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Domain-specificity of motivation: A longitudinal study in upper primary school

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ABSTRACT

The purpose of this study was to examine the domain-specificity of motivation in upper primary school. A sample of 722 students reported on their achievement goals, self-efficacy, and effort in language and mathematics twice a year during grade five and six. Results of confirmatory factor analyses and latent growth curve modeling showed that motivational constructs in language and mathematics were domain-specific in nature and developments in domain-specific motivational constructs mostly predicted achievement growth in corresponding subject domains. Yet, compared to previous studies in secondary or higher education, the degree of domain-specificity in upper primary school was found to be limited. High cross-domain correlations indicated a high degree of generality and similar longitudinal developments co-occurred across both domains. Especially achievement goals were highly domain-general. The results suggest that the degree of domain-specificity depends on the nature of motivational constructs and students´ age. Implications of these findings for practice and research are discussed.

1. Introduction

If a student shows great effort during mathematics, does that imply that this student will also exert great effort during language? Can a teacher conclude that a student who is insecure about her abilities to succeed at her mathematics tasks will also be insecure about her abilities in language tasks? Such questions are reflective of a more general question, i.e., to what extent are motivational constructs domain-specific or general across subject domains? The domain-specificity of motivational constructs has been a topic of interest for many years (e.g., Bong, 2001; Bong & Skaalvik, 2003; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Green, Martin, & Marsh, 2007; Magson, Bodkin-Andrews, Craven, Nelson, & Yeung, 2013; Martin, 2008; Smith & Fouad, 1999) as the issue of domain-specificity is crucial to the question at what level motivational constructs can validly be assessed for research as well as more practical purposes. As such, this study will address the domain-specificity of primary school students' achievement goals, self-efficacy, and effort to increase our understanding of the nature and development of these constructs in young students. From a more practical perspective, a better understanding of the nature of these constructs can help to determine the level of specificity at which these concepts can best be assessed or targeted for intervention purposes in young children.

Studies on domain-specificity of motivational constructs mainly used factor analyses and estimated cross-domain correlations between the domain-specific motivational factors to establish the extent to which motivational constructs in different domains are associated at a certain point in time. However, this approach of establishing cross-domain correlations reflects only one aspect of domain-specificity. For a deeper understanding of the issue of domain-specificity, two other issues are important to take into consideration. The first one refers to independence of developments over time. That is, if a motivational construct is fully domain-specific, then it not only consists of separate uncorrelated factors, but changes in students' motivation over time in one subject-domain can occur independently of changes in another subject domain. On the other hand, if a motivational construct is not domain-specific but reflects general school-related motivation, than similar changes in students' motivation are expected to occur in multiple subject domains. A second issue refers to unique predictive validity. If a motivational construct is fully domain-specific, then (developments in) this specific motivational construct, will predict students' achievement growth in a corresponding domain better than achievement growth in another subject domain. Hence, motivation for math should for example be more predictive of math achievement than achievement outcomes in other subject domains.

To get a better understanding of the degree to which motivational constructs are domain-specific, studies are needed in which the degree

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of independence of changes over time and the extent to which (developments in) motivational constructs uniquely predict achievement growth are taken into account. Moreover, the degree of domain-specificity of a motivational construct may change depending on the age of respondents. That is, when students become older, their executive functions and cognitive abilities develop (e.g. Blakemore & Choudhury, 2006) and they become more aware of their own interests, strengths, and weaknesses (Harter, 1983; Krapp, 2002; Stipek & McIver, 1989; Wigfield & Wagner, 2005) and motivational constructs may therefore become more differentiated with age. Therefore, longitudinal studies on domain-specificity of motivational constructs will also add to a better understanding of developments in domain-specificity of motivational constructs.

The present study adds to existing research by longitudinally examining domain-specificity of motivation during the last two years of primary school. Like previous research, the present study takes into account the cross-domain relations of a variety of motivational constructs (goal orientations, self-efficacy, and effort) in two subject domains (language and mathematics). Additionally, it is also examined whether the degree of domain-specificity changes as a function of age. Also independence of changes in motivation over time and unique predictive validity of the aforementioned motivational constructs are taken into account to provide a more thorough and more complete understanding of the complex issue of domain-specificity.

1.1. Domain-specificity of motivation

In motivation research, a variety of motivational constructs are distinguished. These include motivational *beliefs* or *appraisals* (i.e. students' personal views of their own motivational tendencies or characteristics in a given situation, such as self-efficacy and achievement goals) and students' motivated *behavior*, which is the behavioral investment or effort of students that results from their motivational beliefs (Boekaerts, 2010; Covington, 2000; Wigfield & Eccles, 2000). Previous research suggested that the degree of domain-specificity varies per motivational construct (Bong, 2001; Green et al., 2007). As such, earlier work on domain-specificity of motivation will be discussed per motivational construct.

1.1.1. Domain-specificity of self-efficacy

Students' self-efficacy is a crucial construct in current motivational theories. It refers to domain-specific or task-specific judgments about one's capabilities to perform the actions that are needed to complete academic tasks successfully (Bandura, 1977). Self-efficacy is rooted in social cognitive theory (Bandura, 1977, 1986, 2001), which assumes that motivated behavior is goal-directed and is initiated and sustained by the extent to which an individual feels efficacious in performing the tasks at hand. Self-efficacy is closely related to competence beliefs, although these concepts are conceptually distinct. Whereas competence beliefs focus on present abilities and measures perceived *competence*, self-efficacy involves predictions for future outcomes and measures perceived *confidence* (Bong & Skaalvik, 2003; Pajares, 1996).

Previous research suggested that competence beliefs are more domain-specific than other motivational constructs, such as achievement goals. Eccles et al. (1993) for example found that competence beliefs in math and reading loaded on two separate factors, while items measuring task value in those two domains loaded on a single factor. According to the internal/external (I/E) frame of reference model by Shavelson, Hubner, and Stanton (1976) and revised by Marsh (1986, 1990); Marsh et al., 2014; Marsh et al., 2015), competence beliefs in a particular domain are formed by comparing oneself to others and by comparing one's own competence in different domains to each other. The comparison with others is referred to as external reference, which will result in positive cross-domain correlations. Comparing one's own competence in a particular domain to competence in another domain is referred to as internal reference and is likely to result in negative cross-domain correlations. As such, the combination of those two is expected to result in near-zero correlations. These negative internal reference effects are believed to hold only for contrasting subject domains, such as math and language, but not for subject domains that are more alike such as math and science (Marsh et al., 2014; Marsh et al., 2015). A meta-analysis on the I/E model (Möller, Pohlmann, Köller, & Marsh, 2009) indeed reported near-zero correlations between students' competence beliefs in math and verbal domains. These low correlations were found across different instruments and nationalities. Moreover, effects of competence beliefs on achievement-related outcomes were also found to be domain-specific providing further support for the domain-specificity of competence beliefs (see for example, Marsh et al., 2014).

