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Riikka Hirvonen

Children's Achievement Behaviors in Relation to their Skill Development and Temperament

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Cover picture: At the top of Kiilopää fell, near the Saariselkä region in Inari where I was preparing for my defense in August 2013. Photo by Riikka Hirvonen.

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ABSTRACT

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Yhteenveto: Oppilaiden työskentelytapojen yhteys akateemisten taitojen kehitykseen ja temperamenttiin

This research examined the antecedents and consequences of kindergarten and elementary school students' achievement behaviors. The aim of the research was threefold: first, to examine to what extent students' achievement-related behaviors contribute to the development of their reading and math skills; second, to examine the extent to which students' reading and math skills contribute to the development of their achievement-related behaviors; and third, to examine to what extent students' temperamental characteristics contribute to their achievement-related affects and behaviors. Additionally, changes in students' achievement-related behaviors across time were also examined. Two Finnish data sets were used. The first data set was part of the Jyväskylä Entrance into Primary School (JEPS) study, in which 207 participants were followed from the beginning of kindergarten to the end of fourth grade. The second data set consisted of a sample of 153 participants of the LIGHT study. The participants were examined twice during the first grade of elementary school. The findings of the research suggest that students' achievement-related behaviors and their academic performance form a bidirectional relationship: Good performance in reading and mathematics was related to students' adaptive (task-focused) behavior in achievement situations, which further predicted better performance later on. In contrast, poor performance in reading and mathematics was related to maladaptive achievement behaviors (such as task avoidance), which predicted further poor performance. Consequently, low-achieving students seem to be in a danger of adopting negative cycles of development. Furthermore, the results of the research showed that temperamental characteristics play a significant role in students' achievement behavior: students' temperamental distractibility was related to high task avoidance in achievement situations, whereas inhibition was related to high levels of anxiety and helpless behavior. The findings also suggest that students' achievement-related behaviors show substantial stability from kindergarten through fourth grade, implying that the basis of these behavioral patterns is formed early on. In general, the findings of the research suggest that students' affective and behavioral responses in achievement situations are influenced by their previous performances and behaviors, as well as by their temperament.

Keywords: achievement behavior, anxiety, distractibility, helplessness, inhibition, mathematics, mood, negative emotionality, reading, spelling, task avoidance, temperament

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TABLES

CONTENTS

1 INTRODUCTION

The challenges in learning, that students need to face in classrooms each day, bring out various types of affective and behavioral responses in them (e.g., Dweck & Leggett, 1988; Johnson, 1981; Norem & Cantor, 1986; Turner et al., 2002; Ziegert, Kistner, Castro, & Robertson, 2001). Some students are motivated and excited by the challenges they meet, feel confident, and are not afraid to work hard for their goals (Bandura, 1989; Dweck & Wortman, 1982; Pintrich & De Groot, 1990). Others are frightened of challenging situations and try to avoid them, feel incompetent and helpless, are afraid of failing, and are not able to use their full potential (Pintrich & De Groot, 1990). It is assumed that these affective and behavioral responses are not random, but that distinct patterns of behavior can be identified that are typical for students and recur from one achievement situation to another. In the present research, these affective and behavioral patterns are referred to as students' achievement-related affects and behaviors, or simply as achievement behaviors. They are defined as being a part of a multifaceted process elicited by students' learning experiences and involved with several other motivational constructs, such as self-efficacy, competence beliefs, expectancies, values, and goals. Achievement-related behaviors play a substantial role in learning situations, because they, by definition, reveal how the students' motivational and cognitive processes turn into actions, and eventually determine the outcomes of the situation. Achievement-related affects and behaviors are also likely to influence students' academic achievement, and, at worst, can lead to harmful cycles of academic development (Aunola, Nurmi, Niemi, Lerkkanen, & Rasku-Puttonen, 2002; Fyrstén, Nurmi, & Lyytinen, 2006; Onatsu-Arvilommi & Nurmi, 2000).

From a motivational perspective, students' achievement-related affects and behaviors can be explained in the light of their previous experiences in learning situations, and how these experiences have influenced their beliefs concerning their own competence, their interest in the tasks at hand and their expectations for succeeding in them, as well as their willingness to invest effort in the tasks (e.g., Bandura, 1993; Dweck & Leggett, 1988; Eccles, 2005; Wigfield & Eccles, 2000). Positive achievement outcomes are likely to produce positive

self-perceptions, high motivation, and success expectations in later achievement situations, consequently leading to high effort and adaptive behavior. In contrast, negative outcomes in previous situations may lead to less confidence in one's competence and to expectations of failure, resulting in a loss of motivation and increased maladaptive behavior in subsequent achievement situations.

However, it is possible that there are also other factors, apart from cognitive and motivational ones, influencing students' affective and behavioral responses in achievement situations. For example, innate or early maturing characteristics such as temperament may play a significant role in generating and shaping students' achievement-related behaviors (Keogh, 2003; Martin, Nagle, & Paget, 1983; Rothbart & Jones, 1998), since temperamental characteristics are reflected in individuals' emotional responses and their orientation toward or away from situations, including achievement situations (Ahadi & Rothbart, 1994; Derryberry & Rothbart, 1997). Temperamental differences between individuals can also be seen in their ability to regulate these emotional and behavioral responses (Derryberry & Rothbart, 1997).

The relationship between students' achievement behavior and their academic performance has been studied previously, but these studies have some limitations. Most of the studies have focused on students' general skill development or on one specific subskill only, without considering the divergent roles that achievement-related behaviors may play regarding different subskills of literacy and numeracy. Moreover, many of the previous studies have focused on relatively short time periods in examining the relationship between achievement behaviors and achievement outcomes. Finally, thus far not many studies have considered the role of temperamental characteristics in students' achievement behavior. Consequently, one aim of this research was to take the limitations of the previous studies into account when examining the antecedents and consequences of students' achievement-related behaviors. The research examined the reciprocal relationship between students' adaptive and maladaptive behavioral patterns and their learning outcomes. Regarding academic performance, both numeracy skills and different subskills of literacy were examined. Furthermore, besides considering the role of previous skill development, this research introduces students' temperament as another factor contributing to their achievement-related affects and behaviors. The time span of the research covered kindergarten and the first four grades of elementary school.

1.1 Theories on achievement behaviors

There are several theories on achievement motivation that seek to explain the types of factors and processes that influence students' affective and behavioral responses in achievement situations (see Brunstein & Heckhausen, 2008; Wigfield, Eccles, & Rodriguez, 1998). Some of these factors are discussed here by shortly reviewing the self-efficacy and social cognitive theories, achievement

goal theories, expectancy–value theories of achievement motivation, and control–value theory of achievement emotions.

One aspect explaining individuals' behavior in achievement situations is their self-efficacy, a key concept in Bandura's (1977, 1989, 2001) social cognitive theory. Self-efficacy refers to the beliefs individuals have about their capability to perform actions that are needed to attain desired outcomes (Schunk, 1991). Beliefs of self-efficacy determine the types of behaviors that individuals choose to carry out, the level of effort they invest in the tasks, and the level of persistence they show in the face of obstacles (Bandura, 1977, 1989; Schunk, 1981, 1984, 1989). Individuals can expect a certain form of behavior to lead to a desired outcome (outcome expectation), but if they do not have the belief in their personal ability to produce those outcomes (efficacy expectation), they are not likely to act on them (Bandura, 1977). Self-efficacy perceptions are built on four sources of information: individuals' own accomplishments in previous situations, the feedback they receive for their performance, observations of other people's behaviors, and their own physiological and affective states (Bandura, 1977; Schunk, 1989, 1991). Based on these perceptions, the individual will decide what kinds of activities are applicable in the situation, and to what extent it is worth expending effort in them. Individuals tend to avoid situations and tasks they see as threatening and exceeding their coping abilities, but they are likely to approach situations that they see as rewarding and manageable (Bandura, 1989).

Other social cognitive theories of achievement motivation (Dweck, 1986; Dweck & Leggett, 1988) pose that there are two patterns of motivational behavior, each directed by different psychological processes. According to these theories, individuals' implicit theories of intelligence lead them to pursue two distinct types of goals in achievement settings: A pursuit of performance goals is thought to be motivated by individuals' aim to show their competence (or to avoid showing incompetence) in relation to others' competence. This aim is thought to be based on individuals' belief that intelligence is a fixed entity (Dweck, 1986; Dweck & Leggett, 1988). In contrast, learning or mastery goals are thought to be motivated by individuals' desire to increase their competence, founded on their belief that intelligence is a malleable quality (Dweck, 1986; Dweck & Leggett, 1988). It has also been suggested that the adoption of performance goals leads to maladaptive behavior in achievement situations, whereas learning goals are thought to support adaptive behavior (Dweck & Leggett, 1988). Maladaptive behavioral patterns are characterized by a lack of self-enhancing attributions, as well as by challenge avoidance and task-irrelevant activities, negative affects such as anxiety, and reduced performance (Dweck, 1986; Dweck & Leggett, 1988). Adaptive patterns of behavior, in contrast, include self-serving attributions, optimism, positive affect, challenge seeking, persistence, and effective problem solving.

Later on, the idea of achievement goals (i.e., performance and mastery goals) underlying achievement behaviors has been further developed (for a description of the development of goal theories, see Elliot, 2005). One of the key

revisions of previous theories has been the inclusion of the aspect of *valence*, or the distinction between approach and avoidance motivations (see Elliot, 1999, 2005, 2006; Heckhausen & Heckhausen, 2008). In approach motivation, individuals' behavior is initiated by and directed toward positive stimuli (need for achievement), whereas in avoidance motivation it is initiated by and directed away from negative stimuli (fear of failure; Elliot, 1999, 2006). In the achievement goal framework, the inclusion of this distinction has resulted in a two-by-two taxonomy: mastery-approach and mastery-avoidance goals, and performance-approach and performance-avoidance goals (Elliot & McGregor, 2001). Adoption of these four goals is based on individuals' competence perceptions, and each type of goal is thought to lead to different behavioral and performance outcomes (Elliot, 2005; Elliot & McGregor, 2001). Mastery-approach and mastery-avoidance goals are generally related to better achievement outcomes, and are thus considered functional or adaptive (see Wigfield & Cambria, 2010). Conversely, performance-avoidance goals are generally associated with negative learning outcomes, whereas findings concerning the benefits of performance-approach goals are somewhat mixed. Today, the achievement goal approach is one of the dominant theories in the field of achievement motivation (Elliot, 2005).

Another popular approach to achievement motivation is the expectancy–value theories. These theories posit that individuals' choices, behaviors, and performance in achievement situations can be explained by their judgments about the likelihood of success (expectancies) and their reasons for engaging in the activities (values; Eccles, 2005; Schunk & Pajares, 2005; Weiner, 1992; Wigfield & Eccles, 2000). Individuals are likely to engage in activities if the outcome is something they value, and if they expect to attain the outcome (Schunk & Pajares, 2005; Weiner, 1992). According to Eccles and colleagues' comprehensive expectancy–value theory (Wigfield & Eccles, 2000), students' expectancies of success and the value attached to a task directly influence their achievement-related choices, effort, and persistence. Expectancies and values themselves are influenced by students' beliefs regarding their abilities, their goals, affective responses, and their judgments about the task difficulty, which in turn originate from the students' earlier experiences in similar situations and the inferences drawn from these experiences (Eccles, 2005; Wigfield & Eccles, 2000). Positive learning experiences are likely to promote positive self-perceptions, adaptive goals, expectations of success, positive affects toward a task, interest in the task, and consequently, high effort and persistence in completing the task. Negative experiences, in contrast, are likely to result in low self-efficacy, maladaptive goal pursuit, failure expectations, negative affective responses, lack of interest, and ultimately less effort and more avoidance behavior.

Traditionally, theories of achievement motivation have also considered affective responses as part of the cognitive and behavioral process in achievement situations. Whether achievement situations evoke positive or negative emotions in students is thought to be influenced by the students' previous experiences in similar situations (e.g., Bandura, 1977, 1993; Dweck, 1986; Eccles, 2005; Wigfield

& Eccles, 2000). A substantial number of studies have focused, in particular, on achievement-related anxiety, or test anxiety (see Pekrun, Goetz, Titz, & Perry, 2002; Wigfield & Eccles, 1989; Zeidner & Matthews, 2005). More recently, the role of emotions in learning has received interest on a larger scale, studies being focused on a wide variety of positive and negative emotions as components of the learning process (see Meyer & Turner, 2006; Pekrun et al., 2002; Valiente, Swanson, & Eisenberg, 2012). Emotions are considered both instigators and outcomes of the learning process. For example, the control–value theory of achievement emotions (Pekrun, 2006) suggests that achievement emotions are aroused on the basis of students' control and value appraisals: Students make appraisals of what the possible outcomes of the situation are, how well they can control what the outcomes will be, and how strongly they value the outcomes. These appraisals produce emotions that are related to the activity itself (such as enjoyment or boredom), or to the outcomes of the activity either prospectively (such as anticipatory joy or anxiety) or retrospectively (such as pride or shame).

In the present research, the focus was on two forms of maladaptive achievement behavior, that is, students' task-avoidant behavior (as opposed to task-focused behavior) and helpless behavior. In addition, one type of negative achievement emotion, anxiety, was also examined. Responses such as task avoidance, helplessness, and anxiety are considered maladaptive in terms of their effect on achievement outcomes (e.g., Diener & Dweck, 1978; Dweck, 1986; Nolen-Hoeksema, Girgus, & Seligman, 1986; Pekrun et al., 2002). Although such behaviors may be students' attempts to cope with the situational demands and stress in academic settings (see Brunstein & Heckhausen, 2008), they have negative consequences on students' performance and skill development.

Active task avoidance is characterized by a low level of effort and an active attempt to avoid challenges by engaging in irrelevant activities (Aunola et al., 2002; Jones & Berglas, 1978). Students showing this type of behavior typically have little confidence in their personal competence in the situation, and thus expect to encounter failure. Engaging in task-irrelevant activities can be seen as a self-handicapping strategy in order to create an excuse for this anticipated failure and to avoid looking incompetent to others (Midgley, Arunkumar, & Urdan, 1996; Turner, Thorpe, & Meyer, 1998; Urdan, Midgley, & Anderman, 1998). Self-handicapping strategies can be thought to be grounded in avoidance motivation (a fear of failure), but also a lack of approach motivation (a need to achieve; Elliot & Church, 2003). If the fear of failing is stronger than the need to succeed, the student may find it safer to induce the failure deliberately by not making an effort, rather than taking the risk of failing despite trying one's best (Jones & Berglas, 1978).

