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Changes in Achievement Values from Primary to Lower Secondary School among Students  
With and Without Externalizing Problems

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## Abstract

This study examined the effect of students' externalizing problems on changes in values that they attach to math across the transition from primary to lower secondary school. Data pertaining to externalizing problems and to intrinsic, attainment, and utility values in math were gathered using the self-ratings of students in Grades 6 and 7. The analysis involved a comparison between students who reported persistent high externalizing problems before and after the transition ( $n = 63$ ; 59% boys) and those who had low or non-existent externalizing problems before and after the transition ( $n = 1,352$ ; 50% boys). The results of a mixed-design analysis of covariance (ANCOVA) showed uniformly that students with high externalizing problems had lower intrinsic, attainment, and utility values in math than students with low or no externalizing problems. As the students progressed across the lower secondary transition, the attainment value in math showed a steeper decreasing trend in students with high levels of externalizing problems compared to the declining trajectory of students without such problems. We also found that the utility value decreased across transition, but the declining trend was steeper for students manifesting a high level of externalizing problems, particularly for boys. Overall, the results provide a better understanding of developmental trajectories of achievement values during the transition from primary to lower secondary school. Declining trends in achievement values are pronounced among students with a high level of externalizing problems, and boys with such problems are the most vulnerable group of students.

*Keywords:* Externalizing problems, achievement values, gender differences, school transition

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## **1 Introduction**

A large number of studies have focused on the transition from primary to middle or secondary schools (for a review, see Eccles et al., 1993), which typically takes place between the ages of 10 to 13 years, depending on the educational system. The evidence indicates that this transition is challenging for many students due to increasing academic demands, the exposure to a larger student body and unfamiliar teachers, and educational practices that do not optimally meet early adolescents' changing emotional, cognitive, and social needs (Eccles et al., 1993; Simmons & Blyth, 1987). A much smaller amount of research has examined the unfolding of the transition as a function of individual students' characteristics. For instance, we know very little about how students with externalizing problems navigate the transition. Yet these students have typically faced considerable academic, social, and motivational challenges in their earlier school careers and thus may be at risk for less successful negotiation of the changes associated with this educational transition. Consequently, the present study seeks to examine the extent to which externalizing problems moderate the changes in students' learning motivation, defined in terms of students' achievement values in math, during the transition from primary to lower secondary school. The study was based on a longitudinal data set following students across the secondary school transition in the Finnish educational context.

### **1.1 Secondary School Transition among Students with Externalizing Problems**

Research shows that there are systematic differences between primary and secondary classrooms and schools (Eccles & Roeser, 2009). In Finland, as in many other countries, students entering the lower secondary grades often move from a smaller primary school environment to a larger secondary school. This change in school setting is also accompanied

by transformations in social relationships with their peers (Hardy, Bukowski, & Sippola, 2002; Pellegrini & Bartini, 2000) and teachers. In primary schools, classroom teachers are responsible for the instruction of all or most subjects, whereas in secondary schools, students are instructed by a number of subject-specific teachers who are experts in their respective fields. In addition, these secondary school teachers tend to emphasise achievement orientation and performance goals more than their primary school counterparts (Anderman & Midgley, 1997). Because of the high number of students that they instruct, they are not likely to get to know their students as well as primary classroom teachers do and provide them with the same extent of individual support, resulting in a high demand for students to perform academically in an independent manner. The entrance into lower secondary school introduces students to new classroom compositions and exposes them to a larger student body, calling for adaptation that, for some students, can be challenging and difficult.

Not surprisingly, the literature documents significant negative changes in adolescents' adaptation following the secondary school transition. These changes include decreases in academic achievement (Alspaugh, 1998), increases in psychological distress and worrying (Chung, Elias, & Schneider, 1998; Zeedyk et al., 2003) and declines in self-esteem, self-efficacy, and self-concept of ability (Bouffard, Boileau, & Vezeau, 2001; Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Wigfield, Eccles, Iver, Reuman, & Midgley, 1991). The research on transition effects does not, however, only describe negative changes. Crockett and colleagues (1989, p. 182) suggest that moving out of elementary school may also "generate, mobilize, or enhance the development of internal resources and abilities." Adolescents expect leaving primary school to be somewhat stressful, but they generally consider it to be a desirable change; positive remarks by students outnumber negative comments after students have completed the entrance to lower secondary school (Berndt & Mekos, 1995; see also Gillison, Standage, & Skevington, 2008).