Marsh (1990) suggested that the I/E model also applied to related constructs such as self-efficacy. Yet, outcomes of studies on the domain-specificity of self-efficacy did not support that suggestion and overall found substantial cross-domain correlations for self-efficacy (Marsh, Martin, & Debus, 2001; Möller et al., 2009; Skaalvik & Rankin, 1995). Bong (2001) for example found cross-domain relations of self-efficacy to vary from small to moderate ($r = 0.24$ to $r = 0.63$) with somewhat higher levels of domain-specificity for high school students compared to middle school students. Green et al. (2007) found even stronger cross-domain relations for self-efficacy ($r = 0.71$ to $r = 0.72$) in English, math, and science. Only very few studies have also examined the unique predictive validity of self-efficacy in multiple domains (Bong & Skaalvik, 2003). Two exceptions are Bong (2002) and Green et al. (2007) who found that self-efficacy in a specific domain – although related to effort and achievement outcomes in other domains – most strongly predicted outcomes in the corresponding domain. None of the aforementioned studies examined domain-specificity of self-efficacy longitudinally. Also, none of these studies involved primary school students. By focusing on primary school students and by taking into account longitudinal developments and cross-domain relations with achievement, this study can enhance our understanding of the nature of self-efficacy beliefs in primary school students and how these develop with age.

1.1.2. Domain-specificity of achievement goals

Achievement goal theory (AGT) (Ames & Archer, 1988; Elliott & Dweck, 1988; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010; Nicholls, 1984; Senko, Hulleman, & Harackiewicz, 2011) posits that achievement goals are key aspects of students' motivational beliefs in learning situations. According to AGT, individuals consciously pursue certain goals which guides their behaviors. In the context of schooling, a distinction is made between mastery-oriented and performance-oriented goals (e.g., Ames, 1992; Nicholls, Cobb, Wood, Yackel, & Patashnick, 1990). Mastery-oriented goals – sometimes also referred to as learning goals (e.g., Elliott & Dweck, 1988), task goals, or task-oriented goals (e.g., Nicholls et al., 1990) – reflect an orientation toward developing understanding, increasing skills and competence and mastering tasks at hand (Ames, 1992; e.g., Elliott & Dweck, 1988). Students who adopt mastery goals have been argued to consider ability a malleable characteristic that can be enhanced by effort. As such, these students enjoy challenges and show greater persistence when faced with difficulties (Elliott & Dweck, 1988). Mastery goals have been consistently associated with adaptive learning behaviors and outcomes such as greater engagement in learning and more use of deep learning strategies (for reviews, see Anderman, Austin, & Johnson, 2002; Maehr & Zusho, 2009) as well as higher achievement outcomes (see the meta-analysis by Hulleman et al., 2010).

Performance goals – also referred to as ego goals (Ames, 1992) – reflect an orientation toward demonstrating ability relative to others. As such, individuals with performance goals are concerned with outperforming others or attempting to not perform more poorly (Ames, 1992; Elliott & Dweck, 1988). A further distinction is made between performance-approach and performance-avoidance goals.

Students with performance-approach goals aim to demonstrate higher competence relative to others. Students with performance-avoidance goals want to avoid performing worse than others or showing failure (for reviews, see Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Hulleman et al., 2010). Performance-avoidance goals have been consistently associated with unfavorable outcomes such as self-handicapping, avoidance strategies, and lower achievement. Performance-approach goals, however, have been associated with positive as well as negative learning behaviors and outcomes (Hulleman et al., 2010).

It has been argued that goal orientations are likely to generalize across subject domains because goal orientations reflect students' "personal criteria of success" (Bong, 2001). Several studies examined the domain-specificity of students' achievement goals by examining cross-domain relations and found moderate to high cross-domain correlations for different types of achievement goals ($r = 0.51$ to $r = 0.75$) (Duda & Nicholls, 1992; Green et al., 2007; Marsh, 1990) suggesting a high level of generality across academic domains. Bong (2001) found that especially performance approach and performance avoidance goals correlated substantially across domains ($r = 0.42$ to $r = 0.79$), whereas cross-domain relations tended to be lower for mastery goals ($r = -0.14$ to $r = 0.60$). Domain-specificity tended to be somewhat higher for high school students (Bong, 2001). This supports the assumption that students' motivational beliefs become more differentiated with age. In all, these results suggest a moderate to strong degree of domain-specificity of achievement goals depending on the type of achievement goal and the domains that were compared. Only one study (Green et al., 2007) examined whether these achievement goal orientation are unique predictors of educational outcomes in corresponding subject domains and found that mastery orientations and failure avoidance in a specific domain were slightly more predictive of educational outcomes (such as class participation) in the corresponding domains as compared to other academic domains. None of the aforementioned studies examined domain-specificity of achievement goals longitudinally or involved primary school students. The current study adds to the body of work on achievement goal theory by moving beyond previous studies that have only assessed cross-domain correlations. By focusing on how primary school students' achievement goals develop over time, this study can add to insights on the nature and development of achievement goals from an early age.

The current study does not consider mastery avoidance goals (i.e. striving to avoid losing competency and abilities) (Elliot, 1999). Mastery avoidance goals are described as the least studied and least understood of all types of achievement goals (Elliot & Murayama, 2008). Although recent studies (Hulleman et al., 2010; Madjar, Kaplan, & Weinstock, 2011; Senko et al., 2011) increasingly support the existence of this fourth goal construct, it is still under debate whether or not primary school children pursue these mastery avoidance goals (Carr & Marzouq, 2012). In general, younger children have not yet fully developed their competences (or awareness of specific competencies) in school subjects, and hence have little to lose. As such, they may be less prone to mastery avoidance orientations. From a more practical nature, currently no validated measures of mastery-avoidance are available for children in this age range as items measuring striving to avoid losing competence require complex wording which is difficult for adults to understand, let alone young children. In the current study, mastery-avoidance was therefore not taken into account.

1.1.3. Domain-specificity of effort

Motivational beliefs, including achievement goals and self-efficacy are believed to be reciprocally related to students' achievement outcomes through the motivational behaviors they instigate. A main aspect of motivational behavior is the effort students put into their schoolwork. Students' effort can vary in terms of the intensity, persistence, and direction of school-related behaviors (Maehr & Braskamp, 1986). Previous research indicates that effort is an important predictor of student achievement (Carbonaro, 2005; Hornstra, van der Veen, Peetsma, & Volman, 2013; Schwinger, Steinmayr, & Spinath, 2009). In this study we consider effort to be an integrative part of motivation, which is reciprocally associated with motivational beliefs as well as achievement outcomes. Therefore, not only the domain-specificity of students' motivational beliefs (goal orientations and self-efficacy) are taken into account in the present study, also domain-specificity of effort was considered.

A variety of processes may underlie the degree of domain-specificity of effort. On the one hand, effort differs from other motivational beliefs in the sense that it can be considered a limited resource (Carbonaro, 2005). Hence, the amount of time and effort invested in one subject domain, cannot be invested in another subject domain. As such, the degree of effort may depend on which subject domain requires most attention, for example because of failing grades in that particular domain, or alternatively, or depend on which domain is of most interest to a student, suggesting negative cross-domain relations. On the other hand, there may be general factors associated with the degree of effort in multiple domains (for example, personality characteristics, relations with a teacher or classmates, problems at home that occupy a student's mind), which could cause low or high degrees of effort across multiple domains, suggesting positive cross-domain relations for effort.