In contrast, it has been suggested that students showing helplessness or passive avoidance are concerned about their subjective control in the situation: Helpless students tend to attribute success to external, unstable, and situation-specific causes (such as luck), while explaining their failure with internal, stable, and global causes (such as inability; see Diener & Dweck, 1978; Nolen-Hoeksema et al., 1986). Consequently, in achievement situations, this maladap-

tive attributional style leads the students to expect no success, to experience negative affect, and to withdraw effort because they believe they have no personal control over the situation and the outcomes (Dweck, 1975, 1986; Nolen-Hoeksema et al., 1986; Weiner, 1992).

Anxiety, on the other hand, is by far the most studied emotion in academic settings (Pekrun et al., 2002). In the test anxiety literature, two components of anxiety have been distinguished (Wigfield & Meece, 1988; Zeidner & Matthews, 2005): Worry refers to the cognitive aspect of anxiety, including self-dismissive thoughts and doubts about one's performance, whereas emotionality describes the affective components of anxiety, such as feelings of nervousness and tension. The worry component has been found to be more closely related to a deterioration of performance, because it is thought to interfere more with other cognitive processes in the achievement situation (Wigfield & Meece, 1988; Zeidner & Matthews, 2005). It has also been suggested that students with low self-efficacy beliefs are more vulnerable to experiencing achievement anxiety (Bandura, 1993), as believing that something in the situation exceeds their competence, prevents them from reaching their goals, or threatens their feelings of self-worth leads them to dwell on these worries instead of concentrating on adaptive functioning (Bandura, 1989, 1993; Turner et al., 1998). According to the control–value theory, anxiety is an outcome-related emotion instigated prospectively: if avoiding a failure in the task is important to the student (outcome value), but chances for personal control over the situation are uncertain or lacking (outcome control), anxiety will follow (Pekrun, 2006; Pekrun et al., 2002).

In the existing literature, students' choices and behaviors in achievement situations have often been conceptualized as, for example, achievement strategies (Aunola et al., 2002; Cantor, 1990; Onatsu-Arvilommi, Nurmi, & Aunola, 2002), achievement beliefs and behaviors (Aunola, Nurmi, Lerkkanen, & Rasku-Puttonen, 2003; Fyrstén et al., 2006), cognitive strategies (e.g., Norem & Cantor, 1986), and motivational styles (Dweck & Leggett, 1988; Galloway, Leo, Rogers, & Armstrong, 1996). These conceptualizations seem to represent not only students' behaviors in a given situation, but also the cognitive processes such as their attributions, expectations, goals, or intentions explaining these behaviors. In the empirical studies featured in this research, teachers' and observers' ratings of students' behavior in achievement situations were used. These measures obviously cannot capture the cognitive and motivational processes of the individual (what the student is pursuing to do and why), but they give us information about how these processes are reflected in his or her behavior (what the student actually does). To this end, the term achievement behaviors (or achievement-related behaviors) is used to emphasize the distinction between observer-rated behavior and self-rated strategic choices.

1.2 The role of achievement behaviors in learning situations

In this section, the consequences that students' achievement-related behaviors may have in learning situations are discussed. Besides one's cognitive capacity, one needs sufficient motivation toward learning in order to take full advantage of one's skills and to use these adequately in learning situations. Students who have high motivation and who show adaptive behavioral patterns in learning situations are more likely to succeed. Students with less motivation and maladaptive patterns of behavior are more likely to fail in learning situations. The role that these adaptive and maladaptive behavioral patterns play in students' skill acquisition has been studied both in Finland and abroad.

Studies have shown that Finnish first graders' teacher- or observer-rated task-focused versus task-avoidant behaviors significantly affect their skill development in reading (Aunola et al., 2002; Fyrstén et al., 2006; Onatsu-Arvilommi & Nurmi, 2000), mathematics (Aunola et al., 2003), or both (Mägi, Häidkind, & Kikas, 2010): task-focused behavior is associated with better learning outcomes, whereas task avoidance is associated with worse learning outcomes. Similar findings have also been found concerning students' self-reported task avoidance (Mägi et al., 2010; Onatsu-Arvilommi et al., 2002) and helplessness beliefs (Fyrstén et al., 2006) in the beginning of schooling. In another study, Pakarinen and colleagues (2011) found that students' teacher-rated task-avoidant behavior was associated with lower math skills already at the end of kindergarten. Also in other studies, teacher-rated task-focused versus task-avoidant behavior has been found to predict students' reading performance (Stephenson, Parrila, Georgiou, & Kirby, 2008) and to differentiate groups identified as low-skilled and highly skilled readers (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008; Sideridis, Morgan, Botsas, Padeliadu, & Fuchs, 2006). In contrast, Mägi and colleagues (2011) found that students' parent-rated task avoidance in homework situations did not predict their reading or mathematical performance later on.

Moreover, teacher-rated task orientation (task involvement) has also been found to predict students' reading skills (Lepola, Niemi, Kuikka, & Hannula, 2005; Salonen, Lepola, & Niemi, 1998) and to differentiate between groups of high-achieving or most progressive students and low-achieving or least progressive students (Lepola, Salonen, & Vauras, 2000; Poskiparta, Niemi, Lepola, Ahtola, & Laine, 2003). An opposite pattern of findings has been found concerning social dependence orientation (Lepola et al., 2000; Lepola, Niemi, et al., 2005; Poskiparta et al., 2003) and ego-defensive orientation (task-avoidant and inhibited tendency; Lepola et al., 2000; Poskiparta et al., 2003): students with higher levels of these maladaptive types of orientation at earlier time points showed a lower level of and the least progress in reading later on. Similar findings about the importance of on-task behavior in skill acquisition have been found by several other researchers (e.g., Gijsel, Bosman, & Verhoeven, 2006; Hughes &

Coplan, 2010; Kenney-Benson, Pomerantz, Ryan, & Patrick, 2006; Ladd & Dinella, 2009; Schaefer & McDermott, 1999).

Although most of the previous findings concerning the role of students' achievement behaviors in their literacy and numeracy acquisition are consistent, the significance of students' achievement behaviors can be thought to vary according to the difficulty of the task. For example, the role of achievement behaviors in literacy learning can vary between languages, because learning to read is considered to be more demanding in languages with opaque orthographies than in those with a more transparent orthography (Seymour, Aro, & Erskine, 2003). Indeed, Manolitsis and colleagues (2009) found that task-focused behavior in kindergarten made a bigger contribution to the prediction of English-speaking students' decoding skills in Grade 1 than was the case for Greek-speaking students. Compared to English, the Greek language has a high grapheme–phoneme regularity, enabling a rapid acquisition of decoding skills. Additionally, the effects of achievement-related behaviors can be assumed to also vary within a particular language, depending on the complexity of a task or the skills required. Georgiou and colleagues (2010) found that task-focused behavior predicted Greek students' spelling and reading comprehension, but not their reading fluency, in later grades. In another study, it was found that teacher-rated task focus versus task avoidance significantly predicted students' reading fluency and spelling skills across languages, the contribution, however, being stronger for spelling skills than for reading fluency (Georgiou et al., 2011). Spelling and reading comprehension are considered more complex skills than decoding or fluency of reading.

Previous studies examining the effects of achievement-related behaviors on students' academic achievement have some limitations. First, considerably more studies have focused on literacy acquisition and fewer studies have investigated achievement behaviors in relation to mathematical skills. Second, many of the studies have focused on examining students' general literacy or math development instead of distinguishing between more specific subskills. Moreover, the time spans of many of the previous studies have been short, usually covering only one or two school grades. Consequently, this research aimed to examine the contribution of students' achievement behaviors to the development of their academic skills longitudinally. Both literacy and numeracy acquisition were considered. In the case of literacy, the findings were compared across three subskills (fluency, reading comprehension, and spelling). The time span of the individual studies was four years.

1.3 Learning experiences as antecedents of achievement behaviors

As theories of achievement motivation suggest, students' experiences in previous learning sitations are thought to influence their later affects, thoughts, and

behaviors in similar situations (e.g., Bandura, 1977; Eccles, 2005; Wigfield & Eccles, 2000). There are good reasons to assume that students' affective and behavioral responses in achievement situations are influenced by their earlier experiences in similar situations and by the feedback they have received for their efforts to learn particular skills. Students who are doing poorly compared to others, or who frequently receive negative feedback for their lack of progress, are more likely to experience negative feelings and to rely on task-avoidant patterns of behavior later on. Well-performing students, in contrast, are likely to experience positive feelings and to maintain adaptive patterns of behavior in the future. These assumptions have been examined in previous studies focusing on the relation between academic performance and achievement behaviors.

In a study regarding Finnish first graders, Onatsu-Arvilommi and Nurmi (2000) found that poor reading and math performance predicted students' subsequent teacher-rated task-avoidant behavior, evidenced by a high level of task-irrelevant and helplessness responses as well as a lack of persistence. Furthermore, Aunola and colleagues (2002) found that poor reading performance predicted students' use of task-avoidant strategies at the end of the first grade, but not yet at the beginning of the first grade. Fyrstén and colleagues (2006), on the other hand, found that students' verbal skills predicted a lower level of observer-rated task-avoidant behavior and a higher rate of self-reported mastery beliefs already at age 6. Verbal skills did not, however, contribute to the prediction of self-reported helplessness beliefs. In a study by Mägi and colleagues (2011), students' preliminary skills in kindergarten and their reading and mathematical skills in the first grade negatively predicted their homework-related task avoidance a year later, as rated by their mothers. For fathers' ratings of students' task avoidance, students' skills predicted their task avoidance in the first grade but not in the second grade when the autoregressive effect was taken into account. In contrast, there are also studies that have not found academic skill development to be associated with later self-reported achievement beliefs and behaviors (Onatsu-Arvilommi et al., 2002) or teacher-rated task-focused behavior (Aunola et al., 2003).

The aforementioned studies have all been conducted in Finland. International studies with a similar type of research design are scarcer. Urdan and colleagues (1998) found that fifth graders' use of self-reported self-handicapping strategies could be predicted by their grade point average. Furthermore, in their study on first graders, Morgan and colleagues (2008) found that teachers rated less skilled readers to show more task-avoidant behavior in comparison to more skilled readers. Tutoring the less skilled readers in developing their skills did not affect their post-treatment task avoidance. In addition, there were no differences in teacher-rated helplessness between the low-skilled and highly skilled readers. Furthermore, Byrnes and Wasik (2009) found that prior math achievement predicted students' later approach to learning (including attentiveness, persistence and eagerness to learn, as rated by teachers) both in Grade 1 and Grade 3.

Although previous learning experiences and learning outcomes are thought to influence students' achievement behaviors, the number of studies examining this direct association is small. Much more emphasis has been laid on the opposite direction of the relation, that is, the effects of achievement behaviors on subsequent skill development and competence. Another limitation of previous research is that many of the studies have focused on examining students' overall academic competence or overall literacy development instead of distinguishing between more specific subskills. Moreover, the time span in many previous studies has been short, usually covering only one or two school grades (most often the first grade of elementary school). Consequently, one aim of this research was to study the role of literacy and numeracy skills in the development of students' achievement behaviors. In relation to literacy, the focus was on different subskills (fluency, reading comprehension, and spelling). The time span covered by the individual studies was four years.

1.4 Temperament as an antecedent of achievement behavior

Besides their previous learning experiences, students' behavior in achievement situations may also be affected by their dispositional characteristics, such as temperament (e.g., Chess, 1968; Keogh, 2003; Martin et al., 1983; Rothbart & Ahadi, 1994; Rothbart & Jones, 1998; Thomas & Chess, 1977). Temperament refers to inherited or early-appearing individual differences in behavioral and emotional responses (Thomas & Chess, 1977), visible in the reactivity toward environmental stimuli, as well as in the self-regulation in modulating this reactivity (Henderson & Wachs, 2007; Rothbart, Ahadi, & Evans, 2000). Temperament is assumed to be biologically rooted and genetically directed (Bates, 1989; Henderson & Wachs, 2007; Rothbart et al., 2000), but it also develops over time through the influence of maturation, socialization, and individual experiences (Buss, 1989; Henderson & Wachs, 2007; Rothbart & Ahadi, 1994; Rothbart, Ahadi, Hershey, & Fisher, 2001). Although temperament is thought to be relatively stable across situations and over time (Bates, 1989; Martin, 1992), it is not reflected in all behaviors of the individual (Rothbart et al., 2000). Initial reactions of fear, for example, may arise in novel and unpredictable situations, but they are not triggered when the situation is familiar. Initial reactions can be altered or suffocated through self-regulation processes (Ahadi & Rothbart, 1994). The first forms of self-regulation in infancy are involuntary and reactive forms of control (Derryberry & Rothbart, 1997), visible as tendencies to turn away from threatening or unpleasant stimuli or approaching positive stimuli. More active forms of self-regulation appear later, starting at the end of the first year after birth.

Temperamental characteristics affect the kinds of environments and activities individuals choose to avoid or approach, the kinds of emotional responses situations evoke in them, and the kinds of reactions and feedback they receive in their interaction with parents, peers, and teachers (Ahadi & Rothbart, 1994;

Derryberry & Rothbart, 1997; Keogh, 1989, 2003; Martin, 1989, 1992; Rothbart & Hwang, 2005). As a result, individuals are exposed to different kinds of information about themselves, their actions and the environment, which affects their perceptions of themselves and of their abilities. For example, a child prone to expressions of fear and frustration in novel situations is more sensitive to threatening cues in the environment, and is thus more likely to experience negative emotions, to avoid these anxiety-evoking situations, and to seek for help and protection from other people (Ahadi & Rothbart, 1994; Derryberry & Rothbart, 1997; Rothbart & Jones, 1998; Rothbart & Hwang, 2005). This is likely to lead the child to see him- or herself as vulnerable, ineffective and dependent on others, and the environment as full of threats. Conversely, a child with a strong approach tendency and high activity level is more likely to experience positive emotions, to seek and receive positive feedback from the environment, and, consequently, to see him- or herself as active, efficacious, and independent.