Prior research suggests that minority students and students with other vulnerabilities (e.g., family poverty, low parental education, and low school quality) may struggle more across the secondary school transition than other students (Benner & Graham, 2009; Burchinal, Roberts, Zeisel, & Rowley, 2008; Espinoza & Juvonen, 2011). The specific interest of the present study is on examining the transition of students with externalizing problems, which refer to a range of disruptive behaviors, such as aggressiveness, defiance, oppositional behavior, and attention deficit problems. Externalizing problems are often defined as comprising two primary externalizing domains: conduct problems and hyperactivity/inattention (Campbell, Shaw, & Gilliom, 2000; Hinshaw, 1992; McMahon, 1994). Students with high levels of such problems frequently have primary school histories that include poor relationships with teachers (Henricsson & Rydell, 2004; Pakarinen et al., 2017) and peers (Laird, Jordan, Dodge, Pettit, & Bates, 2001), increasing internalizing problems, poor academic competence (Moilanen, Shaw, & Maxwell, 2010), low persistence in learning tasks and little interest in key academic subjects, such as reading (Metsäpelto et al., 2015, 2017).

These findings are in line with suggestions that externalizing problems increase vulnerability to poor functioning in many domains of adolescents' lives (Moilanen et al., 2010). Students manifesting externalizing problems may, thus, experience even greater declines in adaptation and learning motivation after the transition than are experienced by most students. Such negative development is expected to particularly affect students who manifest a high degree of persistent problem behaviours. The present study will focus specifically on students displaying a high or very high level of externalizing problems before and after transition to lower secondary school. Although, on average, externalizing problems decrease from preschool age to young adulthood (Bongers, Koot, van der Ende, & Verhulst, 2003), the more severe problem behaviours are resistant to change and can predict a high

degree of adjustment problems later in life (Campbell et al., 2000; Moffitt, Caspi, Harrington, & Milne, 2002).

### **1.2 Changes in Achievement Values across the Secondary Transition**

According to Elder (1998), transitions, and the success with which individuals negotiate them, represent significant developmental milestones that—in case of a concatenation of disadvantages—may serve to negatively influence development and lead to an accumulation of problems. One indicator of emerging difficulties in the secondary school transition is a declining motivation to learn. In this study, we will focus on students' achievement values, which refer to students' enjoyment while performing an activity (intrinsic value), the personal importance of doing well in a task (attainment value), and importance of the activity for current and future goals (utility value) (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Achievement values are often linked to specific academic domains, with one of the key domains studied in relation to school transitions being math (Burchinal et al., 2008; Friedel, Cortina, Turner, & Midgley, 2010; Midgley et al., 1989). Although math performance builds largely on complex cognitive abilities (Taub, Keith, Floyd, & McGrew, 2008), it is also promoted by motivational processes such as a student's valuing of the math tasks, which fosters sustained engagement and persistence in those tasks (cf. Lau & Roeser, 2002).

Previous studies show that achievement values in math are negatively affected by school transitions, which may partly be explained by changes in the learning environment. For instance, Feldlaufer, Midgley and Eccles (1988) reported that after transition to junior high school, students perceived their math teachers to be less supportive than the teachers they had the previous year. Using a longitudinal sample of 9- to 17-year olds, Gottfried et al. (2001) found that intrinsic motivation in math showed the greatest decline across the transition from primary to middle school in comparison to other subjects (e.g., science and

reading). In another study, Wigfield and Eccles (1994) used a large sample of young adolescents to examine how the transition to lower secondary school affected students' valuing of different school subjects. Both the importance and the liking of English and math declined immediately after the transition, and for math, the students' importance and liking ratings continued to decrease during the first year of lower secondary school. The liking and perceived importance of English, however, were found to increase in the long run, which is indicative of the rebound effect. Together, these prior findings indicate that achievement values in math may be especially vulnerable to negative transition effects. They also suggest that the timing of data collection waves in longitudinal follow-up studies influences the findings on transition effects.