Thus far, very few studies have examined the domain-specificity of effort. Marsh et al. (2001) examined persistence in math and verbal domains and found a strong correlation of $r = 0.77$ in a sample of first year undergraduates. Green et al. (2007) also found substantial cross-domain correlations ($r = 0.63$ to $r = 0.75$) for persistence in English, math, and science for high school students and furthermore found that persistence was a stronger predictor of domain-specific educational outcomes, than outcomes in other domains. Trautwein, Lüdtke, Schnyder, and Niggli (2006) also focused on high school students found more moderate cross-domain correlations for various indicators of homework effort ($r = 0.40$ to $r = 0.51$). None of the aforementioned studies included primary school students, examined within-domain relations of effort with achievement outcomes, or examined domain-specificity of effort longitudinally. As such, this study will add to our understanding of the nature of the construct of effort and can show whether students' effort needs to be considered a limited resource or a more general trait-like construct.

1.2. Developments in domain-specificity

The results described above demonstrate that domain-specificity is a very complex phenomenon, among other reasons because the degree of domain-specificity varies by motivational construct (e.g., Bong, 2001; Green et al., 2007; e.g., Marsh et al., 2001). In earlier research (Krapp, 2002; Stipek & McIver, 1989), it was found that with age, students develop more differentiated views of their interests, strengths and weaknesses and, consequently, motivational constructs may become more domain-specific with age. This would be in line with Bong (2001), who found higher domain-specificity of various motivational constructs in a sample of high school students compared with middle school students. Yet, thus far, changes in the degree of domain-specificity over time have only scarcely been examined and mostly with cross-sectional rather than longitudinal data (e.g., Bong, 2001; Marsh et al., 2001).

In this study, changes in domain-specificity will be examined during a period of two years at the end of primary school. This is a crucial age period for students (average age 10 to 12 years). Young children have more general views of their abilities which become more specific and fine-grained during pre-adolescence (Harter, 1983; Wigfield & Wagner, 2005). During the pre-adolescent years students develop a realistic awareness of their interests, as well as of their strengths and difficulties. In this period, they increasingly begin to compare their competence with that of others, and they become more informed about their specific abilities through a variety of sources such as feedback from teachers and test outcomes (Pajares & Schunk, 2001). These developments could increase the degree of domain-specificity of motivation over time. Also, characteristics of the school system may also account for a potential increase in a more differentiated awareness that students have of themselves. In the Netherlands, but also in other countries, important decisions with regard to students future educational careers are made in these crucial years, such as the track in which students will continue their educational careers (Hanushek, 2006). Also, an increased amount of testing takes place in upper primary school. Thinking about their future educational careers and the increased amount of tests students are faced with, may confront students with their strengths and weaknesses and as such, may also increase domain-specificity of motivational beliefs in upper primary school. For effort however, domain-specificity may develop in another direction. When students are younger, their effort may depend on the extent to which they like a certain subject and this may differ per subject. Additionally, for younger students, teachers are mostly in control of how often and how much students work on subject domains, but toward the end of primary school, teachers usually require students to become more in control of their own learning (e.g., Rice, Barth, Guadagno, Smith, & McCallum, 2013), for example by assigning homework (Muhlenbruck, Cooper, Nye, & Lindsay, 1999). It may be that differences in students' personality characteristics, work ethics, or parental support, which are not specific to any subject domain, become increasingly important in explaining the degree of effort students put into their schoolwork rather than their interest in particular subject domains. As such, domain-specificity of effort may decrease toward the end of primary school.

As described above, previous research on domain-specificity is almost exclusively cross-sectional. These studies have provided support for a low to moderate degree of domain-specificity for achievement goals, self-efficacy, and effort. As such, declines or increases in motivation in one subject domain may be associated with similar development in another subject domain. Hence, intercepts and mean level changes over time (slopes) can be expected to be associated across subject domains. Although such an expectation can be formulated, it is not known how strong the associations will be. Yet, the strongest associations can be expected for students' goal orientations. Goal orientations have been described as "personal criteria of success" (Bong, 2001; Jansen in de Wal, Hornstra, Prins, Peetsma, & van der Veen, 2015), suggesting that an increase in for example performance goals in math will likely coincide with an increase in performance goals in language. Self-efficacy is argued to be more situation-specific compared to goal orientations and developments in self-efficacy in one domain may occur more or less independent of developments in another domain. Since effort can be considered to be a limited resource (Carbonaro, 2005), developments over time in several domains may be negatively associated. That is, if the degree of effort that a student invests in one domain increases over time, it may consequently decrease in another domain. Alternatively, if changes occur in general factors that are associated with effort in multiple domains (for example if a student develops a more positive or negative attitude toward school in general, or has increasingly conflictual relationships with his or her teachers), effort may be decreased or increased in multiple domains, suggesting a positive relation between developments in multiple domains. Thus far, longitudinal research on these issues is lacking.

Also within- and between-domain associations between motivation and achievement have – to our knowledge – not been examined longitudinally before. Previous cross-sectional research (e.g., Bong, 2002) showed that domain-specific motivational constructs correlate higher with achievement outcomes in a corresponding domain than with achievement outcomes in another subject domain. Longitudinal research may therefore also find that within-domain associations between developments in motivation and achievement (i.e. associations between motivation and achievement in math; associations between motivation and achievement in language) are stronger than between-domain associations (i.e. motivation in math and achievement in language and vice versa).

There is yet another reason why research in primary school can add to knowledge on domain-specificity of motivation. In high school and university, different subject domains are generally taught by different teachers. As such, differences in motivation for different subjects could be due to differences between teachers rather than the content of the specific domain itself. In primary school, usually all subjects are taught by the same teacher. Although primary school teachers can differ in their preferences for certain subject domains, or be more competent in teaching certain domains, it can be expected that estimates of domain-specificity are less dependent on characteristics of the teacher in primary school than in secondary school. Estimates of domain-specificity in primary school will therefore be better reflections of students' domain-specific motivation regarding the content of a domain, cancelling out any potential teacher effects. Even though the last years of primary school appear to be a crucial phase in which students develop domain-specificity and offer an opportunity to examine domain-specificity while cancelling out potential teacher effects, research on domain-specificity in upper primary school is very scarce to date.

1.3. Research questions

Taking into account the considerations discussed above, the following research questions were examined in this study.

1. What is the degree of domain-specificity of motivational constructs (self-efficacy, goal orientations and effort) and how does this develop over time during the last two years of primary school?
2. How are developments over time in motivational constructs (self-efficacy, goal orientations and effort) associated across domains?
3. How are developments in domain-specific motivational constructs (self-efficacy, goal orientations and effort) related to developments in achievement within the same domain and in another domain?

2. Method

2.1. Design

From grade five to grade six, four waves of data were collected between 2009 and 2011. In this longitudinal study, students completed self-report questionnaires on their motivational beliefs (goal orientations and self-efficacy) and motivated behavior (effort) in the subject domains language and mathematics twice a year: at the beginning of and halfway through both years.

2.2. Participants

A sample of 722 primary school students from 37 classes in 25 schools across the Netherlands participated in this study. At the first measurement, all students were in grade five and their average age was eleven years. Three-hundred-and-sixty-one students (50.0%) were boys and 361 (50.0%) were girls. The schools provided information on the ethnic origins of the parents. A distinction was made between ethnic majority and ethnic minority students based on the mother's country of origin. When the student was from a single-parent family, ethnicity was determined based on the ethnicity of this parent. Information on socio-economic status (SES) was also provided by the schools. Three levels were distinguished based on the highest level of education attained by either parent. For 121 students, SES information was missing. Analyses revealed a significant relation between ethnicity and SES for the students in this sample (Spearman's Rho = 0.112, $p < 0.05$). Table 1 provides information on the ethnic and socioeconomic backgrounds of the participating students.

