



Cross-lagged relations between math-related interest, performance goals and skills in groups of children with different general abilities[☆]



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ABSTRACT

This study examined the longitudinal relations among math-related interest, performance goals, and math skills in different ability groups. The participants were 790 Estonian children who were assessed at Grade 2 and Grade 3. The results of SEM analysis showed that previous math skills predicted positively math interest and negatively performance-avoidance goals at Grade 3. Also, Grade 2 performance-avoidance goals were negatively related to subsequent interest towards math. Comparing low-ability students with other students indicated that Grade 3 interest was positively predicted by previous skills, and negatively by performance-approach and -avoidance goals specifically in low-ability group. The results have a practical value, emphasizing the crucial role of math-related skills and goals in the development of young students' interest and goals in math and indicating that relations among interest, goals, and skills in math may be stronger for low-ability students.

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1. Introduction

Students' interest and performance goals are recognized as central motivational constructs, reflecting students' purposes and reasons behind activities apparent in achievement-related situations (Wigfield & Cambria, 2010). Previous research has indicated that children's interest in academic subjects tends to be relatively high at school entry but declines during the primary grades (Fredricks & Eccles, 2002; Gottfried, Fleming, & Gottfried, 2001; Jacobs, Lanza, Osgood, Eccles & Wigfield, 2002; Watt, 2004). While decreases in academically adaptive achievement goals and increases in maladaptive achievement goals have been explored (for an overview see Wigfield, Eccles, & Rodriguez, 1998) the factors contributing to these changes in motivational constructs are not fully understood for primary grades.

One factor that has a role in students' later motivation is student's level of academic skills (for math skills and interest see Fisher, Dobbs-Oates, Doctoroff, & Arnold, 2012). Although the crucial role of math skills in the later school achievement in general is acknowledged

(Duncan et al., 2007; Siegler et al., 2012) there is a lack of longitudinal studies focusing on the relation between math skills, interest and goals. Understanding the relations between motivational constructs and academic skills, specifically in the early school years, can help support students' later academic development. Interrelations among interest, performance goals, and academic achievement have been recently examined (e.g., Conley, 2012; Hulleman, Durik, Schweigert, & Harackiewicz, 2008), but these studies have not targeted students under the age of 10 (according to the review by Huang, 2011). Also, only a few studies have been carried out to assess the longitudinal reciprocal relationship between single motivation constructs and math skills in primary grades in recent years (Hirvonen, Tolvanen, Aunola, & Nurmi, 2012; Mägi, Lerkkanen, Poikkeus, Rasku-Puttonen, & Kikas, 2010; Viljaranta, Lerkkanen, Poikkeus, Aunola, & Nurmi, 2009). To the best of our knowledge, no studies have examined the relations between interest, achievement goals, and skills simultaneously. Integration of the most studied and somewhat overlapping theories, the treatment of interest value from expectancy-value theory (Wigfield & Eccles, 2000) and performance goals from achievement goal theory (Pintrich, 2000), enables to cover motivational patterns of young students more comprehensively than just drawing on one framework (e.g. Hulleman et al., 2008; Spinath & Spinath, 2005).

Another important factor to consider when studying the development of skills and motivation includes general cognitive abilities (for math see Spinath, Spinath, Harlaar, & Plomin, 2006; Taub, Floyd, Keith, & McGrew, 2008). The effect of general ability or intelligence on achievement appears to be stronger than the effect of motivational

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constructs (Gagné & St Père, 2001; Spinath et al., 2006). Still, the effect of motivational constructs on achievement is of greater practical interest, as these constructs are more easily modifiable than abilities (e.g., Midgley, Anderman, & Hicks, 1995). Besides the direct effect of ability on achievement, relations between motivation and achievement may differ in groups of students with different general abilities. For instance, intelligence has been shown to moderate the effect of motivation-regulation strategies on achievement in high school students (Schwinger, Steinmayr, & Spinath, 2009). Relations between motivation and achievement have been examined in groups of children with different skill levels (e.g., Bodovski & Farkas, 2007). Other authors have raised questions about group differences in motivational patterns and their relations with academic skills in the context of poorer school achievement (Wentzel & Wigfield, 2007). These works pose a question of whether mutual relations between motivational constructs and academic skills differ in different general ability groups during primary grades. As low-ability students are specifically vulnerable for school failure, understanding these relations may lead to strategies supporting their academic development during the early school years.

Consequently, the aim of the present study was to examine longitudinal interrelations among math-related interest, performance goals, and math skills in primary grades, and to examine any group differences.

