy-building experiences were maintained over time. Not surprisingly, these children possessed an initial reading skill level that was higher compared to those of the students in the other self-efficacy trajectories. Good readers may be more likely to experience efficacy-building events or messages that would enable them to build confidence, and they presumably perceive and interpret these experiences in ways that support positive self-efficacy development (see also Usher & Pajares, 2006). As theorized, prior skills convey a sense of mastery, enhancing self-efficacy, which in turn likely initiates skill development. It is encouraging that most of the children in our sample were experiencing this positive self-belief cycle in reading.

By contrast, the children in the two trajectories with self-efficacy levels that were relatively lower likewise reported lower initial levels of mastery experiences and encouragement from others. They had lower reading skills than the students with high and average initial self-efficacy. These findings are consistent with those from previous cross-sectional research (Butz & Usher, 2015; Chen & Usher, 2013). Taken together, these findings suggest that attention should be paid to how poor readers perceive feedback and the social persuasions received from others as well as how they interpret their performance in reading tasks. Lower-performing children may need more explicit support to create positive efficacy-building experiences in reading. In addition, high levels of anxiety and tension in reading situations were related to lower perceived efficacy in reading. Previous studies that examined reading using variable-centered approaches did not find this association to be prominent (Butz & Usher, 2015). Negative arousal related to mathematics (mathematics anxiety) is well known and has been found to be related to perceived self-efficacy in mathematics (e.g., Phan, 2012b; Usher & Pajares, 2009; Usher et al., 2019).

These implications become more evident in light of our findings for particular types of efficacy-relevant experiences. Among the children who showed a negative trend in their self-efficacy over time, their persistently low self-efficacy was related to declining exposure to social sources of self-efficacy over time (i.e., verbal persuasions and vicarious experiences). That is, these children either perceived or experienced less social support over time (i.e., received fewer positive verbal persuasions). In previous studies, students' perceptions of teacher support have predicted changes in motivational profiles (Lazarides, Dietrich, & Taskinen, 2019), and teachers' perceptions of students' abilities have been related to children's developing perceptions of their reading abilities (Upadyaya & Eccles, 2015). Our findings extend this line of evidence by suggesting that perceived lack of social support over time can be harmful to children's self-efficacy development.

Moreover, decreasing exposure over time to social models who are skilled readers was related to declining self-efficacy in reading. One explanation for this finding is that children with low self-efficacy and low reading skills may not seek out more proficient models, as the latter's successes might induce feelings of despair. As our items focused only on exposure to proficient models (e.g., *Seeing kids do better than me in reading pushes me to do better*), they did not enable us to assess the degree to which students with low self-efficacy were exposed to struggling readers who may have reinforced their self-doubts (see Usher & Weidner, 2018). Furthermore, exposure to peer and adult models who make errors and who overcome difficulties (i.e., coping models; Pajares, 2006; Schunk, Hanson, & Cox, 1987), may be especially beneficial for low-performing children's self-efficacy development (Schunk et al.,

1987). In reading particularly, seeing similar others succeed is found to be an important source for reading self-efficacy for low-performing students (Usher & Pajares, 2006).

In addition, children with decreasing self-efficacy reported low levels of perceived mastery experience over time, possibly suggesting that the task demands in reading were not at an optimal level for ensuring their incremental success. Differentiated reading instruction might make it more likely for struggling readers to experience and witness their own skill development, albeit at a slower pace. Such mastery experiences can ward off a persistently low self-efficacy, which has been shown to lead to avoidance of challenging tasks and lack of effort or persistence (Galla et al., 2014; Schnell et al., 2015).

Our findings indicate that longitudinal designs and person-centered approaches can extend the current state of knowledge on self-efficacy development. For most of the students in our sample, the changes in self-efficacy were positive and associated with high levels of efficacy-building experiences and high initial reading skills. For the students whose self-efficacy was low, on the other hand, these relationships were not as clear. We found no relationship between the initial levels of sources of self-efficacy or reading skills and negative trajectories of self-efficacy. Rather, the students' persistently low self-efficacy was associated with a decline in exposure to the social sources of self-efficacy over time. The context-dependent variability in the longitudinal interplay between changes in self-efficacy and changes in the sources of self-efficacy might partially explain the inconsistent findings reported in the few previous longitudinal investigations of these variables (2012b; Phan, 2012a).