As children progress through the school system, they face an increasing emphasis on competition and evaluation, which may lead them to devalue tasks and activities in which they do not perform well (Wigfield & Cambria, 2010). Children exhibiting higher externalizing problems tend to have difficulties in developing math skills (e.g., Adams, Snowling, Hennessy, & Kind, 1999; Zimmermann, Schütte, Taskinen, & Köller, 2013), which may lead to a decreasing trajectory of intrinsic value in math. Furthermore, as part of the gradual process of disconnecting from school that eventually increases the risk of having low educational aspirations and dropping out of school (McLeod & Kaiser, 2004), students displaying externalizing problems may also have specific difficulties in sustaining utility and attainment value in math. The transition to lower secondary grades may thus entail major risks for these students in terms of how they perceive the value of math and how it fits into their future plans.

Gender may also influence how students meet the challenges of transition. As math is often regarded as a male-typed academic domain (Watt, 2004), early adolescent boys may feel pressure to conform to beliefs and values they consider appropriate to their own gender

(Hill & Lynch, 1983), leading boys to value math more than girls value it over time. Although stereotypical gender differences of this kind have been reported in some early studies (Eccles, Adler, & Meece, 1984), more recent findings have reported small or non-significant gender differences in values related to math (e.g., liking of math or ratings of its importance and usefulness) (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). In this study, we extended prior research by examining whether the effect of a student's gender on valuing of math across transition depends on the level of externalizing problems. Previous studies investigating the ways a student's gender and externalizing problems operate in unison to predict the development of achievement values across secondary school transition are absent. Consistent evidence indicates that externalizing problems are more prevalent among boys (Bongers et al., 2003), giving impetus to investigate the ways these characteristics work together in an interactive manner. Given the lack of prior findings, however, this goal was largely exploratory.

### **1.3 Aims and Hypothesis**

Three specific goals guided the present study. Our *first* goal was to investigate the changes in achievement values in math from primary to lower secondary school. Based on earlier findings (Eccles et al., 1989; Gottfried et al., 2001; Wigfield et al., 1994), we hypothesised that students' achievement values in math would be more negative in secondary school than in primary school (Hypothesis 1). The *second* goal was to investigate the extent to which students with persistent high externalizing problems and students without such problems differed in their achievement values. On the basis of earlier findings with other at-risk groups (Benner & Graham, 2009; Burchinal et al., 2008; Espinoza & Juvonen, 2011), we hypothesised that students with high externalizing problems would report more negative achievement values in math both before and after the transition than students without such problems (Hypothesis 2). We also expected that students with

externalizing problems would evidence more negative changes in achievement values when compared with students without such problems (Hypothesis 3). *Third*, we examined the extent to which the changes in achievement values varied between girls and boys. We hypothesised that gender would interact with the students' levels of externalizing problems, thus leading to different developmental trajectories in achievement values in boys and girls in the groups of students with high and low levels of externalizing problems (Hypothesis 4). Given the lack of prior studies, the direction of effect was not a priori defined. As research has indicated that prior academic performance or skills correlate with task value concerning corresponding academic tasks (Wigfield & Cambria, 2010), students' achievement levels in math were taken into account in the statistical analyses.

## **2 Method**

### **2.1 Participants and Procedure**

The participants in our current study were taken from a larger, extensive follow-up study (Lerkkanen, Niemi, Poikkeus, Poskiparta, Siekkinen & Nurmi, 2006) based on a community sample of approximately 2,000 Finnish children from four municipalities (two located in central Finland, one in western Finland and one in eastern Finland) who were being followed from kindergarten to lower secondary school. At the beginning of the study, the children's parents and teachers were asked for their written consent for their child's or their own participation in the study. The study protocol follows ethical principles for human subject research (<http://www.apa.org/research/responsible/human/index.aspx>) and was approved by the Research Ethics Committee of the University of Jyväskylä.