A substantial amount of research has been carried out on the role of temperament in the school context (for reviews see Keogh, 1989, 2003; Martin, 1989). Temperament has been examined in relation to, for example, students' academic achievement (e.g., Guerin, Gottfried, Oliver, & Thomas, 1994; Martin & Holbrook, 1985; Martin et al., 1983; Mullola et al., 2010; Newman, Noel, Chen, & Matsopoulos, 1998; Valiente, Lemery-Chalfant, & Swanson, 2010; Zhou, Main, & Wang, 2010), learning disabilities (e.g., Bender, 1985, 1987), learning strategies (e.g., Davis & Carr, 2001), problem behavior (e.g., Bender, 1985; Eisenberg et al., 2004; Eisenberg et al., 2009; Nelson, Martin, Hodge, Havill, & Kamphaus, 1999; Zhou et al., 2010), self-concept (e.g., Bender, 1987; Guerin et al., 1994), psychosocial functioning in school (e.g., Nelson et al., 1999; Windle et al., 1986; Zhou et al., 2010), and student–teacher relationships (e.g., Guerin et al., 1994; Pullis & Cadwell, 1982). It has been suggested that the most influential temperamental facets in relation to students' achievement and psychosocial functioning in school are task orientation (persistence, motor activity, distractibility), personal–social flexibility (approach, positive mood, adaptability), and reactivity (intensity of response, reactivity, negative mood). Together, these dimensions of temperament are sometimes referred to as *school temperament* (Keogh, 2003; Martin, 1992). Keogh (1989, 2003) has also argued that teachers tend to rate students who show low adaptability and persistence combined with high distractibility, activity and reactivity as *low in teachability*, meaning that from teachers' point of view, these students are more demanding and less enjoyable to work with.

The terminology of temperament theories and achievement motivation theories seem to be intertwined and overlapping to some extent; for example, constructs such as task orientation, task-related behavior, on-task behavior, and persistence are common to both research traditions. Moreover, the balance between competing approach versus avoidance motives on one hand, and between reactivity versus self-regulation on the other hand, are central both to theories of motivational systems and theories of temperament and personality (Ahadi & Rothbart, 1994; Derryberry & Rothbart, 1997; Elliot, 2006; Elliot &

Covington, 2001; Elliot & Thrash, 2002, 2010). Despite the similarities, active attempts to merge achievement motivation theories and temperament or personality theories have not been common (see Rothbart & Hwang, 2005), but during the past decade interest in the role of dispositional factors in students' achievement motivation has grown remarkably (e.g., Bipp, Steinmayr, & Spinath, 2008; Bjørnebekk & Diseth, 2010; Chang & Burns, 2005; Clark & Schroth, 2010; De Feyter, Caers, Vigna, & Berings, 2012; Elliot & Thrash, 2002; Komarraju & Karau, 2005; Liew, McTigue, Barrois, & Hughes, 2008; Medford & McGeown, 2012). However, a major part of these studies have been conducted with regard to adult populations (e.g., Bipp et al., 2008; Clark & Schroth, 2010; De Feyter et al., 2012; Elliot & Thrash, 2002, 2010; Komarraju & Karau, 2005), and the number of studies regarding children at the beginning of their school career is limited thus far (for exceptions, see Bjørnebekk & Diseth, 2010; Chang & Burns, 2005; Harris, Robinson, Chang, & Burns, 2007; Liew et al., 2008; Medford & McGeown, 2012; Steinmayr, Bipp, & Spinath, 2011). Furthermore, some of the studies interested in the role of dispositional traits in children's achievement motivation have focused on the Big Five personality traits (Medford & McGeown, 2012; Steinmayr et al., 2011), instead of on temperament (for exceptions, see Bjørnebekk & Diseth, 2010; Chang & Burns, 2005; Harris et al., 2007; Liew et al., 2008). Finally, the majority of the studies on children (as well as adults) have investigated dispositional traits in relation to students' goals or goal orientation (Bjørnebekk & Diseth, 2010; Chang & Burns, 2005; Harris et al., 2007; Steinmayr et al., 2011), and other motivation-related constructs, such as achievement behaviors, have received less attention (for exceptions, see Liew et al., 2008; Medford & McGeown, 2012).

Elliot and Thrash (2002, 2010) have made an effort to integrate the neurobiological, affective and motivational aspects of personality under the construct of approach/avoidance temperament. They define approach temperament as a neurobiological sensitivity toward positive or desirable stimuli that directs individuals' attentional, affective, and behavioral responses. By contrast, avoidance temperament can be defined as an analogous sensitivity toward negative or undesirable stimuli. Elliot and Thrash (2002, 2010) argue that temperament (i.e., approach or avoidance temperament) is the instigator or energizer of individuals' actions, whereas goals (and other cognitive forms of motivation and self-regulation) guide and give direction to these actions. Findings in a sample of Norwegian sixth graders (Bjørnebekk & Diseth, 2010), as well as among college students (Elliot & Thrash, 2002, 2010), showed that approach temperament positively predicted students' mastery-approach goals (one's focus is on learning new things and improving one's skills) and performance-approach goals (one's aim is to demonstrate one's competence relative to others), whereas avoidance temperament was a positive predictor of mastery-avoidance goals (one's focus is on avoiding misunderstanding or failing to learn the course material) and performance-avoidance goals (one's focus is on avoiding to appear incompetent relative to others). In addition, avoidance temperament was found to predict performance-approach goals (Bjørnebekk & Diseth, 2010; Elliot &

Thrash, 2002), and approach temperament to predict performance-avoidance goals (Bjørnebekk & Diseth, 2010), suggesting that individuals may also adopt goals that seem contradictory to their temperament.

The self-regulative aspect of temperament has recently evoked more research interest with respect to school achievement and academic functioning than any other facet of temperament. Self-regulation and effortful control refer to characteristics that enable one to focus, shift and maintain attention, to persist with a task and to control one's behavioral and affective responses and irrelevant thoughts (e.g., Henderson & Wachs, 2007; Rothbart & Ahadi, 1994; Zhou et al., 2010). They are assumed to influence achievement by enabling the planning, initiating and regulation of goal-directed behavior, and generating alternative solutions in achievement situations (Henderson & Wachs, 2007; Rothbart & Ahadi, 1994; Rothbart & Hwang, 2005; Zhou et al., 2010). High self-regulation or high effortful control have been found to be positively related to students' self-efficacy (Liew et al., 2008), academic competence (Liew et al., 2008; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008; Valiente et al., 2010; Zhou et al., 2010), classroom participation (Valiente et al., 2008), school liking (Valiente, Lemery-Chalfant, & Castro, 2007), and work habits (Curby, Rudasill, Edwards, & Pérez-Edgar, 2011). Furthermore, Chang and Burns (2005) found that for performance-oriented (challenge-avoidant) students, a high level of effortful control appeared to serve as a protective factor enabling them to perform better on attention-related tasks in comparison to performance-oriented students with a lower level of effortful control. Additionally, temperamental task orientation (similar to temperamental distractibility investigated in the present research) has been found to be positively related to students' mastery-approach and mastery-avoidance goals, as well as to performance-approach goals (Chen & Zhang, 2011). Students' shyness or behavioral inhibition, on the other hand, has been found to be negatively related to their academic achievement (Hughes & Coplan, 2010; Mullola et al., 2010; Valiente et al., 2010) and engagement (Hughes & Coplan, 2010). Similarly, a withdrawal tendency with regard to new stimuli has been found to be negatively associated with students' mastery-approach and performance-approach goals (Chen & Zhang, 2011).

Compared to the role of behavioral responses and behavioral regulation, findings concerning the role of emotional reactivity or emotional regulation in academic functioning are sparse and less consistent (see Valiente et al., 2010; Valiente et al., 2012). Negative emotionality (as a temperamental facet) refers to the negative quality (unease, worry, anger, frustration, sadness), threshold, intensity, and duration of emotional responses as a reaction to disappointment, anticipated distress, and potential threats in the environment (Presley & Martin, 1994; Rothbart et al., 2001). Intense negative emotions can draw students' attention away from the task at hand and toward threatening cues and potential problems in the situation (Pekrun, 2005, 2006; Rothbart & Ahadi, 1994). This is why it has been argued that high levels of negative emotionality influence students' academic outcomes indirectly by interfering with their cognitive processes and lowering their motivation and engagement (Valiente et al., 2012; Zhou et

al., 2010). It has been shown that negative emotionality (such as dispositional anger and sadness) is associated with low academic performance and low self-perceived competence (Guerin et al., 1994; Gumora & Arsenio, 2002), as well as with high levels of state anxiety, depression, and other forms of internalizing problem behavior (Eisenberg et al., 2009; Gumora & Arsenio, 2002; Lengua, 2003; Nelson et al., 1999).

Temperamental mood refers to the intensity of positive emotions (excitement, anticipation, enjoyment) experienced in response to pleasurable situations, to changes in the environment, or to novel, intense, and incongruous stimuli (Rothbart et al., 2001). The role of positive emotionality in academic functioning has received little research interest (see Lengua, 2003; Valiente et al., 2012), but there is some support for the notion that positive emotionality is related to better academic competence (Gumora & Arsenio, 2002) and positive adjustment in school (Lengua, 2003). It is possible that positive emotionality enhances students' functioning by promoting their creative thinking and engagement (Valiente et al., 2012), and by contributing to their interest and effort (Pekrun, 2005, 2006). However, it is also possible that instead of being beneficial for students' functioning, positive emotionality that is highly intense may be deactivating and distracting in an achievement situation (Pekrun et al., 2002; Valiente et al., 2012).

The temperamental characteristics that were chosen to be the focus of the present research are distractibility (a composite of high activity, low persistence, and high distractibility), inhibition, mood, and negative emotionality. Dimensions of behavioral inhibition, irritability or frustration (cf. negative emotionality), positive affect (cf. mood), activity level, and self-regulation or effortful control (cf. distractibility) are common to many temperament theories, and are considered to be the basic components of temperament (see Rothbart et al., 2000; Zentner & Bates, 2008). The chosen facets of temperament are also comparable to the characteristics that are generally considered most relevant for academic functioning (see Keogh, 2003). Consequently, one aim of this research was to study the role of distractibility, inhibition, mood, and negative emotionality in students' achievement-related behaviors.

1.5 The role of gender

Children's gender can play a role in their school-related attitudes, affects, behavior, and achievement. Previous studies have shown, for example, that boys have a stronger interest in mathematics than girls have (Frenzel, Goetz, Pekrun, & Watt, 2010; Spinath, Freudenthaler, & Neubauer, 2010; Steinmayr & Spinath, 2008), and that boys feel more competent than girls in math (Chouinard, Karsenti, & Roy, 2007; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Goetz, Frenzel, Hall, & Pekrun, 2008; Herbert & Stipek, 2005; Meece, Wigfield, & Eccles, 1990; Seegers & Boekaerts, 1996; Spinath et al., 2010; Spinath, Spinath, & Plomin, 2008; Steinmayr & Spinath, 2008; Wigfield et al., 1997), but also that boys are

rated higher than girls concerning task-avoidant and disruptive behaviors (Kenney-Benson et al., 2006; Mägi et al., 2013; Onatsu-Arvilommi & Nurmi, 2000; Pakarinen et al., 2011; Urdan et al., 1998; Yeung, Lau, & Nie, 2011). Girls, in contrast, have been found to show more interest than boys in learning in general (Byrnes & Wasik, 2009; Klapp Lekholm & Cliffordson, 2009; Logan & Johnston, 2009; Marsh, Martin, & Cheng, 2008; Yeung et al., 2011) and in reading in particular (Eccles et al., 1993; Logan & Johnston, 2009; Wigfield et al., 1997), and to feel more competent in reading than boys (Eccles et al., 1993; Wigfield et al., 1997), to have more math anxiety than boys have (Frenzel, Pekrun, & Goetz, 2007; Pajares & Kranzler, 1995; Spinath et al., 2010; Wigfield & Meece, 1988), to have more mastery-oriented goals than boys have (Kenney-Benson et al., 2006; Marsh et al., 2008; Yeung et al., 2011), and to show more effort (Chouinard et al., 2007; Greene, Debacker, Ravindran, & Krows, 1999), persistence (Byrnes & Wasik, 2009; Marsh et al., 2008), and engagement in comparison with boys (Yeung et al., 2011).

Regarding temperament, studies have shown that boys are generally rated higher than girls in surgency/extraversion, whereas girls are rated to show more effortful control and attention regulation than boys (see Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). There is also evidence suggesting that although there might not be gender differences in standardized test performances (see Herbert & Stipek, 2005; Kenney-Benson et al., 2006), girls nevertheless receive better school grades on average (Kenney-Benson et al., 2006; Klapp Lekholm & Cliffordson, 2009; Spinath et al., 2010; Steinmayr & Spinath, 2008).

In addition to the possible mean level differences, gender may also have a moderating effect on the association between students' achievement-related behaviors and their academic performance, or between their achievement behaviors and temperament. For example, regardless of their skill level, boys and girls may value learning differently (Byrnes & Wasik, 2009; Klapp Lekholm & Cliffordson, 2009; Logan & Johnston, 2009; Marsh et al., 2008; Yeung et al., 2011) or have different opinions on whether effort expenditure makes a difference in learning situations (see Greene et al., 1999), which may cause the relation between their achievement behaviors and academic performance to be different for the genders.

Consequently, in this research the effect of students' gender was controlled for in each of the original studies.

1.6 Finland as research context

The present research was conducted in Finland, a society that has some features that uniquely differ from many Western and Eastern cultures. Two factors that may have significantly influenced the findings of this research are the Finnish school system and the Finnish language.

1.6.1 The Finnish school system and curriculum

Finnish children start their compulsory education in the year of their seventh birthday. One year earlier, in the year of their sixth birthday, they have the possibility to attend kindergarten for one year. The JEPS study (one of the data sets used in this research) commenced in 1999, slightly before a national kindergarten education reform took place in Finland. Before the reform, there were regional variations in how kindergarten education was organized in different municipalities. Starting from August 2001, when the reform came into effect, local authorities had the obligation to provide a kindergarten education to all children during the year preceding compulsory schooling (Ministry of Justice, 1999). According to the reform, every child has the right to a kindergarten education, but participating in it is voluntary (Ministry of Education and Culture, 2004). The kindergarten education is free of charge, including materials, meals, and transportation if necessary. National regulations specify, for example, the minimum scope of the kindergarten education per year, the maximum length of children's daily attendance at the kindergarten, the competence requirements for the teachers, and the core curriculum (Ministry of Education and Culture, 2004). Normally, the kindergarten education takes place in local day care centers or elementary schools. There are no statistics available for 1999, but in 2000 a total of 89.9% of 6-year-olds attended kindergarten (Statistics Finland, 2008). The participation rate has grown since the reform, being above 99.3% in the years 2005 to 2007 (Statistics Finland, 2008), which is when the participants of the LIGHT study (the second data set used in this research) were six years of age.

