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# Consistency, longitudinal stability, and predictions of elementary school students' task interest, success expectancy, and performance in mathematics

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ABSTRACT

This study examined cross-task consistency and longitudinal stability in elementary school students' task interest, success expectancy, and performance from fourth to sixth grade, and their predictive effects on sixth-grade intrinsic value, self-concept, and achievement in mathematics. The results demonstrated consistency in interest, success expectancy, and performance across tasks and stability over time, and these to predict domain-specific motivation and achievement. Virtually no evidence for reciprocal effects was found for task-specific measures, as only previous task performance predicted change in later success expectancy. Cross-lagged effects were observed, however, for predictions of task motivation and performance on domain-specific motivation and achievement, so that success expectancy predicted intrinsic value, interest predicted self-concept, and task performance predicted both self-concept and achievement. Based on the findings, it would seem that students' task-related motivational experiences are associated with their domain-specific beliefs, and that those, in turn, are to some extent manifested in students' task motivation.

## 1. Introduction

Students' incentives for engaging in learning activities and the way they perceive their competence are important motivational precursors of achievement outcomes, including school performance (e.g., grades; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005) and educational choices (e.g., choosing non-compulsory courses; Simpkins, Davis-Kean, & Eccles, 2006). These effects also seem to apply to performance in specific tasks (e.g., task interest and self-efficacy in a problem-solving task; Niemivirta & Tapola, 2007) and to achievement in different subject areas (e.g., value and self-concept in reading; Schoor, 2016), among younger students (Eccles & Wigfield, 1993) as well as older students (Guo, Parker, Marsh, & Morin, 2015). Longitudinal studies have been conducted on the development of domain-specific motivation (i.e., students' relatively stable motivational beliefs in relation to a subject domain such as mathematics; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002) and its relations to achievement (Arens et al., 2017; Seaton, Marsh, Parker, Craven, & Yeung, 2015), but regarding task-specific motivation, research seems to have focused on single tasks or situations (Ainley, 2006). Relatively few studies have looked at the consistency of task motivation across tasks or stability over time, or its predictions on domain-specific motivation and achievement within a longer time span (Fryer, Ainley, & Thompson, 2016; Rotgans & Schmidt, 2011). The available work has mainly focused on out-of-school settings (e.g., extra-curricular courses) and older students (e.g., Knogler, Harackiewicz, Gegenfurtner, & Lewalter, 2015). As it is often argued that domain-specific motivation (e.g., intrinsic value and self-concept in mathematics) accumulates through repeated experiences in tasks and situations that reflect certain subject areas and related activities (Bong & Skaalvik, 2003; Hidi & Renninger, 2006), it would seem reasonable to investigate whether students' task-specific motivation generalizes across different tasks, and whether they predict similar experiences and domain-specific motivation over time.

Accordingly, the aim of the present study was to examine i) the consistency of students' interest, success expectancy, and performance across different tasks (i.e., cross-task consistency) and over time (i.e., longitudinal stability), ii) their longitudinal reciprocal relationships, and, iii) their predictions on intrinsic value, self-concept, and

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achievement in mathematics. The effects of gender were also taken into account.

### 1.1. The dynamics of task motivation and performance

Task motivation refers to students' motivational states (e.g., interest, boredom; e.g., Ainley, 2006) and self-appraisals (Zimmerman, 2000) in relation to a specific task such as calculations in a mathematics class. In this study, we will focus on students' task interest and task-specific success expectancy,[1] which are known to have both independent (Lee, 2009; Linnenbrink-Garcia et al., 2010) and joint effects (Niemivirta & Tapola, 2007) on task performance. Task interest (e.g., Graham, Tisher, Ainley, & Kennedy, 2008; also referred to as situational interest; Ainley & Hidi, 2002) is best described as a momentary state of heightened attention and enjoyment triggered by the interaction between the characteristics of the task and the student, which could be short-lived or last until finishing the task. Success expectancy, in turn, is defined as a person's belief about their success in a task (Eccles et al., 1983; related to, and often equivalently used as self-efficacy, which is defined as an individual's confidence in being able to orchestrate and execute actions required for achieving intended results; Bandura, 1986).

With regard to task interest and its outcomes, it is often intuitively assumed that higher interest should enhance performance, but the empirical findings have been mixed. While task interest appears in some cases to enhance task performance (Vainikainen, Salmi, & Thuneberg, 2015), memorizing and text comprehension (Hidi, 2001), and persistence (Thoman, Sansone, & Pasupathi, 2007), interest evoked by seductive details may also hinder performance (Wang & Adesope, 2016). Then again, it is also possible that task interest does not predict task performance directly, but through students' involvement or engagement in the task (Rotgans & Schmidt, 2011). Task performance does not seem to predict subsequent interest independently either (Shen, Chen, & Guan, 2007), although they often are correlated (Jansen, Lüdtke, & Schroeders, 2016). Also, while prior knowledge can facilitate the triggering of task interest (Logtenberg, van Boxtel, & van Hout-Wolters, 2011; Niemivirta & Tapola, 2007), it can also diminish it, if the task is perceived as too easy (Rotgans & Schmidt, 2014).