In the present study, we utilised data from two waves. The first data collection took place in April 2013 near the end of the participants' Grade 6 year (before transition to lower secondary school at the age of 12). The second data collection occurred one year later in April 2014 at the end of Grade 7 (at the age of 13).

The number of students with complete data on externalizing problems and achievement values in Grades 6 and 7 was 1,635. As the current study focused on high and persistent externalizing problems, the students who scored at least 1.5 standard deviation (SD) above sample mean in externalizing problems in *both* Grades 6 and 7 were defined as belonging to the group with problem behaviours ( $n = 63$ ; 59% boys). Students who scored below 1.5 SD at both measurement times were seen as having low or no externalizing problems ( $n = 1,352$ ; 50% boys, hereafter referred to as the group with *low* externalizing problems). The dichotomization (high vs. low externalizing problems) is justifiable on the grounds of externalizing problems measured in Grades 6 and 7, which had positively skewed distribution. There were a large number of students with no such problems at one end of a distribution and a long tail of children displaying a high or very high level at the other end. The students for whom externalizing problems either increased or decreased across the transition period ( $n = 220$ ; 13% of available sample) were not included in the present study. The total sample size of the present study was, thus,  $n = 1,415$  (50% boys).

In Finnish primary schools, students receive the majority of instruction by their class teacher, who teaches the same group of students each day. The transition from primary to lower secondary school involves a change from the classroom teacher system to the subject-specific teacher system. Secondary schools have different teachers for most subjects, and the transition from one type of school to the other typically brings about changes in class composition and peer group for students.

In the present study, the parents had diverse types of educational backgrounds, but the sample included a slightly higher educational level than the Finnish population as a whole (Statistics Finland, 2007): 4% had only completed their nine-year compulsory education (6% in the general population), 24% had completed secondary education (30% in the general population), 36% had a bachelor's degree or vocational college degree (35% in the

general population), and 36% had a master's degree or higher (29% in the general population).

## 2.2 Measurements

**2.2.1 Externalizing problems.** Externalizing problems were assessed with student self-reports in Grades 6 and 7 using a Finnish version of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), which has been shown to be a valid screening instrument (Goodman, Ford, Simmons, Gatward, & Meltzer, 2000) and to have good psychometric properties among Finnish children and adolescents (Koskelainen, Sourander, & Kaljonen, 2000). The SDQ consists of 25 items rated on a three-point scale (i.e., 0 = *not true*; 1 = *somewhat true*; 2 = *certainly true*), producing scales for hyperactivity/inattention, conduct problems, emotional symptoms, peer problems, and prosociality. To measure externalizing problems, we used the scales for hyperactivity/inattention (five items, e.g., restless, cannot stay still for long) and conduct problems (five items, e.g., often fights with other children or bullies them). The composite score for externalizing problems for each grade was formed as the mean score of the hyperactivity/inattention and conduct problems scales (based on 10 items). The Cronbach alpha reliabilities for the externalizing problems composite scores were 0.71 and 0.73 in Grade 6 and Grade 7, respectively. As previously explained, we classified students as having high externalizing problems if they were at least 1.5 SD above sample mean in the composite score in both Grades 6 and 7 ( $n = 63$ ), while the students with a score below 1.5 SD in both grades were defined as having low externalizing problems ( $n = 1,352$ ).