1.1. Interest and math skills

Interest value, in expectancy-value theory, refers to both liking being engaged in the activity and being interested in the subject matter (Eccles & Wigfield, 2002). So, interest can be perceived as doing something because of liking and enjoyment, as it is accompanied by attention, concentration, and positive affect (Hidi, 2006). With added school years, interest in math tends to decline (Fredricks & Eccles, 2002; Frenzel, Goetz, Pekrun, & Watt, 2010), but this decline is not shown as unavoidable during the early school years (Wigfield et al., 1997). Interestingly, it is proposed that changes in math interest across the school years are related to changes in math achievement (Gottfried, Marcoulides, Gottfried, Oliver, & Guerin, 2007). Children with higher math skills might enjoy completing tasks because they get positive feedback that in turn creates positive feelings and higher self-confidence (cf. Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Thus, they may also become more interested in doing math. Higher interest supports engagement, achievement and persistence in completing school tasks (Eccles & Wigfield, 2002; Renninger, Even, & Lasher, 2002). Studies have confirmed that the development of interest and skills in math are in the long term interrelated – the children who become more interested in subject matter acquire better skills, and children with better skills become more interested in subject matter later on (e.g., Aunola, Leskinen, & Nurmi, 2006; Fisher et al., 2012; Viljaranta et al., 2009).

However, some studies have not found a consistent effect of interest on subsequent math performance in primary grades (Bouffard, Marcoux, Vezeau, & Bordeleau, 2003; Gottfried, 1990). For others, the actual effects of relations found between math interest and achievement have been from nonsignificant and weak to moderate (Aunola et al., 2006; Bouffard et al., 2003; Fisher et al., 2012; Gottfried, 1990; Spinath et al., 2006; Viljaranta et al., 2009). It could be that, interest plays a higher role for children with low general ability, as they struggle with school tasks more than their abler peers. Renninger et al. (2002) argued in their qualitative study that interest might be something that helps low-ability students stay on track when learning, thereby improving their skills. So far, stronger relations between motivational constructs and achievement have been found in children with low academic pre-skills as compared with children with average or high skills. Namely, Bodovski and Farkas (2007) found that kindergarten students' effortful learning behavior (as evaluated by kindergarten teachers and related with motivation) had the largest effect on math

achievement in primary grades for students in the group with the lowest preliminary math skills. However, no studies have examined whether relations between interest and achievement are different in children with low general ability as compared to other children.

1.2. Performance goals and math skills

Performance goals form a part of achievement goals that guide how students perceive information and the meaning they give to the information, as well as the actions they choose (Kaplan & Maehr, 2007; Pintrich, 2000). More precisely, in achievement goal theory, students' personal goals are divided into mastery and performance goal orientations (Elliott & Dweck, 1988) with approach and avoidance dimensions (Elliot, 1999; Elliot & McGregor, 2001). Orientation to mastery goals (also called task or learning goals) refers to improving knowledge and understanding learned material as learning outcomes. Performance goals (also called ego or ability goals) focus on demonstrating one's competence, comparing oneself with others, and being concerned about giving an impression to others (Elliott & Dweck, 1988; Wigfield & Cambria, 2010). Students with performance-approach goals have a desire to obtain good results and to show that they outperform their peers. Students with performance-avoidance goals wish to avoid negative judgments and a perception of being less smart than other students (Midgley et al., 1998). These goals play a role in students' behavior, in learning situations and in learning outcomes, as early as the primary grades (Pintrich, 2003; Smiley & Dweck, 1994).

Although it is an important period for developing achievement goals, only a few studies have been carried out in primary grades, involving math as a variable (Bong, 2009; Mägi, Lerkkanen et al., 2010). This may be related to difficulties of assessing goals in young children. Still, it seems important to study children's own evaluations of their goals. For instance, Ross, Shannon, Salisbury-Glennon, and Guarino (2002) showed that a three-factor structure for mastery, performance-approach, and performance-avoidance goals holds up for both college and fourth grade students in the United States. Moreover, Bong (2009) showed that a four-factor model (mastery-performance and approach-avoidance dimensions) was applicable in Korean Grades 3–9. Still, in both studies, a developmental trend with the factors being less distinct in younger than older students was found, thus suggesting the need to be careful with interpretations. Using questionnaires, achievement goals have also been assessed in primary grades in Estonia, Germany, and Turkey (see respectively, Mägi, Lerkkanen, et al., 2010; Paulick, Watermann, & Nückles, 2013; Sungur & Senler, 2010). As in previously conducted studies in Estonia mastery goals have not been found to be related to achievement (Kikas, Peets, Palu, & Afanasjev, 2009; Mägi, Lerkkanen et al., 2010), we limited our study to examine only performance goals.

The findings concerning the relations between performance-approach goals and achievement have been controversial and depend on students' age (Harackiewicz, Barron, Pintrich, Elliot, & Trash, 2002; Midgley, Kaplan, & Middleton, 2001). Promoting performance approach goals at the classroom level has led to improvement of math test scores in upper elementary schools, although a negative relationship between personal approach goals and later achievement has been shown (Linnenbrink, 2005). On the other hand, Bong (2009) has suggested that performance-approach goals might become important in promoting learning starting in middle school. In primary grades, Mägi, Lerkkanen, et al. (2010) did not find any effect of performance-approach goals on math grades or skills. However, in another study, performance-approach goals were measured, without the context of a subject, and were shown to be related to students' task-avoidance behavior, which in turn predicted lower achievement (Mägi, Häidkind, & Kikas, 2010). Moreover, in middle school, students with higher performance-approach goals have been shown to set higher performance-avoidance goals for the subsequent year (Middleton, Kaplan, & Midgley, 2004). Thus, the effect of performance-approach goals on achievement may be mediated by other constructs.

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