4.4. Implications

From the viewpoint of teaching, our findings offer several important insights on how efficacy beliefs form and change in primary school and the individual variabilities in those changes. First, the self-efficacy trajectories that emerged varied by students' exposures to the sources of self-efficacy. Teachers often provide considerable instructional scaffolding and support for reading at the beginning of the school year, but over time, much of that support diminishes. Ongoing instructional supports that target each of the four efficacy-relevant sources would ensure that children have opportunities to build not only their skills, but their self-efficacy as well.

Second, fewer perceived social sources of self-efficacy support may be especially detrimental to children who already perceive themselves as poor readers. These children would likely benefit from individualized social and academic supports that would help them regain or maintain their self-efficacy in reading. Such supports could include ongoing and explicit positive feedback of the development of their reading skills from teachers and parents. In addition, ensuring exposure to coping models with whom children can identify with when they struggle, could help build their confidence in reading, as Schunk and colleagues' (Schunk & Hanson, 1985; Schunk et al., 1987) early experiments in math suggest. It bears noting that many children with low self-efficacy have become convinced that nothing can raise their self-efficacy (Usher et al., 2019). Thus, researchers should further examine the extent to which learners in the most at-risk self-efficacy trajectories are responsive to social supports and instructional interventions.

Third, our findings suggest that teachers should be aware of the heterogeneity in self-efficacy development. The provision of diverse opportunities to support students' self-efficacy—at varying times and in ways sensitive to diverse student needs—will yield the best results. In other words, a one-size-fits-all approach to supporting self-efficacy development would likely be ineffective.

4.5. Limitations and future directions

Several limitations in this work should be taken into account in future research. First, the study period of 11 months was rather short for investigating changes in self-efficacy and efficacy-building experiences. Longitudinal studies with longer follow-ups would offer a more comprehensive picture of the developmental trends and trajectories of efficacy beliefs. On the other hand, examining variations in reading-related efficacy beliefs intensively during learning situations and from day to day (e.g., via experience sampling methods) would provide a more detailed account of how pedagogical practices, such as feedback, affect students' self-beliefs in reading.

Second, self-efficacy might be more likely to change and efficacy-building experiences might be more beneficial at certain points during the school year than others. Our study did not consider the ways in which students may have weighted and integrated efficacy-relevant information at each time interval. Further research could help identify the point at which efficacy-building experiences induce detectable changes in learners' beliefs. Furthermore, researchers should consider what types of experiences might be *lowering* children's confidence in reading, which we did not focus on in this work.

Third, we did not consider the factors that might mediate or moderate the relationships between sources of self-efficacy and self-efficacy over time. Such factors might be related to both environmental (e.g., social norms, pedagogical practices, and parenting style) and personal (e.g., ability mindsets and identity) characteristics (Usher & Weidner, 2018). For example, a child with a fixed ability mindset might not change his efficacy beliefs despite being exposed to many efficacy-building experiences (Chen & Usher, 2013). Other methodological approaches, such as targeted interviews with children, teachers, or parents, could be useful for understanding why, for whom, and how reading self-efficacy changes.

Fourth, we used a person-centered approach (see Bergman & Trost, 2006; Howard & Hoffman, 2018) for studying individual differences in self-efficacy development. However, for the sake of interpretability, we elected to use a variable-centered approach for modeling the sources of self-efficacy. Future work should consider the variabilities regarding the development of the sources of self-efficacy as well as the relationships between these sources and self-efficacy. These findings could enrich our understanding of the dynamic changes in both the sources and self-efficacy over time. In addition, future work might consider how skill development affects children's perceptions and interpretations of efficacy-building experiences together with changes in their self-efficacy.