Table 1
Ethnic backgrounds and socioeconomic status of the study participants.

Ethnic background	%	N	SES (parental education)	%	N
Ethnic majority (Dutch, other western countries)	89.2%	644	Low: maximum lower vocational education	16.0%	96
Ethnic minority (Morocco, Turkey, other non-western countries)	10.8%	78	Middle: maximum intermediate vocational education	50.1%	301
			High: higher education	33.9%	204

2.3. Instruments

2.3.1. Motivation

During each data collection wave, self-report questionnaires were administered to the students during regular class time. All scales were assessed domain-specifically for both math and language. All items were measured on a 5-point Likert scale ranging from completely not applicable to me (1) to completely applicable to me (5). Table 2 shows the scales that were included.

2.3.2. Mathematics achievement

Students' mathematics achievement scores on national tests from the Dutch National Institute for Educational Measurement (CITO) were obtained from the school records. These tests are administered to students in the Netherlands twice a year to monitor student progress. For each student, four scores on these tests were available: from the end of 4th grade until the middle of 6th grade. Two different versions of the test were used by the schools because the test was updated by the CITO in 2007. Some schools ($N = 6$) in the sample used the older version, whereas other schools ($N = 18$) administered the updated version to their students. The scores on the two versions were not comparable, and therefore, the scores on the older version were transformed so that the mean and standard deviation would be comparable to those of the newer version. One school did not administer CITO tests to its students ($N = 30$). Extensive research on CITO math tests have found this test to be a valid and reliable ($\alpha > 0.80$) measure of math achievement (Evers, Braak, Frima, & Van Vliet-Mulder, 2009; Feenstra, Kamphuis, Kleintjes, & Krom, 2010).

2.3.3. Language achievement

Students' reading comprehension scores on the national (CITO) tests were obtained from the school records as a measure of language achievement. The reading comprehension tests are administered once a year to monitor student progress. For each student, three scores on these tests were available: from the middle of fourth grade until the middle of sixth grade. The reading comprehension tests were updated by the CITO in 2008. Sixteen schools in the sample used the older version, and eight schools administered the updated version to their students. Both versions of the test use the same scale, and analyses showed scores on both versions to be comparable (Feenstra et al., 2010). Previous research suggests that both versions are valid and reliable ($\alpha > 0.80$) measures of reading comprehension achievement (Evers et al., 2009).

2.3.4. Cognitive ability

Cognitive ability was included in this study as a control variable. It was measured in grade three with a cognitive ability test. This test consists of 85 verbal and nonverbal items. There are five subtests: 'composition of figures', 'exclusion', 'number series', 'categories', and 'analogies'. Factor analyses revealed that these subtests form one general cognitive ability factor. The reliability of the test was 0.91 (Batenburg & Van der Werf, 2004).

2.4. Data analyses

The analyses were performed with Mplus (Muthén & Muthén, 2012). Participants with missing values were not removed from the analyses. Instead, missing values were estimated using full-information maximum likelihood (FIML) estimation. FIML estimation is based on the assumption that missing values are missing at random (MAR), and MAR assumes that missing values can be predicted from the available data.

Previous research (Frenzel, Pekrun, Dicke, & Goetz, 2012) showed that motivation questionnaires are not always invariant over time. That is, when students grow older, their meaning of items to measure motivation can change. Therefore, preliminary analyses were conducted to check for measurement invariance across measurement occasions. Also measurement invariance across groups was examined (boys vs. girls, ethnic majority vs. ethnic minority students, and low vs. middle vs. high SES). Consecutive models were estimated from less to more restrictive (i.e., a configural model, a model assuming metric invariance with equal factor loadings, a model assuming scalar invariance with equal factor loadings and intercepts, and a model testing strict invariance that also has equal error variances). The ΔCFI difference test was used to evaluate model fit differences when testing for measurement invariance (as advised by Cheung & Rensvold, 2002). A ΔCFI >0.01 indicates that a stricter model has significant worse fit compared to the previous model. Results indicated that for all models at least metric invariance between groups and across measurement waves was obtained, which is necessary to allow the further analyses to answer the research questions. In most cases even stricter forms of measurement invariance (scalar invariance or even full uniqueness measurement invariance) was obtained. A more detailed report of the analyses regarding measurement invariance in this study can be requested from the first author.

To examine the first research question regarding the degree of domain-specificity, first confirmatory factor analyses were performed. For each motivational construct, two models were estimated (see

Table 2
Example items, numbers of items, and reliabilities of the motivation scales used in the study.

Scale	Example items	N of items	Internal consistencies language m1/m2/m3/m4	Internal consistencies mathematics m1/m2/m3/m4
Goal orientation questionnaire (Seegers, Putten, & Brabander, 2002)				
Mastery goals	"I like when I learn something new during language lessons."	5	0.84/0.84/0.92/0.88	0.85/0.87/0.90/0.91
Performance-approach goals	"I enjoy getting a better grade in mathematics than my classmates."	6	0.82/0.89/0.92/0.93	0.91/0.93/0.94/0.95
Performance avoidance goals	"During mathematics tasks, I am afraid that other students will notice my mistakes."	6	0.82/0.85/0.86/0.87	0.90/0.92/0.93/0.93
Self-efficacy (PALS; Midgley et al., 2000)	"I can even make the hardest language assignments, as long as I try my best."	6	0.85/0.86/0.89/0.87	0.89/0.90/0.93/0.93
Effort (Roede, 1989)	"I put a lot of effort into mathematics."	5	0.77/0.78/0.82/0.83	0.84/0.86/0.87/0.88

Fig. 1). The first model (1a) assumed domain-generality. It consisted of four latent factors: one domain-general factor for each measurement on which language and math items jointly loaded. The second model (1b) consisted of eight latent factors: two domain-specific factors at each measurement. In this model, language and math items loaded on separate factors. To establish the degree of domain-specificity, covariances between the latent factors for language and mathematics were estimated for each measurement wave. In line with Marsh, Roche, Pajares, and Miller (1997), covariances between equivalent items for math and language were included in this model. In addition, to examine whether the degree of domain-specificity changed over time, the cross-domain correlations at each measurement of model 1b were compared. Model 1b was first estimated with equality constraints on these correlations, which were then removed one by one. Model fit was determined by Chi-square difference tests, the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). A significant Chi-square difference indicates whether or not model fit significantly improved or worsened. A CFI above 0.90 indicates good fit of a model. An RMSEA below 0.05 indicates good fit of a model and scores between 0.05 and 0.08 indicate reasonable fit. Scores above 0.10 indicate poor fit (Hu & Bentler, 1999).