The SDQ has normative banding categories that allow for identification of children at risk for psychiatric symptoms in emotional, social, and behavioral domains (e.g., Bourdon, Goodman, Rae, Simpson, & Koretz, 2005; Capron, Thérond, & Duyme, 2007). We used sum scores ( $R = 0-10$ ) of the hyperactivity/inattention and conduct problem scales to

determine the severity of externalizing problems in the current sample. The bandings were based on normative student self-report data collected in the United Kingdom for children from 4 to 17 years of age (see [www.sdqinfo.com](http://www.sdqinfo.com)). The bandings were defined as follows: SDQ scores 0–5 for hyperactivity/inattention and 0–3 for conduct problems were classified as low and within normal range (0–80th percentile), scores 6 and 4 as slightly raised (81st–90th percentile), and scores of 7–10 and 5–10 as high or very high (91st–100th percentile), respectively. We cross-tabulated the level of externalizing problems and the SDQ bands to characterize the degree of externalizing symptoms in the current sample. The chi-square tests were significant for hyperactivity/inattention [ $\chi^2(2) = 477.46, p < .001$ ;  $\chi^2(2) = 603.94, p < .001$ ] and conduct problems [ $\chi^2(2) = 600.89, p < .001$ ;  $\chi^2(2) = 590.38, p < .001$ ] in Grades 6 and 7, respectively. In the target group of 63 students, the individuals reporting high or very high conduct problems (57% in Grade 6; 64% in Grade 7) or an equal degree of hyperactivity/inattention (29% in Grade 6; 61% in Grade 7) were overrepresented with adjusted residuals ranging between 18 and 24. Thus, when the normative SDQ bands were applied, many students in this group manifested externalizing problems that were at clinical range, suggesting a risk for child psychiatric disorders ([www.sdqinfo.com](http://www.sdqinfo.com); Bourdon et al., 2005; Capron et al., 2007).

**2.2.2 Intrinsic, attainment, and utility value in math.** Intrinsic, attainment, and utility values in math were assessed using the Task Value Scale for Children (TVS-C; Aunola & Nurmi, 1999; see also Nurmi & Aunola, 2005). This scale is based on descriptions by Eccles et al. (1983) concerning the interest in and importance that children attach to different school subjects. This self-rating scale consisted of two items measuring each of the following: (1) interest in or liking of math (intrinsic value; i.e., “How much do you like math tasks at school?”), (2) the importance of doing well in math (attainment value; i.e., “How important is it for you to get good grades in math?”) and (3) importance of math

for one's personal goals (utility value; i.e., "How useful math is for your future goals?"). The students were asked to mark their response on a five-point scale ( $1 = not\ at\ all$ ,  $5 = very\ much$ ). Composite scores for the intrinsic, attainment, and utility values in math were created by calculating the mean score of the two corresponding items. The Cronbach alphas for the composite scores of achievement values in Grades 6 and 7 varied between 0.75 and 0.90.

**2.2.3 Arithmetic skills.** Arithmetic skills were assessed in Grade 6 using a group-administered Basic Arithmetic Test (Aunola & Räsänen, 2007). It contains a total of 28 visually presented addition, subtraction (e.g.,  $20-2-4=?$ ), and multiplication problems that become more difficult across the primary school years. The test has a three-minute time limit, and because of this, it remains challenging even for the oldest children, especially as after Grade 4 some of the easiest tasks are replaced with more challenging ones toward the end of the test (e.g., multiplication problems). The test indexes a combination of speed and accuracy of math performance, and its psychometrics have been shown in a number of earlier publications (e.g., Niemi et al., 2011; Zhang et al., 2014). The test score was derived by calculating the total number of correct answers (maximum score: 28). The Cronbach alpha for composite score in Grade 6 was 0.81.

### 3 Analysis Strategy

First, for descriptive purposes, we examined the correlations among the achievement value variables across the transition from primary to lower secondary school. We also compared girls versus boys and students with low externalizing problems versus those with high externalizing problems using Fisher's  $z$ -transformation. Second, we calculated three mixed-design ANCOVAs separately for each achievement value variable. In these analyses, we specified a within-subjects factor of intrinsic, attainment, and utility values in math (in

Grades 6 and 7), the between-subject factors of gender (girl/boy) and level of externalizing problems (low/high), and a covariate (achievement level in arithmetic skills in Grade 6).