The core curriculum for kindergarten education (National Board of Education, 2010) sets out the objectives and core contents of the kindergarten education program, and these are then further specified and complemented locally. The core curriculum emphasizes the development of students' overall physical, psychological, social, cognitive, and emotional development. The objectives of the kindergarten education are to help children, for example, to adopt basic skills and knowledge in different areas of learning, to maintain interest in and enthusiasm for learning, to value the importance of the peer group in learning, to follow rules, to express themselves verbally and through different forms of art, and to observe and respect the environment (National Board of Education, 2010). Core subject areas are language and interaction, mathematics, ethics and philosophy, environmental and natural studies, health, physical and motor development, and art and culture. These are not divided into separate lessons, but instead the curriculum aims to integrate several subject areas into broader themes and contents related to children's own world of experience. In kindergarten, there is no formal teaching of academic skills such as literacy and numeracy, but the development of these skills is supported by introducing children to letters, words, different types of texts, numbers, mathematical concepts, shapes, and so forth, through play, nursery rhymes, songs, stories, and games. Although the kindergarten education does not aim at teaching children to learn

to read, many children actually acquire this skill during the kindergarten year. In a study by Silvén and colleagues (2004), 30% of Finnish children were found to be precocious readers by the end of the kindergarten year, and another 43% could be classified as emergent readers (slow decoders). According to Lyytinen and colleagues (2004), approximately one-third of children with a familial risk for dyslexia and two-thirds of a not-at-risk control group had basic decoding skills when entering the first grade.

In the year of their seventh birthday, Finnish children start their compulsory education. The compulsory education includes nine grades of comprehensive schooling, divided into six grades of elementary school and three grades of junior high school (referred to as lower secondary school). All children permanently residing in Finland are obliged to participate in this statutory schooling, starting in the year of their seventh birthday and ending when they have completed the nine grades of the comprehensive school syllabus or in the year of their 17th birthday (Ministry of Justice, 1998). Municipalities are obligated to arrange the comprehensive education for their residents. Usually, this is organized within the public schools. Like the kindergarten education, the comprehensive school education is free of charge to all children: There are no tuition fees, and materials, meals, health care services and transportation are also provided free of charge (Ministry of Justice, 1998). Remedial teaching and special needs education are provided to students who need them. Each student has the right to attend the nearest school, but parents can also wish to place their child into another school of their choice. Schools are not allowed to select students based on social grounds, but entry qualifications can be tested if the school follows a curriculum with a special emphasis on a particular subject, such as a foreign language or music (Ministry of Justice, 1998). In many regions, choosing a school based on any other reason than location is rare, or even impossible due to a lack of options. In larger cities, there are more options availabe, and this has led to more specialization in the curricula of schools, more competition between schools, and more variation in the students' performance between the schools (Seppänen, 2003). Yet, in international comparisons, the variation between the schools in Finland regarding children's skills is smallest across OECD countries, explaining only 7.7% of the total variance in students' reading performance (OECD, 2010).

The national core curriculum for comprehensive education is determined by the National Board of Education (2004). The core curriculum regulates the objectives and core contents of each subject on each grade level, the guidelines for cooperation between school and home, the central principles of student welfare services and special support services, and the directions for student assessment and school reports (Ministry of Justice, 1998, 2003). Complements to and specifications of the curriculum are compiled by local authorities and education providers.

The focus of the present research was on students who were at the beginning of their education. The first sample consisted of kindergarten students followed to the end of Grade 4, whereas the second sample consisted of first grade

students. When examining students' achievement-related beliefs and behaviors, the beginning of schooling is an important time point to focus on, because the foundation for individuals' later interests, choices and behaviors is laid in early learning situations (Aunola et al., 2003; Onatsu-Arvilommi et al., 2002; Ziegert et al., 2001).

1.6.2 The Finnish language

The Finnish demography is very homogenous in terms of the native language and the origin of the residents: In the year 2011, 95.1% of all residents were born in Finland, and 90.0% were Finnish-speaking (Official Statistics of Finland, 2011). Of the 5- to 9-year-olds, 96.5% were born in Finland and for 89.3% Finnish was their native language. Besides Finnish, Finland has a second official language, Swedish, which is the native language of 5.4% of the population (in 2011; Official Statistics of Finland, 2011). The data sets used in this research were collected in areas where the vast majority of residents (96.6 to 98.9% of 5- to 9-year-olds between the years 1999 to 2008; Official Statistics of Finland, 2011) were Finnish-speaking, and all data collections (including interviews with the participants and the questionnaires presented to them) were conducted entirely in Finnish.

The Finnish language has a highly transparent orthography (Seymour et al., 2003) that is based on 29 grapheme-to-phoneme combinations. Because of the consistent grapheme–phoneme correspondence, learning to read is considered a relatively easy and fast process for the majority of Finnish-speaking children (Holopainen, Ahonen, & Lyytinen, 2001; Lerkkanen, Rasku-Puttonen, Aunola, & Nurmi, 2004; Lyytinen et al., 2006; Silvén, Poskiparta, Niemi, & Voeten, 2007), as compared to beginning readers in languages with less regular orthographies, such as English (Seymour et al., 2003). Once children "crack the code" of the grapheme–phoneme correspondence, they can accurately decode any word or pseudoword (see Alcock & Ngorosho, 2003; Leppänen, Niemi, Aunola, & Nurmi, 2006). Only less than 10% of Finnish children do not attain this mechanical decoding skill by the end of the first grade of elementary school (Leppänen, Niemi, Aunola, & Nurmi, 2004).

However, in addition to the orthography, there are other features in each language that define the complexity and difficulty of reading and spelling tasks, and that can consequently increase the level of effort needed to master these tasks (see Georgiou, Parrila, & Papadopoulos, 2008; Georgiou et al., 2011). A typical feature of the Finnish language is its high degree of inflection (Lyytinen & Lyytinen, 2004; Silvén et al., 2004; Silvén et al., 2007). Endings are added to the stem of the word to indicate the case, possession, and plural form of nouns and adjectives (e.g., 'auto' = a car, 'autoissamme' = in our cars). Verbs are conjugated according to person and tense by adding endings to the word stem. The addition of endings often induces changes to the stem of the word as well (Lyytinen & Lyytinen, 2004), such as consonant gradation (e.g., 'kenkä' = a shoe, 'kengässä' = in the shoe; 'juosta' = to run, 'juoksin' = I ran). Compounds consisting of two, three, or even more parts are also common to the Finnish language.

Consequently, the acquisition of spelling is considered to be more demanding for Finnish children than the acquisition of reading (Leppänen et al., 2006), because in spelling, children need to follow the rules of morphology, grammar and syntax, in addition to needing orthographical knowledge (Alcock & Ngorosho, 2003). Understanding morphology, syntax and grammar also plays a key role in reading comprehension, together with general inference skills and vocabulary (see Leppänen, Aunola, Niemi, & Nurmi, 2008; Taboada, Tonks, Wigfield, & Guthrie, 2009).

1.7 Aims of the research

The main objective of this research was to examine the antecedents and consequences of kindergarten and elementary school students' achievement-related behaviors. The first aim was to study to what extent students' achievement-related behaviors contribute to the development of their reading and math skills. Conversely, the second aim was to examine the extent to which students' reading and math performance contribute to the development of their achievement-related behaviors. The third aim was to investigate to what extent students' temperamental characteristics contribute to their achievement-related affects and behaviors. Additionally, because the data sets used were longitudinal and enabled the examination of changes across time, changes in students' achievement-related behaviors were also investigated.

For these aims, three studies were conducted. Study 1 focused on the reciprocal relationship of students' task-focused behavior and literacy skills from kindergarten to Grade 4. The study examined to what extent students' task-focused behavior predicts their subsequent reading fluency, reading comprehension and spelling, on the one hand, and to what extent students' reading fluency, reading comprehension and spelling predict their subsequent task-focused behavior, on the other hand. The effects of gender and autoregressors were controlled for.

In Study 2, the developmental dynamics of students' task-avoidant behavior and math performance from kindergarten to Grade 4 were studied. The study examined, first, whether students' task avoidance and math performance change across time. Second, the study examined to what extent students' task-avoidant behavior and math performance are interrelated and predict each other's development. Students' gender and parents' level of education and tutoring of mathematics to their children were controlled for.

Study 3 investigated the role of students' temperament in their achievement-related affects and behaviors in Grade 1. The study examined to what extent students' distractibility, inhibition, mood, and negative emotionality contribute to their anxiety, active task avoidance, and helplessness in achievement situations, after controlling for their reading and math performance.

2 METHOD

The data sets, variables, and statistical methods of the three studies are summarized in Table 1. A brief description of the samples and measures is provided here (for a more detailed description, see the original studies).

2.1 Participants

The three featured studies of this research were parts of the larger *Jyväskylä Entrance into Primary School* (JEPS) study (Nurmi & Aunola, 1999–2009) and LIGHT study (Aunola, Nurmi, & Viljaranta, 2006–2009). Both of these larger studies focused on the development of children's academic skills and motivation in the context of school and home. The JEPS study was a longitudinal study that followed the same children from kindergarten through elementary school (Grades 1 to 6) and junior high school (Grades 7 to 9), whereas the LIGHT study was comprised of three consecutive age cohorts followed through their first year in elementary school.

Studies 1 and 2

In Studies 1 and 2, data from the *Jyväskylä Entrance into Primary School* (JEPS) study were analyzed. The original sample of the JEPS study consisted of 210 children residing in two medium-sized districts of Central Finland, and who were born in 1993 and started kindergarten in 1999. Of this original sample, 207 children (111 boys and 96 girls) were given parental permission to participate and were recruited to the study. The children were followed from the beginning of kindergarten (age 5 or 6 years) until the end of junior high school (age 15 or 16 years). During the study, new students that moved to the districts and joined the participating classrooms were also recruited to the study.

In Study 1, four measurement points of the JEPS study were used: kindergarten (Fall semester), Grade 1 (Spring semester), Grade 2 (Spring

semester), and Grade 4 (Spring semester). Only the children of the original sample were included in the study and all new participants were excluded from the analyses. Some of the participants left the study because they moved away or chose to no longer participate. Thus, the sample size changed from 207 children in kindergarten to 196 in Grade 1, 196 in Grade 2, and 178 in Grade 4.

In Study 2, again, four measurement points of the JEPS study were used: kindergarten (Spring semester), Grade 1 (Spring semester), Grade 2 (Spring semester), and Grade 4 (Spring semester). All children who participated in at least two of the measurements were included in the sample. Despite the fact that some of the participants dropped out, the total number of participants increased during the study because new children were recruited. Thus, the sample size changed from 205 children in kindergarten to 216 in Grade 1, 224 in Grade 2, and 227 in Grade 4. A total of 225 children participated in at least two measurements.

Study 3

In Study 3, data from the LIGHT study were analyzed. The LIGHT study was conducted over a period of three consecutive years during which a sample of three age cohorts of first graders was collected. The sample consisted of a total of 166 first graders from three medium-sized towns in Finland. The participants were born in the years 1999, 2000 and 2001, and they were 6 to 7 years of age at the time of the first measurement. They were interviewed and tested twice during the first grade of elementary school, first in either October or November and then again the following April.

Both measurement points of the LIGHT study were used in Study 3. Eleven children were left out of the analyses because they were enrolled in special education classes. Additionally, only those participants for whom complete data were available at Time 1 were included in the final sample. Thus, the sample used in Study 3 consisted of 153 children (75 boys, 78 girls).

2.2 Measures

In the three studies, different sets of measures were used. Achievement-related behaviors were the main focus in all three studies, and were consequently measured in each one. Students' academic performance was also measured in all three studies, either regarding reading performance (Study 1), mathematical performance (Study 2), or both (Study 3). Temperamental characteristics were the focus of interest in Study 3, and family-related factors were used as background variables in Study 2.

2.2.1 Achievement-related behaviors

In Studies 1 and 2, students' achievement-related behaviors were rated by their kindergarten and classroom teachers using the 'Behavioral Strategy Rating Scale' (BSR; Onatsu & Nurmi, 1995). The teachers were presented with seven items concerning students' behavior in kindergarten or school, and they were asked to respond to these items on a five-point Likert scale based on their impression of how each student typically behaves when working on tasks. Five of the items relate to students' avoidant behavior versus perseverance when facing difficulties, and two items measure students' attributional styles regarding failure. Only the scale measuring task avoidance was used in Studies 1 and 2. This scale produces a rating of students' behavior along a continuum, with one end presenting students' task-focused behavior (or lack of task avoidance) and the other end presenting their task-avoidant behavior. In Study 2, the scale was used as a measure of students' task-avoidant behavior (a high value indicating high task avoidance), whereas in Study 1, the scale was reverse-coded and used as a measure of task-focused behavior (a high value indicating high task focus).

In Study 3, students' achievement-related affects and behaviors were rated by research assistants who were responsible for testing and interviewing the students. After meeting the students and presenting them with the tests in one-on-one test sessions, the assistants rated the students' affective and behavioral responses using the 'Observer Rating Scale of Achievement Strategies' (OSAS; Nurmi & Aunola, 1998). The scale consists of ten items answered on a six-point Likert scale, based on the assistant's observation about the student's behavior during the testing session. The items specifically focus on the student's affective and behavioral responses toward difficult tasks and setbacks. The scale produces four subscales measuring the student's active task avoidance, passive avoidance (helplessness), social dependence, and anxiety. Of these scales, the scales for active task avoidance, helplessness, and anxiety were used in Study 3.

2.2.2 Academic performance

Pre-reading skills. Tests of phonological awareness and letter knowledge were used in Study 1 as measures of students' pre-reading skills at the beginning of kindergarten. The tests that were used for phonological awareness were 'Recognizing the Initial Sound of a Word' and 'Naming the Initial Sound of a Word' (Poskiparta, Niemi, & Lepola, 1994): In the first test, the students were shown 10 sets of pictures, each consisting of one target picture and four pictures for comparison. The task was to identify which of the four objects for comparison had the same initial sound as the object shown in the target picture. In the second test, 10 words were read to the students and their task was to say aloud the first sound of each word. A score for each student's phonological awareness was calculated by adding up the number of correct answers in these two tests.

Students' letter knowledge was assessed with a test in which they were asked to name 21 letters from a sheet of paper (Normaalikoulu, 1985; see also

Lerkkanen et al., 2004). A student's test score was the number of correctly named letters.