To examine the second research question regarding cross-domain relations between developments in domain-specific aspects of motivation, the data were first analyzed using univariate latent growth curve

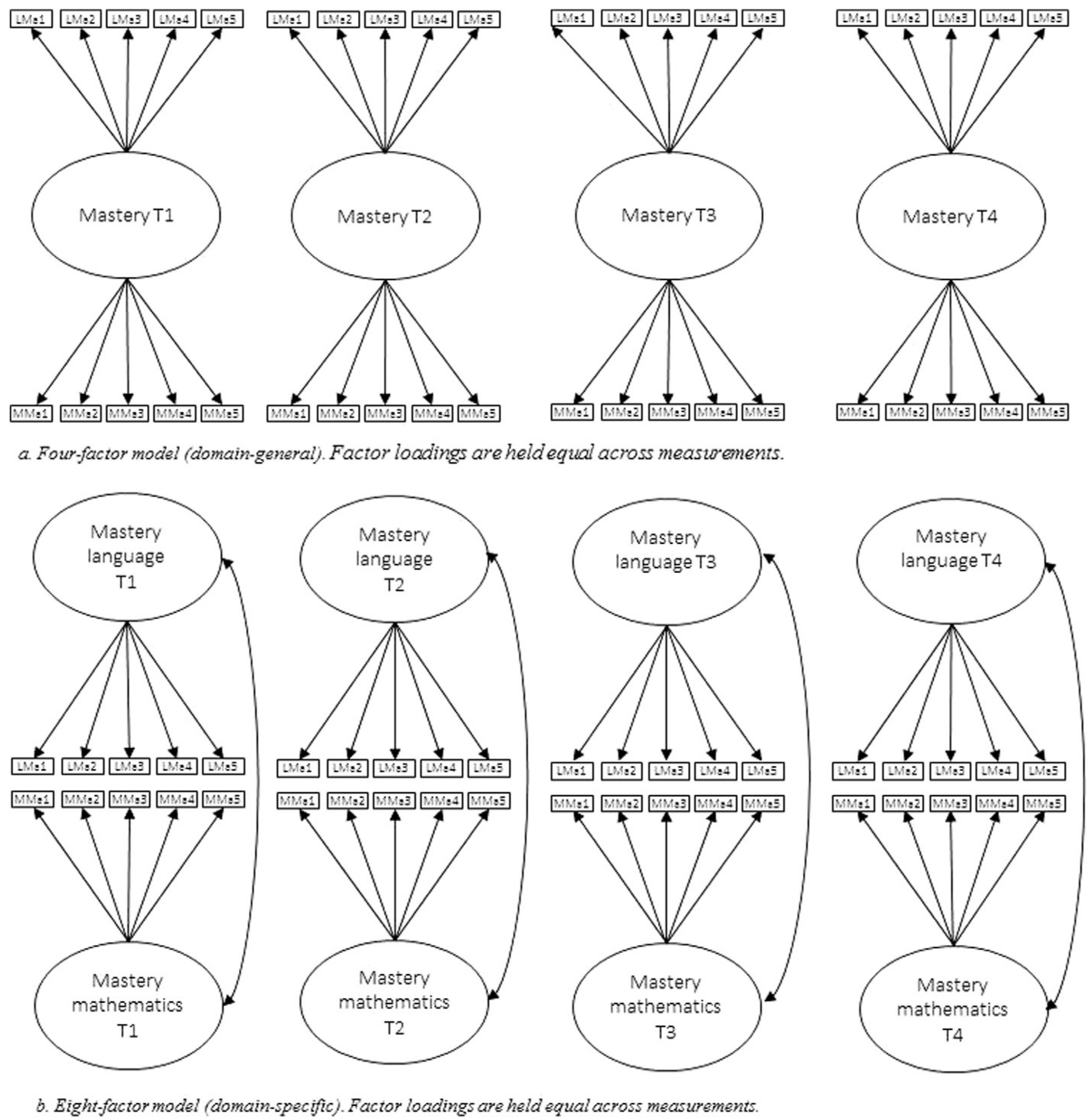

Fig. 1. Domain-general and domain-specific model (example mastery).

analyses (LGCA) (McArdle & Epstein, 1987). The underlying assumption of LGCA is that individuals can vary in their initial scores and growth patterns. For each individual, LGCA estimates an intercept (initial level in grade three) and slope (growth a year) on each variable. These latent variables are estimated based on observed scores on multiple measurement occasions. To examine potential curvilinear growth patterns, a quadratic growth term was also estimated for each individual. Linear and quadratic growth models were compared based on their fit indices to determine whether developments showed a linear or quadratic growth pattern. Next, to examine the extent to which developments in one subject domain were related to another subject domain, multivariate LGCA models were estimated to estimate the standardized and unstandardized cross-domain relations between intercepts and slopes. The standardized coefficients of the cross-domain relations give an indication of the strength of these relations. Standardized coefficients of 0.1, 0.3, and 0.5 are indicative of small, medium, and large effects, respectively (Cohen, 1988). In the analyses, we corrected for the multilevel structure of the data.

To examine the third research question on relations between domain-specific motivation and achievement growth, multivariate LGCAs were performed. In these models, the intercepts (initial level) and slopes (growth a year) – and quadratic growth terms if they were applicable – of each motivational construct and growth in language or mathematics achievement were related to each other, while controlling for gender, ethnicity, SES, and cognitive ability. The estimated relationships between the initial levels of motivation and achievement are comparable with the relationships that can be examined in cross-sectional data. The longitudinal nature of these data, however, also allowed for examining the relationships between slopes, that is, whether developments in motivation over time related to developments in achievement. To compare the strength of the within-domain relations with the between-domain-relations equality constraints were added to the relations between intercepts and between slopes, which were then removed one by one. Model fit was determined at each step. Because our primary aim was to compare subject domains, only direct associations between the intercept and slope of each motivational constructs and the intercept and slope achievement growth were examined even though motivated behaviors (effort) can function as a mediator between motivational beliefs (goal orientations, self-efficacy) and achievement (Pintrich, 2004).

3. Results

3.1. Domain-specificity and developments over time

For each motivational construct, two models were estimated and compared by means of confirmatory factor analyses (CFA). The first (1a) was a domain-general model with one latent factor per measurement on which all language and math items jointly loaded. The second was a domain-specific eight-factor model (1b) in which items for language and mathematics loaded on separate factors. Table 3 reports the fit statistics of the domain-general and domain-specific models. The results demonstrated that for each of the motivational constructs, the domain-specific eight-factor model had much better fit to the data than the domain-general four-factor model.

In the domain-specific models, the strength of the cross-domain associations was examined and compared across measurement waves. The cross-domain associations were held equal across measurement waves, unless model fit significantly improved by releasing the equality constraint. Note that the fit statistics of the domain-specific models in Table 3 refer to the final models in which equality constraints are released where needed. Table 4 and Fig. 2 show the degree of domain-specificity of each motivational construct during the four measurement waves. The figure shows that achievement goals had the highest domain-generality, whereas effort and self-efficacy were more specific across the two subject domains. For both mastery and self-efficacy, the degree of domain-specificity remained similar during all four measurement waves. The degree of domain-specificity did not change much over time for the other motivational constructs, but some significant differences were found. The cross-domain association of performance-approach goals was significantly lower at the last measurement compared to the previous three measurements. The cross-domain association of performance-avoidance goals was significantly higher at the first measurement compared to the last three measurements. Also the cross-domain association of effort was significantly higher at the last two measurements, compared to the first two measurements.

Table 4
Cross-domain correlations: standardized path coefficients.