As to the relationship between success expectancy and task performance, the limited findings available suggest it to be reciprocal, although the empirical evidence is surprisingly sparse (see, Williams & Williams, 2010). This is nevertheless in line with the theoretical assumptions (Schunk & DiBenedetto, 2016), and also echoes the findings from the reciprocal effects model as applied to domain-specific motivation (Marsh & Martin, 2011). The underlying logic here would be that performances viewed as successful raise success expectancy, and perceived failures, by contrast, lower success expectancy. Success expectancy, in turn, enhances performance, as individuals with high success expectancy tend to apply more sustained effort, and they appear to be able to do so even in the face of boredom or other distractions (e.g., Honicke & Broadbent, 2016).

In empirical research, interest and success expectancy have often been found to be correlated, and one explanation for this is that some level of certainty or confidence in one's competence is a prerequisite for interest to arise in the first place (e.g., Bandura, 1986; Silvia, 2003), and positive self-appraisals are likely to enhance positive emotions and to diminish negative feelings (Chen et al., 2016; Tanaka & Murayama, 2014). Then again, positive emotions and interest may boost effort and commitment (Patall, Vasquez, Steingut, Trimble, & Pituch, 2016), thus resulting in experiences of success, which, in turn, may amplify sense of efficacy (Bandura, 1978). The causal relationships between interest, success expectancy, and performance are not clear, although findings from studies looking at their longitudinal relationships seem to support reciprocal effects, with competence perceptions having a stronger effect on achievements and interest than vice versa (Marsh et al., 2005). Other findings, however, complicate the picture. For example, in a study on the dynamics of task-specific motivation, Niemivirta and Tapola (2007) found that in addition to cross-sectional relations, also the changes across the task in interest and self-efficacy were strongly correlated (i.e., change in interest paralleled the change in self-efficacy), and, even more importantly, that the initial level of self-efficacy (but not the change in it) and the change in interest (but not the initial level of it) independently predicted task performance. In a recent study by Fryer et al. (2016) on university students' second language learning, self-efficacy positively predicted competence after the course (i.e., performance in a standardized language test), as did course interest, but task interest at the end of the course did not. Initial self-efficacy also predicted change in task interest over an eight-month period. Linnenbrink-Garcia, Patall, and Messersmith (2013), instead, found in their study on a summer science course that triggered situational interest (i.e., temporary affective state evoked by the context; Hidi & Renninger, 2006) predicted self-efficacy at the end of the course, whereas maintained situational interest (i.e., sustained involvement in and enjoyment of the task content) did not.

In a more recent study, Chen et al. (2016) investigated the predictive effects between situational interest (triggered and maintained) and self-efficacy during a ten-day science intervention. The results showed these to be reciprocally related, and maintained interest to have stronger effect on post-intervention self-efficacy than triggered interest. However, neither of the above two studies measured actual performance or achievement.

### 1.2. The cross-task consistency and longitudinal stability in task motivation and performance

Although students' domain-specific motivation seems rather stable over time (Spinath & Steinmayr, 2008), it is less clear whether and to what extent the same applies to task motivation. It is often assumed, at least implicitly, that psychological experiences during a task, such as interest, are specific to the task and thereby 'unique' and transient (Renninger & Hidi, 2011). Simultaneously, however, it would also be reasonable to argue that students' domain-specific motivational beliefs and other individual tendencies provide the motivational lenses through which one perceives the different situations (Boekaerts & Niemivirta, 2000), thus increasing the likelihood of consistency and stability in task motivation, particularly within a specific subject domain.

Current findings on task interest suggest there to be both task-specificity and cross-task consistency. Students' interest (i.e., mean level) does fluctuate during a task (Niemivirta & Tapola, 2007) as well as across different tasks (Graham et al., 2008) and learning activities (Palmer, 2009; Rotgans & Schmidt, 2011). However, there also seems to be relatively high stability in interindividual differences (i.e., rank-order between students) within and across tasks, at least when the time span between the measurements is relatively short (e.g., tasks are done within one learning session; Rotgans & Schmidt, 2011). As most existing studies have focused on a rather short time span, more is to be learned about the stability in task-related interest over extended periods of time.

Knogler et al. (2015) directly addressed the question of cross-situational consistency and situation-specific variability in interest across different learning activities (e.g., information gathering and role play) over a time period of three weeks. Compared to previous findings (e.g., Rotgans & Schmidt, 2011), they detected less consistency in situational interest, and that even this observed stability was largely explained by

[1] Studies examining the expectancy and value components of motivation often focus on conceptually different but related constructs. Thereby, even though our empirical focus is on individuals' task-specific experiences of interest (e.g., *"The task was interesting"*; Durik & Harackiewicz, 2007) and expectations of success (e.g., *"I performed well in the task"*; Seegers, van Putten, & de Brabander, 2002), we will in our review also consider studies investigating other similar constructs, and thus generalize from these results in order to draw conclusions about previous findings.