In each ANCOVA model, we examined the main effect of the achievement value variable to investigate its change across the secondary school transition. The main effect of externalizing problems was investigated to see whether students with high externalizing problems would perceive their achievement values in math more negatively than students with low externalizing problems. The interaction between externalizing problems and change in achievement values was examined to test the hypothesis that a decrease in achievement values would be more pronounced among students with high externalizing problems than students with low or no problems. Finally, we investigated the interactions among a change in achievement value, externalizing problems, and gender to study the hypothesis that there are different developmental trajectories in achievement values in boys and girls within the two groups of students with high and low externalizing problems. The students' achievement levels in math were set as a covariate in each model because research indicates that achievement often correlates with the development of domain-specific motivation (Wigfield & Cambria, 2010). Partial eta squared ( $\eta_p^2$ ), which specifies the proportion of variability associated with an effect when the variability associated with all other effects has been removed from consideration (Fritz, Morris, & Richler, 2012, p. 8), was used to indicate the magnitude of the effect (.01 = small, .06 = moderate, .14 = large; Cohen, 1988).

## **4 Results**

### **4.1 Descriptives and Correlations**

The descriptive statistics and correlations of the study variables for the total sample are shown in Table 1. Overall, the correlations for the achievement value variables from Grades 6 to 7 indicated moderate inter-individual stability. The lowest stability coefficient

was found for utility value [ $r(1,415) = 0.48, p < .001$ ], and the highest stability coefficient occurred in intrinsic value in math [ $r(1,415) = 0.58, p < .001$ ].

Correlations of the study variables separately for students manifesting high externalizing problems and those with no such problems are depicted in Table 2. The stability coefficients in students manifesting a high level of externalizing problems ranged between  $r(63) = .08$  (for utility value) and  $r(63) = .52, p < .001$  (for intrinsic value), while the stability coefficients for students with low externalizing problems varied between  $r(1,352) = .50, p < .001$  (for utility value) and  $r(1,352) = .57, p < .001$  (for intrinsic value). Fisher's  $z$ -transformation was calculated to compare girls versus boys and students with low externalizing problems versus those with high externalizing problems. The findings indicated that the students with low externalizing problems evidenced significantly higher stability coefficient than the students with a high level of externalizing problems in attainment ( $z = 2.35, p < .05$ ) and utility ( $z = 3.56, p < .001$ ) values in math.

## 4.2 Changes in Achievement Values across the Transition: A Mixed-Design ANCOVA

**4.2.1 Intrinsic value in math.** A mixed-design ANCOVA with intrinsic value as a within-subject factor revealed that intrinsic value did not change from Grade 6 to Grade 7 (see Table 3). This stable trajectory was similar irrespective of students' level of externalizing problems, gender, or their interaction. However, significant between-subject effect indicated that students with a high level of externalizing problems had a significantly lower level of intrinsic value, averaged across Grades 6 and 7 ( $M = 2.36, SE = .114$ ), than those with low externalizing problems ( $M = 2.99, SE = .024$ ). In addition, the effect of gender was significant, as boys had a higher intrinsic value in math ( $M = 2.81, SE = .075$ ) than girls ( $M = 2.54, SE = .089$ ).

**4.2.2 Attainment value in math.** A mixed-design ANCOVA with attainment value as a within-subject factor revealed a significant change across time that was dependent on the

student's level of externalizing problems. The attainment value of students with low externalizing problems declined across the transition while a similar, although steeper, decreasing trend was found for students with a high level of externalizing problems (Figure 1). The significant between-subject effect of externalizing problems indicated that students with a high level of externalizing problems had significantly lower attainment value in math, averaged across Grades 6 and 7 ( $M = 3.48$ ,  $SE = .085$ ), than students without such problems ( $M = 3.93$ ,  $SE = .018$ ). The moderating effect of a student's gender on change in attainment value was also significant, with boys evidencing a significantly steeper decline than girls (Figure 2).