Reading skills. Several tests of reading performance were used. In the 'Word Reading Test' the students were asked to read aloud a list of 20 words. The words in the list became progressively more difficult, and the test was discontinued if the student could not read four successive words correctly. One point was given for each correctly read word. This test was used in Study 3 to assess students' decoding skills at the beginning of the first grade.

The 'Oral Reading Fluency Test' (Onatsu, Nurmi, & Aunola, 1999) is sensitive to more advanced reading skills, and it was presented only to those students who could already read properly. The test consists of a short fictional story which the student is asked to read aloud as fast and accurately as possible. A student's test score can be computed as the time (in seconds) it takes the student to read the story, or as the number of correctly read words divided by the reading speed. In Study 1, this test was used as a measure of students' reading fluency in Grades 1, 2, and 4, whereas in Study 3, it was used as one of the measures for students' general reading performance in Grade 1.

Students' reading comprehension was assessed with two subtests from a national reading achievement test battery (ALLU; Lindeman, 1998). In the 'Sentence Comprehension Test' students are asked to silently read four sentences and choose the one that best matches the meaning of a picture they are shown. There are 20 picture–sentence pairs in the test, and one point is given for each correct answer. This test was used in Study 1 to measure students' reading comprehension in Grade 1. In the 'Reading Comprehension Test', students silently read two expository and two narrative texts, and, after having read each text, they are asked to answer multiple-choice questions on the text. Each student's score on the test is computed by adding up the number of correct answers for all four texts. This test was used in Study 1 to measure students' reading comprehension in Grades 2 and 4.

Spelling and writing skills. Students' performance in spelling and writing was assessed with two tests. A dictation test from a broader test battery (Vauras, Dufva, Hämäläinen, & Mäki, 1994) consists of 10 sentences that the students have to write down after hearing them being read aloud. The sentences become progressively more difficult, and a score for a student's spelling performance is computed by adding up the number of correctly written sentences. This test was used in Study 1 to measure students' spelling performance in Grades 1 and 2. Further, in a task of creative writing, students are presented with a drawing and asked to make up and write down a story based on the picture. This test was used in Study 1 to measure students' writing skills in Grade 4. Each student's performance score was calculated by multiplying the number of correctly spelled words by 100 and dividing this by the total number of words used in the story (100 x correct words / all words used).

Mathematical skills. Two subtests from the 'Diagnostic Test for Basic Mathematical Concepts' (Ikäheimo, 1996) were used to assess students' math performance. The first of these tests measures students' knowledge of cardinal

numbers and basic mathematical concepts. In this test, students are presented with a picture of a set of dots and are then asked to draw a relative number of dots (e.g., *Draw four dots more than there are in this picture*). The tasks become progressively more difficult, and one point is given for each correct answer. This test was used in Study 3 as one of the two measures of students' math performance in Grade 1. The second test that was used to measure students' skills in basic arithmetic has been modified from another subtest of the 'Diagnostic Test for Basic Mathematical Concepts'. The test consists of arithmetic items and algorithmic computation problems, including addition, subtraction, multiplication, and division. The tasks are presented on a sheet of paper, and students are asked to write down their answers. One point is given for each correct answer. This test was used in Study 2 (kindergarten and Grades 1, 2, and 4) and Study 3 (Grade 1). To avoid a ceiling effect, test items were dropped or added at different measurement points to better correspond to the students' age and skill level.

2.2.3 Temperament

In Study 3, teachers rated students' temperament in the Fall semester of Grade 1. A scale consisting of 41 items was created by combining four scales from the Temperament Assessment Battery for Children – Revised (TABC-R; Martin & Bridger, 1999; Presley & Martin, 1994) and two scales from the Revised Dimensions of Temperament Survey (DOTS-R; Windle & Lerner, 1986). The chosen scales were modified to be suitable for school settings and teachers (see Mullola et al., 2010; Mullola et al., 2012). The scales did not include dimensions that were not readily observable for teachers (such as rhythmicity). Teachers rated the items on a five-point Likert scale based on their impression of how well the items describe the student in the school context. The original TABC-R scales that were used in the present study measured students' activity, inhibition, negative emotionality, and persistence, whereas the DOTS-R scales measured distractibility and mood. Based on an explorative factor analysis, the activity, persistence, and distractibility scales were combined into a single composite score entitled distractibility. Consequently, teachers' ratings of the students' temperament produced four scores measuring students' distractibility, inhibition, mood, and negative emotionality.

2.2.4 Family background

In Study 2, parents reported their level of education and their teaching of mathematics to their children, filling in a questionnaire in December of their children's kindergarten year. The questionnaires were delivered to each home, and mothers and fathers were asked to fill them in independently without consulting each other. Regarding parents' levels of education, the parents were asked to report the highest level of education they had acquired thus far. They had four options to choose from: no vocational degree, vocational school degree, technical college degree, and university or college degree. Concerning numeracy activities at home, the parents were asked to report how often they

had helped their child with math-related tasks during the first semester of the child's kindergarten year. Two questions were presented, one concerning the teaching of number recognition and another one concerning the teaching of simple math problems. The scale for the parents' replies ranged from 1 (not at all) to 4 (several times a week). Parents' responses to the two questions were combined to create composite scores for their teaching of mathematics to their children, separately for mothers and fathers. Mothers' and fathers' education and their teaching of mathematics were used as control variables in Study 2.

TABLE 1 Summary of the variables and methods used in Studies 1–3.

Study	Data set	Concepts	Variables	Statistical methods
Study 1	The JEPS study (*N* = 207) - Kindergarten - Grade 1 - Grade 2 - Grade 4	Pre-reading skills Literacy skills Achievement behaviors	- phonological awareness - letter knowledge - reading fluency - spelling - reading comprehension - task-focused behavior	Hierarchical regression analysis
Study 2	The JEPS study (*N* = 225) - Kindergarten - Grade 1 - Grade 2 - Grade 4	Mathematical skills Achievement behaviors Family background	- math performance - task-avoidant behavior - parents' education - parents' teaching of mathematics	Latent growth curve modeling
Study 3	The LIGHT study (*N* = 153) - Grade 1, Fall - Grade 1, Spring	Temperament Achievement-related affects and behaviors Academic performance	- distractibility - inhibition - mood - negative emotionality - active task avoidance - anxiety - helplessness - math performance - reading performance	Latent growth curve modeling

3 OVERVIEW OF THE ORIGINAL STUDIES

3.1 Study 1: Task-focused behavior and literacy development: A reciprocal relationship

The aim of Study 1 was to examine the bidirectional relationship between Finnish-speaking students' task-focused behavior and their literacy skills. Two research questions were posed: 1) Does task-focused behavior predict reading fluency, spelling, and comprehension after controlling for the preceding literacy level? 2) Do reading fluency, comprehension, and spelling predict task-focused behavior after controlling for earlier task-focused behavior?

Two hundred seven students (96 girls and 111 boys) were followed from the beginning of kindergarten until the end of Grade 4. The students' pre-reading skills (phonological awareness and letter knowledge) were tested at the beginning of kindergarten (October). The students were also tested for reading fluency, spelling, and reading comprehension in Grade 1 (April), Grade 2 (March), and Grade 4 (April). The teachers rated the students' task-focused behavior at each measurement point.

The results of hierarchical regression analysis showed, first, that task-focused behavior measured one year earlier predicted students' reading comprehension and spelling skills over and above the effects of gender, pre-reading skills, and earlier levels of comprehension and spelling. However, task-focused behavior measured one year earlier did not add to the prediction of students' reading fluency after controlling for gender, pre-reading skills, and earlier levels of fluency. Second, the results showed that reading fluency, comprehension, and spelling measured a year earlier predicted students' task-focused behavior after controlling for gender and the earlier level of task-focused behavior.

The results of Study 1 suggest that task-focused behavior and literacy skills form cycles of cumulative development. The development of students' literacy skills reinforces their later task-focused behavior. Task-focused behavior, at the same time, contributes to the development of reading comprehension and spelling skills. The effect of task-focused behavior on reading fluency seems to be weaker, which can be explained with the transparent orthography of the Finnish language enabling rapid learning and automation of decoding.

3.2 Study 2: The developmental dynamics of task-avoidant behavior and math performance in kindergarten and elementary school

The aim of Study 2 was to examine the developmental dynamics of task-avoidance and math performance. To this end, four research questions were posed: 1) Do students' math performance and task-avoidant behavior change (at the mean level) from kindergarten to Grade 4? 2) To what extent are the initial levels of and changes in students' task-avoidant behavior and math performance related? 3) To what extent does the initial level of students' task-avoidant behavior predict changes in their math performance? 4) To what extent does the initial level of students' math performance predict changes in their task-avoidant behavior?

Two hundred twenty-five students (107 girls and 118 boys) were followed from kindergarten to the end of Grade 4. The students' arithmetic skills were tested in kindergarten (April) and in Grade 1 (April), Grade 2 (March), and Grade 4 (April). At each measurement point, the students were also rated by their teachers regarding task-avoidant behavior in learning situations. Parents were asked about their level of education and their teaching of mathematics to their children during the children's kindergarten year.

As expected, the results of latent growth curve modeling showed, first, that there was an increase in students' math performance across time, and that this increase accelerated. Moreover, the change in students' task-avoidant behavior accelerated across time, indicating that students' task avoidance increased particularly in later grades. There were also inter-individual differences in the changes of students' math performance and task-avoidant behavior. Second, the findings of the study showed that math performance and task-avoidant behavior were developing hand in hand. Good performance in mathematics was associated with a low level of task avoidance, and improvement in mathematics was associated with a decrease in task-avoidant behavior. Finally, the findings showed that a high initial level of task avoidance predicted less and slower improvement in mathematics later on. The associations remained the same after controlling for students' gender, and for parents' level of education and their teaching of mathematics to their children.

The results of Study 2 suggest that task-avoidant behavior plays a detrimental role in the development of mathematical skills, leading to less and slower improvement of skills. However, task-avoidant behavior may be less sensitive to the influence of math skill development since it was not affected by the previous math performance levels.

3.3 Study 3: The role of temperament in children's affective and behavioral responses in achievement situations

The aim of Study 3 was to examine the relations of students' temperamental characteristics and their affective and behavioral responses in achievement situations. Students' active task avoidance, helplessness, and anxiety were examined over a 6-month period. The following research questions were addressed: To what extent do students' distractibility, inhibition, mood, and negative emotionality in the Fall semester of the first grade predict the levels of and the subsequent changes in their 1) active task avoidance, 2) helplessness, and 3) anxiety?

One hundred fifty-three students (78 girls, 75 boys) were assessed twice during their first year in elementary school. Teachers rated the students' temperament in the Fall semester (October or November). The students were tested for their math and reading performance both in the Fall semester (October or November) and the Spring semester (April). After both testing sessions, students were rated on their achievement-related affects and behaviors by research assistants.

The results of latent growth curve modeling showed that students' active task avoidance and helplessness increased during Grade 1. There were also inter-individual differences in the levels of and changes in students' task avoidance, helplessness, and anxiety. Furthermore, the results showed that temperamental characteristics were uniquely related to students' affects and behaviors in achievement situations, after controlling for their performance in math and reading. Distractibility (high motor activity, low persistence, and high distractibility) predicted both the level of active task avoidance and the increase in task avoidance during Grade 1. Moreover, high inhibition positively predicted the levels of students' helpless behavior and anxiety in achievement situations. There were no gender differences in the associations between students' temperament and achievement-related affects and behaviors.

The findings of Study 3 suggest that, besides motivational and ability-related factors, there are also innate or early maturing, individual characteristics that contribute to the development of students' achievement-related behaviors. Especially the roles of affective and behavioral self-regulation on the one hand, and behavioral inhibition on the other hand, seem to be crucial in the formation of maladaptive response patterns.

4 GENERAL DISCUSSION

The aim of this research was to examine the antecedents and consequences of students' achievement-related behaviors. For this purpose, three studies were conducted. The findings of these studies are discussed here with regard to four aspects: the relation between achievement behaviors and academic performance, the contribution of temperament to achievement behaviors, changes in achievement behaviors across time, and gender differences regarding achievement behaviors.

4.1 Achievement behaviors and academic performance

The relationship between achievement-related behaviors and academic performance was examined in each of the original studies. The findings are first discussed from two opposite viewpoints: the impact of academic performance on achievement behaviors on the one hand, and the impact of achievement behaviors on academic performance on the other hand. Following this, the findings are summed up in a discussion on the reciprocal relation between behaviors and performance.

4.1.1 The effect of achievement behaviors on academic performance

The role of task-focused and task-avoidant behavior in the development of academic skills was examined in Studies 1 and 2. The findings were consistent across the studies and confirmed that achievement-related behaviors contributed significantly to the acquisition of literacy and numeracy skills. In Study 2, students' task-avoidant behavior was negatively associated with the development of their mathematical skills: the more task avoidance the students showed, the slower their subsequent improvement in mathematics. In Study 1, task-focused behavior (or lack of task avoidance) measured a year earlier positively

predicted students' reading comprehension and spellings skills, but not their reading fluency. Both studies covered a time span from kindergarten to Grade 4.

Overall, the findings suggest that students' task-avoidant strategy in the classroom may cause problems in their skill development. Consequently, students who have developed maladaptive patterns of behavior are at a risk of facing problems in their learning because they fall behind their classmates with regard to skill development. By avoiding the tasks, the student misses a chance of practicing existing skills, improving new skills, and using creativity for finding new solutions and mastering the situation (Meece, Blumenfeld, & Hoyle, 1988; Pintrich & De Groot, 1990). At the same time, the student loses an opportunity for succeeding, feeling competent, and building a positive self-concept. Findings analogous to those found in Studies 1 and 2 have also been reported in previous studies concerning the learning of numeracy (Aunola et al., 2003; Kikas, Peets, Palu, & Afanasjev, 2009; Lepola, Niemi, et al., 2005; Onatsu-Arvilommi et al., 2002) and literacy (Aunola et al., 2002; Georgiou et al., 2010; Lepola, Poskiparta, Laakkonen, & Niemi, 2005; Manolitsis et al., 2009; Onatsu-Arvilommi & Nurmi, 2000; Stephenson et al., 2008). A majority of the previous studies, however, have covered a shorter time period compared to the 4-year period of the present research.