	Start grade 5	Middle grade 5	Start grade 6	Middle grade 6
Self-efficacy	0.49	0.49	0.49	0.49
Mastery	0.64	0.64	0.64	0.64
Performance-approach	0.86	0.86	0.86	0.83
Performance avoidance	0.81	0.75	0.75	0.75
Effort	0.55	0.55	0.60	0.60

3.2. Cross-domain associations between developments in domain-specific motivational constructs

To examine cross-domain associations between developments in domain-specific motivational constructs, first univariate growth curves were fitted to the data. Means, variances and fit statistics for the final models are displayed in Table 5. All models fitted the data good to reasonably well. For most motivational constructs, linear growth curves fitted the data better than a quadratic growth curve, indicating that these motivational constructs developed linearly over time. A linear increase was found for self-efficacy language, and linear declines were found for all goal constructs in both domains and effort in mathematics (see Fig. 3). Quadratic growth models fitted slightly better than linear models for self-efficacy in mathematics which showed a very small increase which leveled off after the second measurement and effort in language which showed a very slight 'n'-shaped growth pattern.

Table 6 reports the outcomes of multivariate latent growth curve models in which cross-domain associations between intercepts and

Table 3
Fit indices for the domain-general and domain-specific models.

	Domain-general model				Domain-specific model			
	χ^2	(df)	RMSEA	CFI	χ^2	(df)	RMSEA	CFI
Self-efficacy	3987.914	684	0.083	0.769	1486.083	665	0.042	0.943
Mastery	4165.367	684	0.086	0.791	1749.713	664	0.049	0.935
Performance-approach	4586.688	1014	0.071	0.859	2879.759	994	0.052	0.926
Performance-avoidance	5205.241	1014	0.077	0.799	3134.814	994	0.056	0.897
Effort	4013.731	1014	0.065	0.780	2001.501	994	0.038	0.926

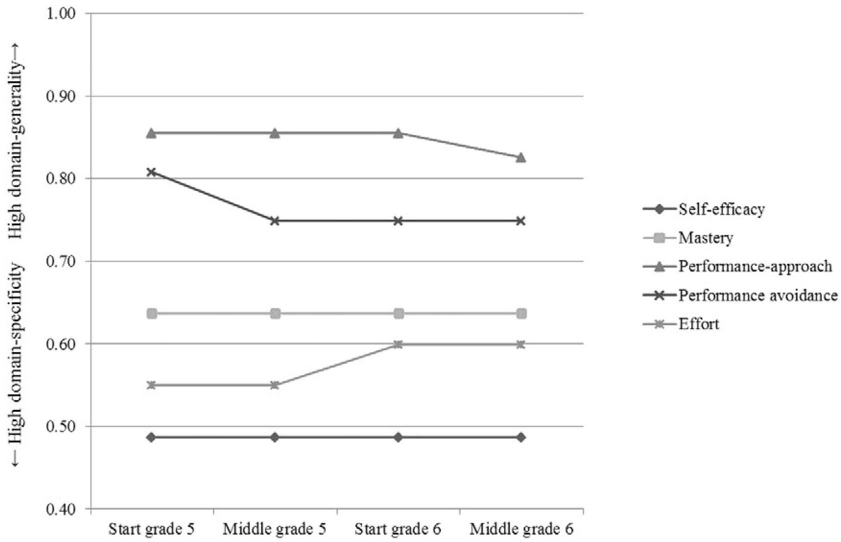

Fig. 2. Degree of domain-specificity per measurement wave.

slopes were estimated. Models in which also the quadratic growth terms of self-efficacy mathematics and effort in language were included showed worse fit to the data than models in which only linear growth was estimated. Also, the quadratic growth terms both did not have significant variance. Quadratic growth terms were therefore not taken into account in the multivariate models. Strong cross-domain associations were found between the intercepts. More specifically, standardized path coefficients for cross-domain relations varied between 0.55 and 0.96. The standardized path coefficients for the relations between the slopes were even stronger (0.86 to 1.22). Developments in motivation in one domain were thus highly likely to co-occur with similar developments in the other domain. These strong associations suggest that although factor analyses support the domain-specific nature of motivational constructs, there is a high degree of generality in the development of motivational constructs across language and mathematics domains for students in primary school.

3.3. Unique predictive validity of (developments in) domain-specific aspects of motivation and achievement growth

To examine the strength of the associations between developments in the domain-specific aspects of motivation and achievement growth, multivariate models that included achievement growth in language and mathematics were estimated. In these models, we controlled for gender, ethnic background, SES, and cognitive ability. Non-significant paths were omitted from the models. Table 7 shows the outcomes for these analyses. All the final multivariate models fitted the data well. Overall, within-domain relations between motivation and achievement (i.e. associations between motivation for math and achievement in math; and associations between motivation for language and achievement in language) were stronger than between-domain relations between motivation and achievement (i.e. motivation in math and achievement in language and vice versa) or the between-domain relations were not significant at all as can be seen in Table 7. In order to allow for comparisons across the subject domains, unstandardized estimates were compared. Table 7 reports both standardized and unstandardized estimates of the covariances between developments in motivation and achievement.

Overall within-domain associations between motivation and achievement were stronger than between-domain associations. There were some deviations from this pattern, but in general it was found that domain-specific aspects of motivation were more strongly associated with achievement growth in the corresponding subject domain than in the non-corresponding subject domain. The standardized coefficients show that the effect sizes were moderate to strong. For mathematics, moderate to strong relations were found between the intercepts of the motivational constructs and achievement. Somewhat stronger relations between motivation and achievement were found within the domain of mathematics compared to language.

4. Discussion

The aim of the present study was to provide a deeper understanding of developments in domain-specificity of motivation in upper primary school. By longitudinally assessing multiple aspects of domain-specificity, it was found that motivational constructs in language and mathematics were domain-specific in nature and mostly predicted achievement growth in corresponding subject domains. However, the

Table 5
Unstandardized means and variances for the univariate latent growth curves and model fit statistics.

	Means (standard errors)			Fit indices		
	Int	Slope	Quadr.	χ^2 (df)	RMSEA	CFI
Self-efficacy language	3.64 (0.04)	0.07 (0.03)	–	20.616 (5)	0.066	0.97
Self-efficacy mathematics	3.68 (0.04)	0.34 (0.09)	−0.19 (0.06)	0.176 (1)	0.000	1.00
Mastery language	3.90 (0.04)	−0.12 (0.04)	–	18.078 (5)	0.060	0.97
Mastery mathematics	4.04 (0.03)	−0.10 (0.03)	–	23.903(4)	0.083	0.95
Performance-approach language	3.10 (0.04)	−0.35 (0.04)	–	15.687 (2)	0.097	0.97
Performance-approach mathematics	3.07 (0.05)	−0.26 (0.05)	–	10.929 (3)	0.061	0.99
Performance-avoidance language	2.20 (0.04)	−0.31 (0.03)	–	10.980 (3)	0.061	0.98
Performance-avoidance mathematics	2.12 (0.04)	−0.24 (0.03)	–	7.900 (5)	0.028	0.98
Effort language	3.34 (0.03)	0.25 (0.12)	−0.22 (0.09)	4.061 (1)	0.065	0.99
Effort mathematics	3.70 (0.04)	−0.08 (0.03)	–	21.526 (5)	0.068	0.96