**4.2.3 Utility value in math.** A mixed-design ANCOVA with utility value in math as a within-subject factor revealed a significant three-way interaction, as the change in utility value across time was dependent on the joint contribution of a student's gender and the level of externalizing problems. The utility value decreased across the transition, but the declining trend was steeper for students manifesting a high level of externalizing problems, and particularly for boys (Figures 3 and 4). The significant between-subject effect indicated that students with a high level of externalizing problems had significantly lower utility value in math, averaged across Grades 6 and 7 ( $M = 3.46$ ,  $SE = .094$ ), than students without such problems ( $M = 3.81$ ,  $SE = .020$ ).

## 5 Discussion

In this study, we examined changes in students' self-reported intrinsic, attainment, and utility values at a critical time of development across the transition from primary to lower secondary school, focusing on students who have a risk for problems in school adjustment due to high and persistent externalizing problems. Many students in this group manifested externalizing problems that were at clinical range, suggesting a risk for child psychiatric disorders (see Bourdon et al., 2005; Capron et al., 2007; [www.sdqinfo.com](http://www.sdqinfo.com)). As we

predicted, the students with high externalizing problems were shown to have lower intrinsic, attainment, and utility values in math than students with low externalizing problems. As the students progressed across the lower secondary transition, the attainment value in math showed a steeper decreasing trend in students reporting high levels of externalizing problems compared to the declining trajectory of students without such problems. We also found that the change in utility value was dependent on the joint contribution of the student's gender and the level of externalizing problems. The utility value decreased across the transition, but the declining trend was steeper for students manifesting a high level of externalizing problems, and particularly for boys.

### **5.1 General Discussion**

Our findings showed that the students with high externalizing problems were characterised by lower achievement values when compared with students with low externalizing problems. Although the differences between the two student groups were not large (i.e., the effect sizes were small), they were systematic and consistent across all achievement values we measured. These findings indicate that students with high levels of persistent problem behaviours found less enjoyment in studying math, attached less importance to getting good grades in math, and saw math as being less useful for their current and future goals than students without externalizing problems. Strong evidence links externalizing problems to poor functioning in many domains of adolescents' lives (Moilanen et al., 2010), and our study extended this literature by showing that students with externalizing problems have difficulties in sustaining motivation in a key academic area of achievement: math.

As hypothesised, our findings show that students' utility and attainment values in math decreased across the transition from primary to lower secondary school, which can likely be explained by the relatively large changes in school structure, interactional learning, and

social contexts during this transition (Eccles et al., 1993; Eccles & Roeser, 2009). We found this decline to be in effect after the first full school year in lower secondary school, as data on student perceptions were gathered in the spring of Grade 7 rather than immediately after the transition. Prior evidence suggests that some achievement values (e.g., beliefs about the importance of English) dip immediately after the transition and students then regain their motivation and again reach pre-transition levels (Wigfield et al., 1994). The declining trajectories in attainment and utility values documented in this study possibly reflect a more permanent decrease in the value that students attach to math. However, a longer follow-up would be needed to reveal the patterns of change over the entire three-year lower secondary school period.

We also found evidence that students manifesting a high level of externalizing problems struggled even more with maintaining math motivation across the transition period than students without externalizing problems, even after accounting for previous arithmetic skills. The significant moderating effect of externalizing problems on change in attainment value indicated that students reporting high and persistent problem behaviour reported a sharper decrease in the perceived importance of doing well in math compared to students with low externalizing problems. In addition, the three-way interaction between change in utility value, gender, and externalizing problems was significant. Although the effect size was small, both girls and boys with externalizing problems showed a steeper decline in the sense of personal importance they attached to math (i.e., utility value) compared to students without such problems, but the declining trajectory was steepest in boys with a high level of externalizing problems. These were important and novel findings. They showed that the transition to secondary school represents an important period of risk for the development of students with externalizing problems—particularly boys—which may, in the long run, hamper their engagement in schooling and increase their risk for dropping out of school.