It is important to note that task-focused versus task-avoidant behavior can have a different kind of influence on different subskills. Concerning literacy, many of the previous studies have examined the role of achievement behaviors only in relation to students' decoding skills or reading fluency, whereas in the present research (Study 1), several subskills of literacy were examined. It was found in Study 1 that students' task-focused versus task-avoidant behavior did not contribute to the development of students' reading fluency, although it contributed to their reading comprehension and spelling skills. This implies that a lack of effort or persistence in learning situations does not automatically influence the development of all academic skills, but the significance of on-task behavior can vary depending on the nature and the difficulty of the task. Because of the transparent orthography of the Finnish language, the acquisition of reading accuracy is considered a relatively easy and rapid process for most children learning to read Finnish (Holopainen et al., 2001; Lerkkanen et al., 2004; Lyytinen et al., 2006; Silvén et al., 2007). Once the technical reading skill is acquired, the fluency of reading develops rapidly. In Study 1 of this research, the first two measurement points covered the time span from the Fall semester of kindergarten to the Spring semester of Grade 1, a period during which almost all of the participants learnt to read more or less fluently. To discover what role achievement behaviors play at the very beginning of students' reading acquisition, more frequent measurements during kindergarten and Grade 1 would probably be needed (cf. Aunola et al., 2002; Onatsu-Arvilommi & Nurmi, 2000).

In contrast to reading fluency, it can be said that reading comprehension and spelling require morphosyntactic, semantic, and lexical knowledge, in addition to orthographic knowledge and inference skills (see Alcock & Ngorosho, 2003; Leppänen et al., 2008; Taboada et al., 2009). The necessity of combining all

this knowledge makes these skills more complex and demanding (in comparison to reading fluency), and hence they also require more effort, persistence, and on-task behavior for the learner to succeed in them, even after the basic skills have been acquired. Similar findings concerning the divergent role of task-focused behavior across different subskills of literacy have also been found with regard to other languages (Georgiou et al., 2008; Georgiou et al., 2011).

4.1.2 The effect of academic performance on achievement behaviors

Concerning the contribution of academic achievement to the development of achievement-related behaviors, the findings of the original studies were somewhat mixed. In Study 1, reading fluency, reading comprehension, and spelling skills significantly predicted students' task-focused behavior one year later, after controlling for their earlier level of task-focused behavior. These findings were true for each measurement point from kindergarten to Grade 4. However, in Study 2, students' mathematical skill level was associated with the level of their task-avoidant behavior, but not with the subsequent changes in task avoidance from kindergarten to Grade 4. Similarly, in Study 3, both reading skills and mathematical skills were associated with the level of students' active task avoidance, helplessness, and anxiety, but not with the changes in these during Grade 1.

These findings suggest that especially the development of literacy skills can play a significant role in students' later motivation and willingness to invest effort in their learning. Similar findings concerning the significance of reading skill development for later task-focused versus task-avoidant behavior have also been found in previous studies (Aunola et al., 2002; Onatsu-Arvilommi & Nurmi, 2000). Improvement in reading and writing is likely to boost one's self-efficacy perceptions and success expectations, consequently supporting effort and serving as a buffer against task-irrelevant behaviors in subsequent learning situations (Eccles, 2005; Wigfield & Eccles, 2000). In contrast, having problems in learning and failing to improve one's skills is likely to have a negative effect on one's self-efficacy beliefs and to increase failure expectations, which in turn can add to the likelihood of task-irrelevant activities later on. This may be particularly true for literacy skills that are essential for the learning of several school subjects. Difficulties in these basic skills may impede the understanding of course material across subjects, and may influence students' interests, expectations, and behaviors in relation to all school tasks rather than affecting only literacy-related tasks.

On the other hand, the findings of the present research indicate that problems in learning do not necessarily affect students' later achievement-related behaviors in all domains. This was particularly true with respect to mathematics (Study 2). It is possible that problems in mathematics do not reflect to learning in other domains, thus keeping the negative effects of math difficulties on students' motivation and task-focused behavior limited to that particular domain. We must keep in mind that, in this research, students' task-focused versus task-avoidant behaviors were rated across domains and situations, that is,

not in relation to specific school subjects. These domain-general behaviors may not be that sensitive to skill development in one subject area only. Another explanation for these findings is that patterns of achievement behavior form and begin to stabilize already in the beginning of schooling (Ziegert et al., 2001), and may not be that sensitive to environmental feedback or to changes in the competence of the student. Similarly, some previous studies have failed to find a link from earlier math skill development (Aunola et al., 2003; Onatsu-Arvilommi et al., 2002) and reading skill development (Onatsu-Arvilommi et al., 2002) to subsequent task-focused versus task-avoidant behavior.

4.1.3 The reciprocal relationship between achievement behaviors and academic performance

One of the aims of this research was to examine the reciprocal relation between achievement behaviors and academic performance, considering both directions of the relation. It has been suggested that achievement-related behaviors and academic performance form cumulative cycles of development (Aunola et al., 2002; Fyrstén et al., 2006; Morgan & Fuchs, 2007; Nurmi, Aunola, Salmela-Aro, & Lindroos, 2003; Onatsu-Arvilommi & Nurmi, 2000): maladaptive behavioral patterns in learning situations are likely to lead to less or slower improvement of academic skills, which in turn is likely to decrease students' later motivation and to increase the adoption of maladaptive behavioral patterns in the future. Adaptive behaviors, on the other hand, are likely to support skill development and to further increase motivation and the later use of adaptive strategies. Support for the assumption of developmental cycles has been received from cross-lagged longitudinal studies examining the relationship bidirectionally during students' first grade of elementary school (Aunola et al., 2002; Onatsu-Arvilommi & Nurmi, 2000).

The findings of this research supported this assumption in a longer time span, at least partly. The results consistently lent support to the notion that achievement behaviors contribute to the development of academic skills: previous levels of task-focused versus task-avoidant behavior were shown to predict students' later literacy (Study 1) and numeracy skills (Study 2). This side of the relationship seems straightforward: If students avoid the tasks given to them and do not actively try to solve them, then they are not likely to learn and improve their skills. It seems that it is particularly important to stay focused in demanding tasks that require a versatile use of recently acquired skills, but on-task behavior might not be as essential when employing skills that are already automatized. This was reflected in the findings of Study 1, showing that task-focused versus task-avoidant behavior did not contribute to the prediction of students' reading fluency in the first grades of elementary school, although it did contribute to the development of reading comprehension and spelling.

The findings concerning the role of skill development in students' achievement-related behaviors were also fairly consistent, yet weaker. In Studies 2 and 3, students' skill level was found to be related to the degree of their task-avoidant behavior and anxiety. However, the students' previous skill level

did not predict any increase or decrease in such behaviors and affects. This implies that those students who performed worst and made the least progress also showed higher levels of task avoidance and anxiety across time, although their maladaptive responses did not necessarily increase. Nevertheless, the tight interrelation between skill development and patterns of achievement behavior is worrisome in the case of the low-achieving students.

However, the picture outlined by the findings of this research may be a simplification of the reality: skill level and achievement behavior do not necessarily develop hand in hand in all cases. Instead, it is possible that there are students for whom problems in learning are not connected to maladaptive behaviors, or students who can perform at high levels despite their use of maladaptive strategies (see Mägi et al., 2013).

4.2 Temperament and achievement behavior

The associations between first graders' temperamental characteristics and their achievement-related affects and behaviors were investigated in Study 3. The results showed that a high level of distractibility (high activity, high distractibility, low persistence) was related to the level of and increase in students' active task avoidance. Moreover, showing a high level of inhibition (low adaptability, and withdrawal in novel situations and around unfamiliar people) was related to the level of students' helpless behavior and anxiety.

The findings of Study 3 suggest that the two types of maladaptive achievement behavior, active and passive task avoidance, at least partly stem from two distinct types of dispositional systems. Active task avoidance in achievement situations was characterized by attempts to turn to other things around oneself and to find substitutive tasks. The initial level of this behavioral pattern, as well as the increase of it across time, was associated with temperamental distractibility, that is, high activity, low persistence, and low resistance to distraction. In other words, off-task behavior can be seen, at least partly, to result from the fact that active, impulsive students become easily engaged in all things around them (Derryberry & Rothbart, 1997) but have a poor ability to channel their excitement toward one task at a time (Henderson & Fox, 1998; Rothbart & Jones, 1998). If there are many different stimuli competing for their attention, these students are likely to turn to the ones they are most interested in. On the other hand, task-irrelevant behavior can be seen as a self-handicapping strategy motivated by low competence beliefs, fear of failure, and an attempt to have an excuse prepared for the expected failure (Elliot & Church, 2003; Midgley et al., 1996; Turner et al., 1998). Because the active, easily distracted students may have had difficulties in finishing their tasks in previous learning situations and have received negative feedback for their impulsive behavior, they may have developed a low belief in their competence. If they doubt their abilities and expect to fail, avoiding the tasks may be more tempting to

them than taking the risk of trying and failing because of not being competent enough (Jones & Berglas, 1978).

The second type of maladaptive behavior in achievement situations was passive avoidance, or helplessness, characterized by withdrawal of effort and by disengagement. This behavior was associated with temperamental inhibition, which has been found to be related to students' low level of academic engagement (Hughes & Coplan, 2010). It has been suggested that cautious and restrained behavior in learning situations results from a withdrawal (avoidance) tendency and high behavioral regulation skills (Henderson & Fox, 1998). From a neurobiological perspective, the system explaining this type of withdrawn behavior is the behavioral inhibition system (BIS) that is sensitive to punishment and frustration, and motivates an individual to avoid stimuli and environments that may cause unpleasant experiences, distress, and anxiety (Rothbart et al., 2000). In learning situations, this could mean avoiding tasks that are considered to be too challenging and a threat to one's self-perceptions. Additionally, students showing helpless behavior are thought to have low confidence in their personal control (Dweck, 1986; Nolen-Hoeksema et al., 1986). It is possible that in the assessment situation of Study 3, faced with the challenging tests and the presence of an unfamiliar adult, the inhibited children were unsure of how to proceed with the tasks but also felt too uncomfortable to ask for help; passiveness in the situation might just have been a sign of their insecurity.

Furthermore, the findings of Study 3 showed that inhibition was also related to students' high level of anxiety in achievement situations. These results are in accordance with the notion that the BIS underlying inhibited behavior sensitizes individuals to possible frustration and punishment, alerts them to the threats in the situation, and prepares them for action (Ahadi & Rothbart, 1994). Anxiety follows if the individuals have an inadequate ability to regulate their negative affects, to reorient their attention away from the fear-provoking stimuli, and to come up with appropriate solutions to overcome the threats (Ahadi & Rothbart, 1994; Henderson & Fox, 1998). It is possible that for the inhibited students, the unusual testing situation with an unfamiliar adult was overwhelming and they were simply not able to control their feelings of anxiety. The students may have attempted to relieve their anxiety in the situation by avoiding the tasks that were causing the uneasy feelings (Ahadi & Rothbart, 1994; Derryberry & Rothbart, 1997; Miller, 1987). This is suggested by the fact that students' anxiety positively correlated both with their active and passive task avoidance (helplessness). By avoiding the threatening situation, the students may get temporary relief from their feelings of anxiety but their ability to regulate their behavioral and emotional reactions does not develop (Derryberry & Rothbart, 1997; Rothbart & Jones, 1998).

Finally, the findings of Study 3 showed that temperamental characteristics were related to the levels of students' anxiety and helplessness, but not to the changes in these during the first grade. This result suggests that temperament may be important for the students' overall behavioral and emotional responses, but perhaps the students' experiences, perceptions, aims, and motives are more

likely to determine how the initial responses eventually transform into actions and how they develop and become established with time (Dweck & Leggett, 1988; Rothbart & Jones, 1998; Rothbart & Hwang, 2005). For example, reserved students may be able to overcome the discomfort evoked by achievement situations if they gain experiences of performing well despite their anxiety, or if they consciously aim to revise the situation- and self-related appraisals leading to the uneasy feelings. Distractibility, on the other hand, was the only characteristic that was found to be related to a change in students' achievement behavior, that is, in active task avoidance. This emphasizes the role of activity level, persistence, and distractibility as essential temperamental characteristics in the school context (Keogh, 2003; Martin, 1989), because the overactive, impersistent, and easily distracted students seem to be most at risk for developing harmful cycles of maladaptive behavior. These characteristics are related to the ability to shift attention, to stay focused, and to inhibit impulses, and they may reflect difficulties in voluntarily regulating one's behavioral responses. Across time, as the demands of learning situations increase and the need for self-regulation skills in meeting these demands becomes more obvious, a student lacking such skills is even more likely to react by avoiding tasks (see also Bjørnebekk, 2008). However, given the fact that there were only two measurement points in Study 3, interpretations of the process of change should be made with caution.

All in all, the findings of Study 3 showed that temperament contributes to students' achievement-related behaviors. Temperamental characteristics affect the ways in which individuals orient toward or away from the environment, and the kinds of reactions and feedback they receive from the environment (Derryberry & Rothbart, 1997). Consequently, students with differing characteristics look for and receive different types of information in learning situations, which further affects the way they see themselves as learners and how they learn to regulate their emotions and behavior in these situations. Therefore, temperament can play multiple roles in the school context, explaining students' academic achievement, behavior, and self-perceptions. It is also possible that some characteristics or traits are more advantageous for school adjustment than others (see Keogh, 2003; Spinath et al., 2010), depending on how well they suit the demands of the learning situations and to what extent they promote students' academic development (cf. goodness-of-fit; Thomas & Chess, 1977). According to the findings of Study 3, characteristics related to behavioral and emotional underregulation (distractibility) or overregulation (inhibition), in particular, may be maladaptive in this sense.

4.3 Changes in achievement behaviors across time

The data sets used in the original studies were longitudinal in nature, which enabled the examination of how students' behavioral patterns change across time. In Studies 1 and 2, the time span included four measurement points from

kindergarten to Grade 4, whereas in Study 3, two time points were examined in Grade 1.

According to the findings of Study 1, previous levels of students' task-focused behavior significantly contributed to their later task-focused behavior at each time point. Similar findings have been found in other longitudinal studies concerning the stability of task-focused versus task-avoidant behavior in Grade 1 (e.g., Aunola et al., 2002; Aunola et al., 2003; Onatsu-Arvilommi & Nurmi, 2000; Onatsu-Arvilommi et al., 2002). This is an interesting finding, considering that the participants of these studies were young students in the very early stages of their school career. It seems that the foundation for achievement-related behaviors is laid already in kindergarten or even earlier (see Ziegert et al., 2001), and the behavioral patterns may be hard to change once they have been adopted. This is alarming in the case of those students who show dysfunctional patterns of behavior already in kindergarten.