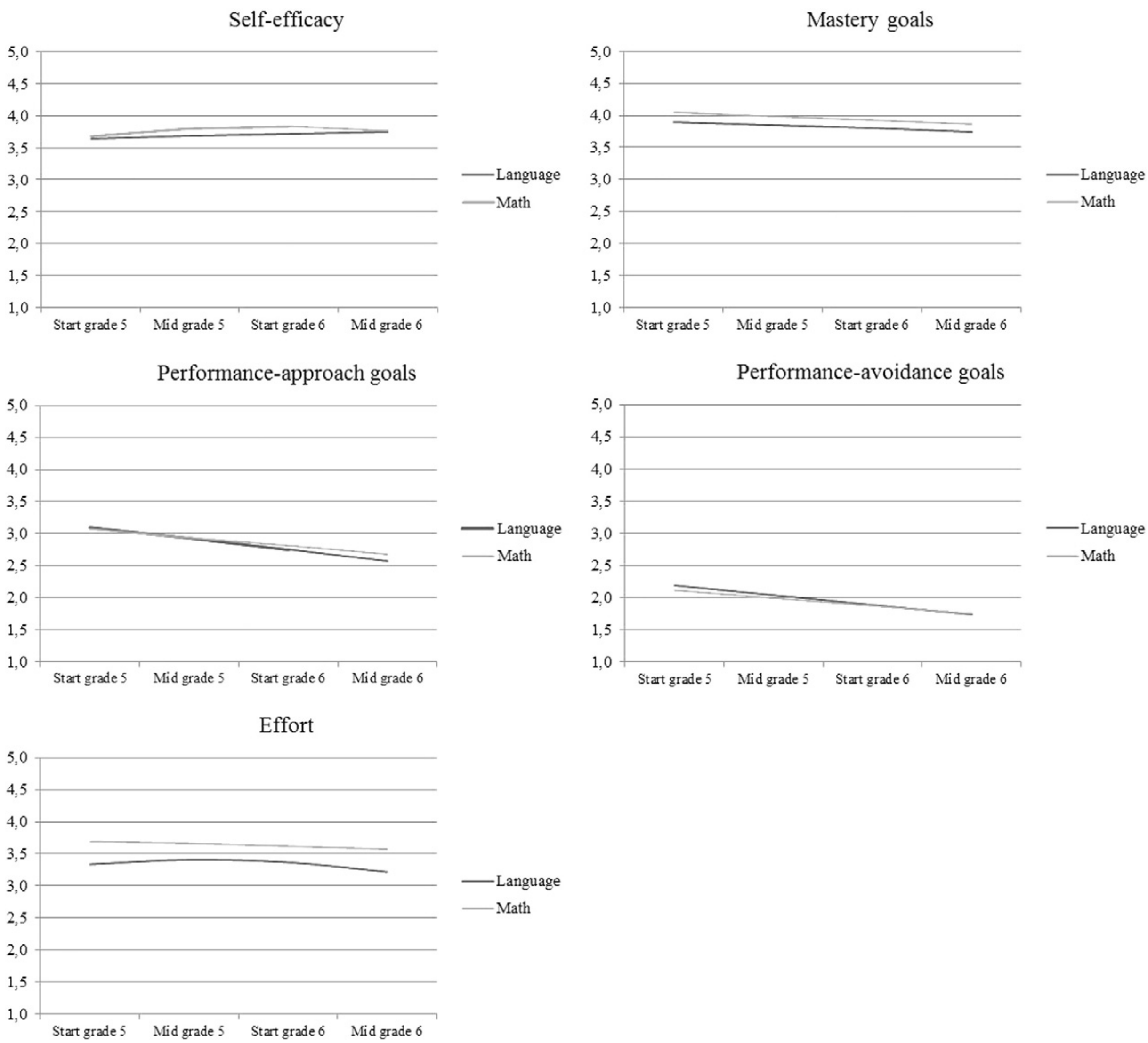

Fig. 3. Growth curve trajectories of domain-specific motivational constructs.

degree of domain-specificity was limited, especially for achievement goals, and appeared to be lower in upper primary school compared to previous studies in secondary school and beyond. The results indicated that the degree of domain-specificity depended on the nature of the motivational construct and changed with age. Below, these results are discussed in more detail.

Through its longitudinal nature this study provided new insights into the issue of domain-specificity of motivation. Substantial cross-domain correlations were found at each separate measurement wave, but especially the strong associations between *developments* in motivational constructs across domains suggest that developments in motivation in different domains do not occur independently. This indicates that the degree of domain-specificity appears to be more limited than what is usually found in cross-sectional studies. This contrasts previous studies conducted in secondary school or beyond (e.g., Bong, 2001; Duda & Nicholls, 1992; Green et al., 2007). As such this study also provides further support for the view that domain-specificity develops with age.

Furthermore, consistent with previous research (Bong, 2001; Green et al., 2007), the domain-specificity of students' motivation was found to vary per motivational construct. Especially achievement goals appeared to have a high degree of generality. Although achievement goals mostly predicted achievement outcomes within specific domains

Table 6
Multivariate growth models of cross-domain relationships: Standardized and unstandardized path coefficients are displayed with standard errors in parentheses.

	Standardized path coefficients		Fit indices		
	Intercepts	Slopes	χ^2 (df)	RMSEA	CFI
Self-efficacy	0.55** (0.06)	0.87** (0.19)	49.438* (18)	0.049	0.980
Mastery	0.70** (0.06)	0.86** (0.12)	42.978 (18)	0.044	0.979
Performance-approach	0.82** (0.04)	0.87** (0.06)	100.214 (17)	0.082	0.964
Performance-avoidance	0.96** (0.05)	1.22** (0.27)	49.033 (18)	0.047	0.972
Effort	0.58** (0.09)	0.86** (0.14)	61.100 (18)	0.058	0.966

Note. Quadratic growth terms were not taken into account in the multivariate models, because variances of the quadratic were non-significant and including them decreased model fit.
* $p < 0.05$.
** $p < 0.001$.

Table 7
Multivariate growth models of the within- and between-domain relationships between developments in motivation and achievement: Standardized and unstandardized path coefficients are displayed with standard errors in parentheses.

	Unstandardized coefficients				Standardized coefficients							
	Within-domain		Between-domain		Within-domain		Between-domain		Fit indices			
	Intercepts (SE)	Slopes (SE)	Intercepts (SE)	Slopes (SE)	Intercepts (SE)	Slopes (SE)	Intercepts (SE)	Slopes (SE)	χ^2	(df)	RMSEA	CFI
Self-efficacy language	1.57** (0.37)	0.24* (0.08)	0.90* (0.42)	0.24* (0.08)	0.33* (0.07)	0.34* (0.13)	0.23* (0.10)	0.34* (0.14)	251.277	(135)	0.041	0.959
Self-efficacy math	2.61** (0.58)	0.48** (0.14)	1.28* (0.42)	ns	0.58* (10)	0.53* (0.16)	0.24* (0.07)	ns				
Mastery language	ns	0.20* (0.07)	ns	0.20* (0.07)	ns	0.38* (0.29)	ns	0.30* (0.15)	302.431	(141)	0.047	0.942
Mastery math	1.05* (0.41)	0.35* (0.11)	ns	ns	0.21* (0.08)	0.53* (0.21)	ns	ns				
Performance-appr. language	ns	ns	ns	ns	ns	ns	ns	ns	324.371	(140)	0.050	0.953
Performance-appr math	1.54* (0.46)	ns	ns	ns	0.22** (0.06)	ns	ns	ns				
Performance-av. language	−1.50** (0.40)	ns	ns	ns	−0.26** (0.06)	ns	ns	ns	243.064	(139)	0.038	0.965
Performance-av. math	ns	ns	−1.40* (0.45)	ns	ns	ns		ns				
Effort language	0.63* (0.25)	0.21* (0.09)	ns	0.21* (0.09)	0.18* (0.07)	ns	ns	0.31* (0.14)	307.221	(136)	0.049	0.936
Effort math	1.07* (0.36)	0.30* (0.11)	ns	0.30* (0.11)	0.29* (0.08)	0.51* (0.21)	ns	ns				