Lastly, to ensure that our findings did not depend on the children's developmental levels, we controlled for grade level in all the analyses. However, this leaves open the question of whether changes in the variables and their relationships might have been moderated by these group characteristics. Examining the differences in the changes between developmental phases (e.g., at the beginning of schooling and in transition phases) might reveal a more nuanced picture of age-related differences in self-efficacy development.

5. Conclusion

This study is among the first to use a longitudinal and person-centered approach to investigate the development of children's reading self-efficacy. Our findings indicate substantial variabilities in the level, direction, and rate of change of primary school students' reading self-efficacies over time, which highlights the need for person-centered approaches in understanding self-efficacy development. Importantly, efficacy-building experiences and changes in them were found to be associated with the students' self-efficacy trajectories. To identify and support young readers—particularly those who harbor self-doubt—teachers should be sensitive to changes in self-efficacy as well as changes in how students perceive efficacy-building experiences. Educational practices that permit teachers to address the needs of different groups of students, such as differentiated instruction, may best support self-efficacy.

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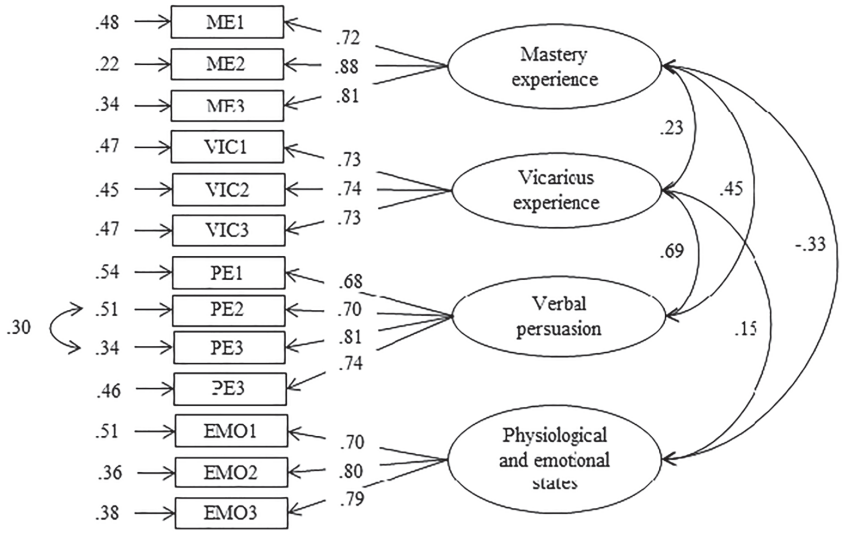
Appendix A

Four-Factor Structure of Sources of Reading Self-Efficacy



Note. ME = Mastery experience, VIC = Vicarious experience, PE = Verbal persuasion, EMO = Physiological and emotional states. Standardized estimates and only significant estimates are presented.

Appendix B

The invariance of the sources of self-efficacy was tested by comparing the fit of the baseline model (i.e., parameters of the model were freely estimated in all grade levels) to that of the constrained model (i.e., parameters were constrained to be equal across grade levels), using the Satorra-Bentler scaled χ^2 test (Satorra & Bentler, 2001). A statistically significant χ^2 difference test ($p < .05$) denotes that the model with fewer constraints fits better with the data, whereas statistically non-significant χ^2 difference test denotes that the model with more constraints fits better with the data. However, because the χ^2 test is sensitive to large sample size, the CFI, RMSEA, and SRMR criteria (see Chen, 2007; Cheung & Rensvold, 2002; MacCallum, Browne, & Cai, 2006) were also used. A change smaller than −0.01 in CFI supplemented by a change of smaller than 0.015 in RMSEA and smaller than 0.03 in SRMR indicates that the hypothesis of invariance of factor loadings or intercepts should not be rejected, even though the χ^2 test indicates a statistically significant result.