Having said that, the findings based on growth curve modeling in Studies 2 and 3 showed that, at the mean level, there were also significant changes in achievement-related behaviors: students' task-avoidant behavior and helpless behavior slightly increased over time (Study 3), and the changes in students' task avoidance accelerated with time (Study 2). The increase in task-irrelevant behaviors across time may reflect a more general descending trend in students' motivation and interest during elementary school (Frenzel et al., 2010; Yeung et al., 2011). Moreover, findings of both Studies 2 and 3 showed that there was inter-individual variance in the changes of students' achievement-related behaviors, indicating that individuals differ in the ways their behaviors change over time. Some students may be in a danger of negative cycles of dysfunctional behavior, whereas for others, the development of behavioral patterns may be more adaptive, showing a decreasing pattern. As the findings of this research also suggest, the potential for change (whether positive or negative) may lie in students' previous learning experiences and related feedback as well as in their individual characteristics, such as temperament.

4.4 The role of gender

The findings of each of the original studies showed that there were significant gender differences in the mean levels of students' various achievement behaviors. In Studies 1 and 2, teachers rated boys, compared to girls, higher on task avoidance and lower on task-focused behavior. Moreover, in Study 3, research assistants rated boys higher than girls on active task avoidance. On helpless behavior and anxiety, boys and girls were rated equal.

The observed differences may reflect actual differences in the behavioral patterns of girls and boys. It is possible that boys choose to avoid school tasks because they do not find the tasks as interesting and enjoyable as girls do (Byrnes & Wasik, 2009; Klapp Lekholm & Cliffordson, 2009; Logan & Johnston, 2009; Yeung et al., 2011), and consequently do not find it necessary or useful to invest

effort in them. Even though learning tasks and working methods have been designed to be gender neutral (National Board of Education, 2011), it is nevertheless possible that they are more appealing to girls than to boys.

Another explanation for the gender differences is that the teachers' and research assistants' ratings may have been influenced by cultural stereotypes of boys' and girls' behavior. Behavior that is valued as desirable in classrooms is considered to be more typical for girls than for boys (see McClowry, Rodriguez, & Koslowitz, 2008). It is possible that already from the outset, boys' behavior is judged as less appropriate and less desirable compared to that of girls, although in reality there might not be much of a difference in their manifestation of maladaptive behaviors.

Moreover, despite the mean level differences in boys' and girls' achievement-related behaviors (especially task-avoidant behavior), gender had no moderating effect on any of the associations between the achievement-related behaviors and the other study variables. There were no differences between girls and boys in how their achievement-related behaviors were related to their academic performance, or to what extent their temperament contributed to their achievement-related behaviors.

4.5 Practical implications

Based on the findings of this research, some practical implications can be suggested. Many of these rely on the bidirectional relation between achievement-related behaviors and academic performance. Students' task-avoidant behavior in learning situations was found to lead to poor learning outcomes in literacy and numeracy. To some extent, students' previous performance was also found to predict their subsequent achievement behaviors. This was particularly true for literacy. In other words, students with lower skills in literacy are most at risk of getting caught in a harmful cycle of negative learning experiences, with increasing levels of task-avoidant behavior leading to increasing experiences of failure and vice versa. Because these negative cycles can have far-reaching consequences for students' later learning outcomes, it is crucial to invent means of preventing students' maladaptive behavioral patterns. Next, seven significant points to be considered in designing interventions for low-achieving students and students with maladaptive patterns of behavior will be discussed.

First, interventions could be directed at the kinds of attributions students use to interpret their performance in learning situations, and the types of beliefs the students have about their capabilities. Maladaptive achievement behaviors have been found to be related to attributions of external control or feelings of having no control over outcomes (Butkowsky & Willows, 1980; Diener & Dweck, 1978; Dweck, 1975; Pintrich, 2003; Weiner, 1992), whereas students' adaptive behaviors are usually preceded by attributing success to ability and failure to a lack of effort (Bandura, 1989; Cantor, 1990; Diener & Dweck, 1978). Moreover, low beliefs of efficacy and expectations of failure are likely to lead to

a low level of effort and to task-avoidant behavior in learning situations (e.g., Bandura, 1989; Pajares, 1996; Schunk, 1989; Wigfield & Eccles, 2000). Students' efficacy beliefs can be supported by pointing out the progress they have made and the knowledge they have gained in relation to what they knew or were able to do before (Bandura, 1993). Offering them positive feedback about their progress and level of effort in cases of success and failure can also support the students' beliefs of self-efficacy and perceived control, and teach them how their own actions lead to learning outcomes (Martin, Marsh, & Debus, 2001; Schunk, 1984).

Second, students may need help in learning to set realistic yet challenging goals. Task-avoidant students may have a tendency to avoid challenges in order to appear competent in the eyes of the others, or to avoid appearing incompetent (Midgley et al., 1996; Turner et al., 1998). However, trying to avoid failures and mistakes is not beneficial for skill development. Instead, one needs setbacks and realistic feedback on one's abilities in order to acquire mastery or expertise in learning (Midgley, Kaplan, & Middleton, 2001; Pintrich, 2003). Hence, task-avoidant students could be taught how to set goals for their learning by taking into account their own competence as well as the situational cues, such as the difficulty of a task. Reaching self-chosen, challenging but attainable goals leads to higher self-efficacy, feelings of mastery, and more self-directed learning (Bandura & Schunk, 1981).

Third, students could be provided enough opportunities to make use of their existing skills and to feel competent (Pajares, 1996; Schunk & Pajares, 2005). Constant experiences of failing do not promote efficacy expectations (Bandura, 1977), which is why it is essential to make sure that even the lowest-performing students gain experiences of success in learning situations. Interventions that focus entirely on skill development may not be optimal for supporting students' learning motivation (see Morgan et al., 2008), because focusing only on skills they are lacking or on tasks that students are likely to fail may just further increase students' failure expectations and lower their beliefs of self-efficacy.

Fourth, the atmosphere in learning situations should be such that failing is permitted, each other's success is greeted with joy, and competing is unimportant. Students benefit if they learn to judge their improvement in relation to their own previous performances, instead of making normative comparisons or comparing themselves to their peers (Bandura, 1993; Pintrich, 2003; see also Heckhausen & Heckhausen, 2008). As early as in kindergarten, children show less task avoidance in classrooms where the teacher provides individualized feedback and scaffolding (Pakarinen et al., 2011). Also, encouraging students to cooperate with each other can draw their attention away from competition and performance (Martin et al., 2001). Findings reported in goal orientation literature suggest that students show more adaptive achievement strategies in classrooms where the atmosphere and teacher's practices are mastery oriented (Ames & Archer, 1988; Meece et al., 1988; Midgley et al., 2001), that is, the focus is on students' understanding of the content and on developing the knowledge and skills needed to master the tasks. In contrast, when the classroom atmos-

phere promotes competition and comparison between the students, they are more likely to concentrate on performing better than the others instead of focusing on effort, improvement, and enjoyment (Urdan et al., 1998).

Fifth, students could be taught early on to understand the relevance of effort and motivation in supporting and enhancing learning (see Heckhausen & Heckhausen, 2008). Students may benefit if they learn to see learning as a continuous process in which previous knowledge and skills help in gaining new ones (Schunk, 1989), and as a process that the students can themselves influence with their own actions (Pintrich, 2003). Especially those students who engage in task-avoidant behavior because they are concerned about their performance (Bandura, 1989; Pajares, 1996; Schunk & Pajares, 2005) would benefit from finding learning strategies that work best for them and from learning how to access information they need, as well as from recognizing the factors that support or hinder their learning. Students' understanding and regulation of their own cognitive, affective, and behavioral processes is often referred to as *metacognition* (e.g., Flavell, 1979; Metcalfe & Shimamura, 1994), *learning to learn skills* (e.g., Heiman, 1985; Smith, 1990), or *self-regulated learning* (Pintrich & De Groot, 1990; Schunk & Zimmerman, 2008; Zimmerman & Schunk, 2011). Increasing students' learning to learn skills is also mentioned as one of the objectives of the Finnish kindergarten education program (National Board of Education, 2010).

Sixth, learning materials and teaching methods could be designed to equally appeal to all students as fas as possible. Tasks and activities that are relevant, interesting and beneficial from the students' perspective promote their motivation and engagement best (Pintrich, 2003). For instance, gender differences in task-avoidant behavior and persistence may indicate that boys find the school assignments and practices more boring and less inspiring than girls do (Logan & Johnston, 2009). A good starting point for supporting students' adaptive achievement behaviors would be to give them tasks that they find worth putting their effort in.

Seventh, educators could also pay attention to their own attitudes, behavior, and working methods with different types of learners. Students do not always deliberately choose the way they behave in learning situations, since—as the findings of this research also showed—dispositional traits play a role in their achievement-related behaviors. It has been suggested that if educators see a student's maladaptive behavior as intentional and motivation-driven, they easily disapprove the behavior, but if they recognize student's maladaptive behavior as unintentional and caused by neurobiological predispositions, they are more likely to treat the student instructively (Hepburn, 2003; Keogh, 2003). For example, from the teacher's point of view, working with an active, impersistent student may be unpleasant and unrewarding (see Keogh, 2003; Martin, 1989; Nurmi et al., 2013) because the student's behavior disturbs the work of the entire group. However, instead of being accused of disruptive behavior, the easily distracted student would benefit more from guidance on how to control and regulate his or her affective and behavioral responses (Rothbart & Jones, 1998). Similarly, the inhibited and withdrawn type of student can be frustrating for a

teacher, because such students do not actively participate and they need more time to get started (Hughes & Coplan, 2010; Thomas & Chess, 1977). These students need time and help in adjusting to changes (Keogh, 1989) and in finding ways to overcome their feelings of anxiety and fear in new situations (Ahadi & Rothbart, 1994).

4.6 Strengths and limitations

The present research has several strenghts. First, the focus of the research was on kindergarten and elementary school students. The beginning of formal schooling is an essential time for studying the development of students' achievement-related affective and behavioral patterns (Aunola et al., 2003; Onatsu-Arvilommi et al., 2002; Ziegert et al., 2001). The very first learning experiences provide a foundation for students' later choices and behavior in learning situations, and it is important to study these experiences more closely in order to understand the origins of behavioral patterns. Students' achievement-related behaviors have also been found to show substantial stability already during the first years of elementary school (e.g., Aunola et al., 2003; Onatsu-Arvilommi & Nurmi, 2000; Onatsu-Arvilommi et al., 2002; Ziegert et al., 2001). This research aimed to examine to what extent these behaviors are stable and to determine the key factors that contribute to the development of and changes in students' achievement-related behaviors from kindergarten through Grade 4.

Second, the research was longitudinal and covered four-and-a-half years of the students' lives, including their transition from kindergarten to elementary school. This is a longer time span than most of the previous studies have been able to cover. It is probable that changes in one's behavioral patterns do not happen overnight but take a longer time to form. A period of four years made it possible to examine the nature and rate of these changes. The longitudinal setting with several time points also enabled the studying of bidirectional relations, as was done regarding students' achievement-related behaviors and academic competence.

Third, this research made an attempt to link two distinct theoretical fields: achievement motivation and temperament. These two research branches have been kept rather separate, and actual attempts to find links between them have only been made during the last decade (see Rothbart & Hwang, 2005). In this research, the terminology and the main theoretical ideas stem from the achievement motivation literature, but temperament was considered as an additional factor—in conjunction with cognitive and motivation-based factors—contributing to students' behavioral and affective responses in achievement situations. The findings showed that temperamental characteristics make a unique contribution to students' achievement-related affects and behaviors, in addition to the influence of academic performance.

Fourth, in the present research, the role of academic skill development in the formation of students' achievement-related behaviors was examined across

a wide variety of skills. Findings of previous studies have been inconsistent and not able to confirm a reciprocal relation across domains, which is why the present research covered both literacy and numeracy skills, and with regard to literacy skills even more specific subskills of reading and writing. The findings showed that the strength of the relationship between achievement-related behaviors and academic skills can vary depending on the nature of the skill, the relation being stronger for more complex skills.

Finally, the present research used teachers' and research assistants' ratings of students' behaviors. The young age of the participants justifies that observer ratings rather than self-ratings were used (Aunola et al., 2002). Although self-ratings of behavior may more closely reflect students' aims, intentions and explanations for their behavior (what they are pursuing to do and why), observers' ratings more directly describe the actual affective and behavioral responses of the students. Teacher ratings have proved to be a reliable method to assess students' in-class behavior (e.g., Gijsel et al., 2006; Hecht & Greenfield, 2002). The Behavioral Rating Scale used in Studies 1 and 2 has also proven to be a valid measure of students' behavior (Zhang, Nurmi, Kiuru, Lerkkanen, & Aunola, 2011).

The present research also has some limitations. The first limitation concerns the measures of achievement-related affects and behaviors, and the fact that the ratings were domain general, not specific to school subjects or certain tasks. It is possible that relevant information about students' task-related affects and behaviors was lost when the raters were asked to make their observations across different situations and different school subjects. The final rating might reflect an average of a student's behavioral responses and overleap the fact that the student perhaps showed one type of behavior regarding a certain school subject and another type of behavior in connection with another subject. For example, a student may do well in mathematics and show task-focused behavior in math classes, but instead could show task avoidance in reading tasks because of having had problems in learning to read. A domain-general rating of achievement behavior also touches upon the construct of dispositional traits and raises the question whether this measure is sufficiently distinct from the measure for temperament used in Study 3. In order to better examine the relationship between achievement-related behaviors and specific academic skills such as numeracy and literacy, the behavior ratings should perhaps be undertaken separately for each particular skill.

The second limitation is related to the measure of temperament used in Study 3. Students' temperament was rated by their teachers, most of whom had known the student for only a few months at the time of the rating. This fact may have caused the ratings to be less than accurate descriptions of the students' dispositional traits. Comparing or combining the teacher ratings with those of the parents would perhaps give a more reliable picture. Another concern in relation to the temperament measure is the fact that a combination of two temperament scales was used. The scales were originally not designed to be used together and their combination may not be consistent in relation to structure

and content. Relatively high correlations between the final temperament factors also suggest that the factor structure of the scales needs more investigation.