* $p < 0.05$.
** $p < 0.001$.

and the factor analyses suggested domain-specific models of achievement goals, domain-general models also fitted the data reasonably well and the cross-domain correlations as well as the similarity in developments across domains suggest high generality. As such, this study adds to research on achievement goals by showing that especially in primary school, achievement goals could be considered personal dispositions of students, rather than domain-specific or situational beliefs. For effort, the degree of domain-specificity was much more substantial than domain-specificity of the achievement goal constructs. This supports the view of effort as a limited resource (Carbonaro, 2005). Furthermore it was found that domain-specificity of effort decreased, indicating that the amount of effort students invest in their schoolwork initially differs more across domains but becomes a bit more general over time. For younger students, the degree of effort they report may mostly reflect or depend on the extent to which they have interest in a particular subject. When students become older and get more control over their own schoolwork, it could be that other more general factors, such as personality characteristics, work ethics, or parental support, may become more crucial in explaining the degree of effort students put into their schoolwork causing effort to become more general.

Compared to the other motivational constructs, self-efficacy had the highest degree of domain-specificity. The relatively high degree of domain-specificity supports the application of the I-E model to self-efficacy and implies that students may partly base their self-efficacy judgments on an internal frame of reference (Marsh, 1990), such that students may compare their efficacy in one domain to another subject domain. Additionally, the dimensional comparison theory (Marsh et al., 2015) states that this would hold only for subject domains that are not closely related, as is the case in this study that focuses on motivation for language and mathematics. This means that students may base their self-efficacy judgments partly on contrasting their abilities in these subject domains.

In addition, it was examined whether domain-specificity of motivational beliefs (self-efficacy and achievement goals) and effort would change over time and depend on students' age. Domain-specificity of performance-approach and performance-avoidance goals was indeed found to increase slightly over time, supporting the assumption that when students grow older, they become more aware of their strengths, difficulties, and interests (Harter, 1983; Krapp, 2002). Also changes in the school context may contribute to heightened awareness of one's abilities and interests. The changes in domain-specificity of motivational beliefs during this study were rather small, perhaps due to the relatively small time span of the study. The fact that the cross-domain correlations appear to be higher than in previous studies (e.g., Bong, 2001; Duda & Nicholls, 1992; Green et al., 2007) with older students does however provide some further support for the assumption that domain-specificity of motivational beliefs develops with age. Alternatively, it could be that domain-specificity is lower in primary school because students are taught all subjects by the same teacher in contrast to secondary school where students are usually taught different subjects by different teachers and where teacher and subject effects are consequently confounded.

The results of this study also provide some insight into mean-level developments in motivation in upper primary school. Even though the degree of domain-specificity differed by motivational construct and varied over time, developmental trends were mostly similar for language and mathematics. Mean levels of achievement goals and effort all declined in both subject areas. Self-efficacy on the other hand slightly increased in both subject areas. The declines that were found for achievement goals and effort correspond to previous research on developments in students' motivation (Hornstra et al., 2013; Paulick, Watermann, & Nückles, 2013; Peetsma & van der Veen, 2011; van der Veen & Peetsma, 2009). Motivation for mathematics tended to be somewhat higher than motivation for language, which is in line with Skaalvik and Valås (1999), but contrasts with other studies that found mean levels of language motivation to be higher than mathematics motivation (Bong, 2001; Gottfried, Fleming, & Gottfried, 2001). Also in line with previous research (Wigfield & Cambria, 2010), motivational developments were related to achievement growth, beyond effects of cognitive abilities, ethnic background, SES, and gender. These associations were stronger for mathematics than for language. This could suggest that language achievement depends less on students' motivation than mathematics achievement. This could also be a result of how the motivation and achievement measures in both domains aligned. With regard to mathematics, students were asked about their motivation for mathematics and the achievement test measured their mathematics performance, whereas in the domain of language, students' motivation for language was assessed and achievement in language was measured by a reading comprehension test. Because reading comprehension only captures a part of the subject domain of language, it could be that alignment in the language domain was lower than that for mathematics.

Some limitations of the study need to be acknowledged. First, students' motivation was studied during two school years. Although this was hypothesized as a crucial period for the development of domain-specificity, this may also be a rather short period for studying changes in domain-specificity as a function of age. Even though significant changes over time were found in the degree of domain-specificity, it has to be noted that these changes were rather small and were not found for all motivational constructs. It is expected that if longer periods are studied or if developments across school transitions are included in future research even more substantial changes in domain-specificity will be found. Additionally, only two academic subject domains, mathematics and language, were included, and results may be different if other subject domains are compared (Marsh et al., 2015). Another limitation to this study is that it entirely relies on self-report measures. This is also the case for previous research on domain-specificity of motivation. Observational studies comparing students in different settings or studies that include multiple informants (teachers, peers) could add to the understanding of the domain-specificity of motivation. Last, the high correspondence between the slopes of performance-avoidance goals, may have lead to multicollinearity in the subsequent multivariate analyses. Multicollinearity can produce large standard errors in the outcome variables and as such, may have lead to an underestimation of the associations between performance-avoidance goals and achievement outcomes.

Overall, this study shows that domain-specificity is an intricate phenomenon that depends on a complex interplay of factors, including the specific nature of motivational constructs and students' age. It appears that motivational beliefs are more general for students in primary school, compared to studies in secondary and higher education. From a methodological perspective, these results suggest the need for researchers to carefully consider the use of domain-specific or domain-general measures based on the nature of the motivational construct and respondents' age. From a more practical perspective, this study adds to other studies that contrast the commonly held view of many teachers and practitioners that motivation is a single domain-general habitual attribute of students (see for example, Nespor, 1987; Patrick & Pintrich, 2001). On the contrary, motivational constructs, especially students' self-efficacy and effort, can vary across domains and motivation can develop over time. For many students, several aspects of their motivation were found to develop negatively during the last years of primary school. This shows that declining motivation can have its onset already in primary school and that teachers need to be aware of students potentially at risk for declining motivation. When designing motivational interventions or counseling programs to counteract these declines in motivation, it is important for teachers and practitioners to take domain-specificity into consideration, especially concerning self-efficacy or effort (for examples of motivational interventions, see the meta-analysis by Lazowski & Hulleman, 2016). The outcomes of this study suggest that teachers need to carefully diagnose in which domain(s) their students may show declining self-efficacy or effort, and to address these problems specifically within that domain. Decreasing effort in math for example may be targeted domain-specifically by enhancing a students' interest in math, whereas the outcomes suggest that more general interventions may be less effective with regard to effort or self-efficacy. When students' achievement goals are developing in non-optimal ways, an intervention that targets achievement goals in a more general way may be the most suitable (see for example O'Keefe, Ben-Eliyahu, & Linnenbrink-Garcia, 2012). Hence, depending on the nature of the motivational constructs and students' age, domain-specific interventions may be more effective than general interventions. In all, the findings of this study suggest that it is of critical importance for researchers, teachers and other practitioners to be aware of the complexity regarding the domain-specificity of motivation.

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