Invariance Comparisons of the Sources of Self-efficacy by Grade Level

Model	χ^2	*df*	*CFI*	*TLI*	*RMSEA 90%. C.I.*	*SRMR*	χ^2 difference test	*ΔCFI/ΔRMSEA/ΔSRMR*
Invariance of the Sources of Self-efficacy Model								
1 Unconstrained model	342.704***	232	0.979	0.971	0.039 0.030–0.047	0.043	–	–
2 Loadings set to be equal	379.265***	259	0.977	0.972	0.038 0.030–0.046	0.050	χ^2 (27) = 36.661, $p = .10$	−80.002/0.001/0.007
3 Loadings and intercepts set to be equal	437.108***	286	0.971	0.968	0.041 0.033–0.048	0.053	χ^2 (27) = 58.133, $p < .001$	−80.006/0.003/0.003

Note. In χ^2 difference test and *ΔCFI/ΔRMSEA/ΔSRMR* model compared to previous, less constrained model.
*** $p < 0.001$

Appendix C. Sources of reading self-efficacy scale

Original items in Finnish	Translated items	Original items (Usher & Pajares, 2009)
Mastery experience		
Olen aina ollut hyvä lukija.	I have always been a good reader.	I have always been successful with math.
Osaan lukea hyvin.	I do well on reading.	I do well on math assignments.

(*continued on next page*)

(*continued*)

Original items in Finnish	Translated items	Original items (Usher & Pajares, 2009)
Osaan lukea hyvin vaikeitakin tekstejä.	I do well on reading even the most difficult texts.	I do well on even the most difficult math assignments
Social persuasion		
Opettajani on usein kehunut siitä, että lukutaitoni on parantunut.	My teacher has often told that I am getting better in reading.	My math teachers have told that I am good at learning math.
Vanhempani sanovat usein, että olen hyvä lukija.	My parents have often told me what a good reader I am.	Adults in my family have told me what a good math student I am.
Lukutaitoani on usein kehuttu.	I have been praised for my reading skills.	I have been praised for my ability in math.
Luokkakaverit ovat sanoneet, että olen hyvä lukija.	My classmates have told me that I'm a good reader.	Other students have told me that I'm good at learning math.
Vicarious experience		
Kun näen toisten lasten olevan parempia lukijoita, se saa minutkin harjoittelemaan lukemista.	Seeing kids do better than me in reading pushes me to do better.	Seeing kids do better than me in math pushes me to do better.
Ajattelen usein, että jonain päivänä olen taitava lukija.	I often imagine myself being a good reader.	I imagine myself working through challenging math problems successfully.
Ihailen aikuisia, jotka ovat hyviä lukijoita.	I admire adults who are good readers.	(not in the original scale)
Physiological and emotional states		
Ahdistun, kun tiedän, että joudun lukemaan ääneen tunnilla.	I get anxious when I know that I have to read aloud during class.	(not in the original scale)
Ahdistun, kun aloitan lukemisen.	I start to feel anxious as soon as I begin to read.	I start to feel stressed-out as soon as I begin my math work.
Tunnen kehossani jännitystä, kun minun pitää lukea.	I feel tension in my body when I have to read.	My whole body becomes tense when I have to do math.

Note. The original items (Usher & Pajares, 2009) were translated from English to Finnish and then adapted for the reading context and primary school children. The items were then back-translated to English.

Appendix D. Results concerning model covariates

	Self-efficacy		Mastery experience		Verbal persuasion		Vicarious experience		Physiological and emotional states	
Covariates	Level	Slope	Level	Slope	Level	Slope	Level	Slope	Level	Slope
Grade level	0.24**	−0.31	−0.05		−0.08	−0.19**	−0.30***	−0.09	−0.08	0.06
Gender[a]	0.13*	−0.30	0.09***	0.11***	−0.15	0.03	−0.78***	0.07	−0.09	−0.09
Intervention status[a]	−0.05	0.03	0.02	0.04	0.08***	0.68***	−0.07	0.32	0.71*	0.00

Note. [a]Gender and intervention status were recoded for the analyses (0 = girl, 1 = boys; 0 = no intervention, 1 = intervention).
*$p < .05$, **$p < .01$, ***$p < .001$.

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