The third limitation is related to background factors that may have affected the findings of the study but were not controlled for in the analyses, such as students' intelligence or general cognitive capacity. Students' intelligence is most likely related to their academic performance, but it may also be related to their ability to judge their own performance, to attribute the reasons for their success and failure, and to estimate the probability of success in future situations. Misjudged expectations may further lead to unrealistic goals, failure in reaching them, and consequently to negative emotions and a lack of effort. Furthermore, the students' age was not controlled for either. Additional analyses with the sample used in Studies 1 and 2 showed that students' task-avoidant behavior was negatively associated with their age at the time of the rating. This could be related to the development of self-regulatory skills that may be less developed among the younger students.

The fourth limitation concerns the lack of study variables that may have a mediating role in the relation between academic performance and achievement-related behaviors. Previous learning experiences and later achievement behavior are just two parts of a multiphase process that also includes students' attributions, beliefs, values, expectations, goals, and so forth. The role of these other factors was not examined in this research. Furthermore, the role of contextual factors was considered in only one of the featured studies (Study 2) by controlling for family-related factors. However, factors such as teaching practices, classroom climate, and peer relations may also play a significant role in the development of achievement-related behaviors.

The fifth limitation concerns the measures of academic performance that were used in the original studies. The tasks for reading, spelling, and mathematics slightly varied from one assessment to another, making it harder to compare the performance of the students across time. The obvious reason for this is that the same set of tests could not be used with kindergarten students and, for instance, with fourth graders. The tests had to be modified and made more difficult to better respond to the improved skills of the students. This is a common procedure in longitudinal settings to avoid a ceiling effect in academic measures.

The sixth limitation is related to the context of the study. The study was carried out in Finland, which is a unique environment at least regarding the language and the school system. The findings of the study may not be generalizable to other cultures.

4.7 Future directions

The findings of this research raise some new and interesting research topics and questions for the future. First, the results showed that, at the group mean level, the changes in students' achievement-related behaviors across time were small.

However, there were individual differences in these changes, indicating that there may be various different types of growth trajectories illustrating the development of students' achievement behavior. Moreover, it is reasonable to assume that the association between students' achievement behaviors and their academic competence is not identical for everyone: for example, not all low-achieving students avoid learning tasks, and not all high-achieving students show task-focused behavior. To identify the individual patterns of association and the individual growth trajectories of achievement behavior across time, person-oriented approaches could be applied in future studies.

Second, the findings of this research showed that students' achievement-related behaviors are influenced by their academic performance and temperamental characteristics, but a considerable portion of variation in the behavioral patterns remained unexplained nonetheless. Some of the possible factors that could be included in future studies as predictors of achievement-related affects and behaviors are students' self-concept of ability, their interests and goals, their parents' beliefs, their teachers' instructional practices, and the classroom goal structure. For example, key factors in students' choice of action may be their goals and the means they believe to be sufficient to reach their goals. The students may not consider their task-avoidant behavior in the math class as maladaptive if getting the highest grade is not their goal in mathematics.

Third, with regard to the factors predictive of the various types of achievement-related behaviors, intervention studies could be conducted to examine by what means students' maladaptive behavioral patterns might be altered and how the students could develop more adaptive patterns. Maladaptive types of behavior such as task avoidance and helplessness can lead to harmful cycles of development, which is why it is important to prevent these negative cycles by influencing the factors that lead to these types of behavior. Possible interventions could include training students in metacognitive skills, teaching them how to attribute the failure or success of their performance constructively and how to set goals for their learning, as well as training teachers in how to shape the classroom atmosphere to better support students' mastery orientation.

Fourth, the findings of the research showed that students' temperamental characteristics, distractibility and inhibition were related to their anxiety, task avoidance and helpless behavior in achievement settings. The relation between elementary school students' temperament and their achievement motivation has received research attention only recently, and this attention has focused almost exclusively on students' goals or goal orientations (e.g., Bjørnebekk & Diseth, 2010; Chang & Burns, 2005; Harris et al., 2007). Clearly, there is a need for more research to examine the influence of innate factors, such as temperament, on various motivation-related constructs such as students' self-concept of ability and their attributions, interests and expectations. There is an evident need to include measures of temperament (or personality) in future studies focused on students' achievement-related emotions and behaviors.

4.8 Concluding remarks

This research focused on Finnish kindergarten and elementary school students' achievement-related affects and behaviors. These affects and behaviors were examined in relation to the students' temperamental characteristics and reading and math skill development. The findings of the research showed, first, that students' achievement behavior and their academic performance form a bidirectional relationship: A high level of literacy and numeracy skills was associated with a high level of task-focused behavior in achievement situations, which further predicted greater improvement in these skills. In contrast, lower performance in literacy and numeracy was associated with a high level of maladaptive achievement-related behaviors (task avoidance, helplessness, anxiety), which further predicted less performance improvement. These results emphasize the importance of supporting students in dealing with their learning experiences and understanding the consequences of their own behavior, because the low-achieving students, in particular, are in danger of adopting harmful cycles of development. Furthermore, the findings of this research showed that students' achievement-related behaviors were associated with their temperamental characteristics, with distractibility being related to high task avoidance, and inhibition being linked to high anxiety and helplessness. These findings suggest that students' affective and behavioral responses in achievement situations are not only determined by their previous experiences in learning situations, but are also influenced by dispositional factors, such as their temperament. Finally, the findings suggest that students' behavioral patterns show substantial stability across time, starting from kindergarten. This implies that patterns of affective and behavioral responses form early on in students' school career and may be susceptible to only small changes thereafter.

YHTEENVETO (SUMMARY)

Oppilaiden työskentelytapojen yhteys akateemisten taitojen kehitykseen ja temperamenttiin

Tämän tutkimuksen tavoitteena oli tarkastella esiopetus- ja alakouluikäisten oppilaiden työskentelytapoja oppimistilanteissa. Työskentelytavoilla tarkoitetaan oppilaalle tyypillistä tapaa toimia ja suhtautua oppimistilanteissa hänelle annettuihin tehtäviin. Oppimistulosten kannalta haitallisina työskentelytapoina voidaan pitää esimerkiksi tehtävien välttelyä ja avuttomuutta, kun taas oppimisen kannalta suotuisaa on tehtävään suuntautuminen. Tutkimuksella oli kolme tarkempaa tavoitetta: Ensimmäisenä tavoitteena oli tutkia, kuinka oppilaiden työskentelytavat suoritustilanteissa ennustavat heidän myöhempää lukemisen, kirjoittamisen ja matematiikan taitojensa kehittymistä. Toisena tavoitteena oli tarkastella, kuinka oppilaiden aiemmat taidot lukemisessa, kirjoittamisessa ja matematiikassa vastaavasti ennustavat heidän myöhempiä työskentelytapojaan. Tutkimuksen kolmantena tavoitteena oli tutkia, ovatko oppilaiden temperamenttipiirteet yhteydessä heidän työskentelytapoihinsa oppimistilanteissa. Lisäksi käytetyt pitkittäisaineistot ja analyysitavat mahdollistivat sen tarkastelun, millaisia muutoksia oppilaiden työskentelytavoissa tapahtuu ajan kuluessa.

Tutkimus koostui kolmesta osatutkimuksesta. Kahdessa ensimmäisessä osatutkimuksessa aineistona käytettiin Koulutaidot ja motivaatio -pitkittäistutkimuksen (Jyväskylä Entrance into Primary School, JEPS) aineistoa esiopetusvuodesta alakoulun neljännelle luokalle saakka. Ensimmäisen osatutkimuksen tutkimusjoukkona oli 207 lasta (111 tyttöä, 96 poikaa) ja toisen osatutkimuksen tutkimusjoukkona puolestaan 225 lasta (107 tyttöä, 118 poikaa). Kolmannessa osatutkimuksessa käytettiin Vanhemmat, lapset ja oppiminen -tutkimuksen (VALO) aineistoa, johon kuului 153 lasta (78 tyttöä, 75 poikaa).

Ensimmäisessä osatutkimuksessa tarkasteltiin oppilaiden tehtävään suuntautuvan tai tehtäviä välttelevän työskentelytavan ja luku- ja kirjoitustaidon välistä kehityksellistä yhteyttä esiopetuksesta neljännelle luokalle. Tulokset osoittivat, että tehtävään suuntautuva työskentelytapa ennusti oppilaan myöhempiä taitoja luetun ymmärtämisessä ja oikeinkirjoituksessa senkin jälkeen, kun oppilaan sukupuoli ja aiempi taitotaso oli huomioitu. Sen sijaan tehtävään suuntautuminen ei ennustanut oppilaan myöhempää lukemisen sujuvuutta, kun sukupuoli ja aiemmat taidot huomioitiin. Toisaalta osatutkimuksen tulokset osoittivat, että oppilaan taidot lukemisen sujuvuudessa, luetun ymmärtämisessä ja oikeinkirjoituksessa ennustivat hänen myöhempää tehtävään suuntautuvaa työskentelyään senkin jälkeen, kun sukupuoli ja aiempi työskentelytapa oli huomioitu. Osatutkimuksen tulokset antavat viitteitä siitä, että tehtävään suuntautuva tai tehtäviä välttelevä työskentelytapa ja luku- ja kirjoitustaito kehittyvät kumulatiivisesti ja toisiaan ruokkien. Luku- ja kirjoitustaidon kehittyminen vahvistavat tehtävään suuntautuvaa työskentelytapaa, joka puolestaan edelleen tukee luetun ymmärtämisen ja oikeinkirjoitustaidon kehittymistä. Työskentelytavan merkitys lukemisen sujuvuuden kehityksessä näyttää tulos-

ten perusteella sen sijaan olevan vähäisempi. Syynä tähän voidaan pitää sitä, että suomen kielen täydellisen kirjain–äänne-vastaavuuden vuoksi suomalaislapset oppivat lukemaan verraten nopeasti, eikä työskentelytavalla lukusujuvuutta mittaavissa tehtävissä näin ollen ole suurta roolia enää sen jälkeen, kun lukemisen perustaidot on saavutettu.

Toisen osatutkimuksen tavoitteena oli selvittää oppilaan tehtäviä välttelevän työskentelytavan ja matematiikan taitojen kehittymistä sekä niiden kehityksellistä yhteyttä esiopetuksesta neljännelle luokalle. Tulokset osoittivat, että oppilaiden välillä oli merkitseviä eroja siinä, kuinka tehtävien välttely väheni tai lisääntyi tarkastelujakson aikana. Tulokset osoittivat edelleen matematiikan taitojen ja tehtäviä välttelevän työskentelytavan kehittyvän kumulatiivisessa vuorovaikutuksessa. Hyvä taitotaso matematiikassa oli yhteydessä vähäiseen välttelykäyttäytymisen määrään, ja taitojen paraneminen oli yhteydessä välttelykäyttäytymisen vähenemiseen ajan myötä. Toisaalta välttelykäyttäytymisen suuri määrä ennusti matematiikan taitojen hitaampaa kehitystä myöhemmin. Nämä tulokset pätivät myös, kun huomioitiin oppilaan sukupuoli sekä vanhemman koulutustaso ja matematiikkaan liittyvien taitojen opettaminen lapselleen. Osatutkimuksen tulokset osoittavat, että tehtäviä välttelevä työskentelytapa on ilmeisen haitallinen matemaattisten taitojen kehittymisen kannalta, koska se johtaa vähäisempään ja hitaampaan taitojen kehittymiseen. Toisaalta välttelevä työskentelytapa ei näytä olevan yhtä herkkä taitojen kehitykselle, sillä aiempi taitotaso matematiikassa ei ennustanut myöhempää tehtävien välttelyn määrää.

Kolmannessa osatutkimuksessa selvitettiin, kuinka oppilaan temperamenttipiirteet ovat yhteydessä hänen työskentelytapoihinsa suoritustilanteissa ensimmäisellä luokalla. Työskentelytavoista tässä osatutkimuksessa mitattiin niin oppilaan aktiivista tehtävien välttelyä, passiivista avuttomuutta kuin ahdistuneisuutta suoritustilanteissa. Tulokset osoittivat, että temperamenttipiirteistä häirittävyys ennusti sekä oppilaan aktiivisen tehtävien välttelyn määrää että tämän välttelykäyttäytymisen lisääntymistä ensimmäisen luokan aikana. Estyneisyys puolestaan ennusti oppilaan suoritustilanteisiin liittyvää avuttomuutta ja ahdistuneisuutta. Tulokset pätivät myös, kun oppilaan taitotaso lukemisessa ja matematiikassa oli huomioitu. Tuloksissa ei ollut eroja tyttöjen ja poikien välillä. Osatutkimuksen tulokset osoittavat, että oppilaan taitojen ja aiempien oppimiskokemusten lisäksi oppimistilanteissa on merkitystä myös oppilaan taipumuksellisilla piirteillä, kuten temperamentilla. Haitallisten työskentelytapojen muodostumisen kannalta erityisen keskeisessä roolissa näyttävät olevan tunteiden ja käyttäytymisen ali- ja ylisäätelyyn liittyvät piirteet.

Kaiken kaikkiaan tämän tutkimuksen tulokset osoittavat, että oppilaiden työskentelytavat ja taidot ovat vastavuoroisessa yhteydessä: Hyvät taidot lukemisessa, kirjoittamisessa ja matematiikassa tukevat suotuisia työskentelytapoja (kuten tehtäviin suuntautumista), mikä puolestaan edelleen ennustaa parempaa taitojen kehitystä myöhemmin. Vastaavasti heikko taitotaso on yhteydessä epäsuotuisiin työskentelytapoihin (kuten tehtävien välttelyyn ja avuttomuuteen), jotka edelleen ennustavat alhaisempaa taitotasoa myös myöhemmin.

Erityisesti taidoiltaan heikommat oppilaat ovat näin ollen vaarassa joutua kehityksen kannalta haitallisiin noidankehiin. On tärkeää tukea näitä oppilaita heidän oppimiseen liittyvien onnistumis- ja epäonnistumiskokemustensa läpikäymisessä sekä sen ymmärtämisessä, miten heidän oma toimintansa vaikuttaa heidän oppimiseensa. Tutkimuksen tulokset osoittavat taitotason lisäksi myös oppilaiden temperamentin olevan merkityksellisessä roolissa työskentelytapojen kehityksessä: häirittävyys eli alhainen reaktiokynnys erilaisille ärsykkeille oli yhteydessä oppilaan tehtävien välttelyyn, kun taas estyneisyys oli yhteydessä oppilaan ahdistuneisuuteen ja avuttomuuteen suoritustilanteissa. Tutkimuksen tulokset antavat viitteitä myös siitä, että oppilaiden työskentelytavat ovat varsin vakiintuneita jo esiopetuksesta alkaen, eikä niissä tapahdu suuria muutoksia ensimmäisten kouluvuosien aikana.

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