Apparently, students with problem behaviours may be less able to sustain learning motivation in a challenging subject such as math when the demands for performance and independent learning are higher than in primary school and when there may be less teacher support available (Anderman & Midgley, 1997). Students with externalizing problems often have concomitantly lower academic performance levels (Adams et al., 1999; Zimmermann et al., 2013), which may lead to increased frustration, lower motivational interest, and decreased enjoyment in school tasks or create a vicious circle that leads to further decreases in academic performance (Zimmermann et al., 2013). In addition, these students are likely to experience challenges in coping with peers and teachers, and the resources and attention these relationships require may hamper their valuing of school work. As such, the transition to secondary school represents “a normative discontinuity” in development (Bellmore, 2011), and failure to negotiate this key point successfully may lead to cumulative disadvantages in later life (Elder, 1998). Future research should study further why math loses its perceived importance, particularly among boys, and how these students could be better supported across the transition. Within classrooms, every effort should be made to prevent the development and escalation of externalizing problems. For instance, instead of valuing the demonstration of ability and doing better than others, classrooms should increasingly emphasize learning, understanding, and improvement over past performance to prevent and decrease disruptive behaviour (Kaplan, Gheen, & Midgley, 2002).

The findings of the present study also showed that intrinsic value for math differed in important ways between girls and boys. Specifically, boys had more positive intrinsic valuing of math than girls, suggesting that they found math more enjoyable. This finding is in line with some of the prior research suggesting that math is a male-typed academic domain and that boys typically favor math (Eccles, Adler, & Meece, 1984; Watt, 2004). In contrast to developmental trajectories of attainment and utility values, intrinsic value did not

change across the transition from primary to lower secondary school. The inspection of the mean in Grade 6 ( $M = 2.67$ ,  $SE = .06$ ), adjusted for arithmetic skills, indicates that the intrinsic value was relatively low to begin with and therefore unlikely to exhibit a further decrease. These findings are a source of concern, because inherent feelings of liking and enjoying the specific academic domain directly influence students' choice of tasks and their persistence and performance on those tasks (Wigfield & Eccles, 2000). The risk here is that a low level of such perceived intrinsic value severely undermines the learning of math skills.

## **5.2 Limitations**

Some limitations to the present study should be taken into account when interpreting the findings. First, although the sample size was large, the number of children with persistent externalizing problems was—as expected—relatively small. It is therefore necessary to replicate the results, particularly those involving interactions, because the power to detect interactions was limited and the findings might be attributable to the specificity of the sample. Second, in this study we used the same informants (via students' self-reports) to gather information about both externalizing problems and achievement values, which can introduce measurement confounds. It should be noted, however, that externalizing behaviours and achievement values inherently include perceptions, experiences, and behaviours that are highly personal and some of which are socially sanctioned by adults (e.g., bullying) and, thus, they may be more reliably obtained by self-report measures. Third, an analysis of the specific mechanisms that may influence achievement values in students with high levels of externalizing problems was outside of the scope of the current study. Further research is necessary to more directly test the significance of different factors that might explain the developmental trends found in the current study.

## **5.3 Conclusion**

In summary, the findings of the current study provide an increased understanding of how both students with high externalizing problems and those without such problems navigate the secondary school transition. The specific value of these findings lies in the clarification of the developmental processes that compromise the educational progress of students with a high level of externalizing problems and, as problems accumulate, may lead to increasingly negative achievement trajectories and risk for school failure and dropout. Furthermore, the inclusion of self-ratings of intrinsic, attainment, and utility values as separate measures was important, as it enabled us to document that the achievement values may be differently influenced by the transition. Given the significant differences between students with high versus low externalizing problems in achievement values, it is relevant to tailor ways of supporting motivation in math for different student populations, to pay attention to student perspectives, and to utilise engaging instructional strategies, especially at the beginning of lower secondary school.

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Table 1

Sample Correlation Matrix and Descriptive Statistics of the Study Variables ( $n = 1,415$ )

Variables	1	2	3	4	5	6	7
1. Intrinsic value (G6)	--						
2. Attainment value (G6)	.58	--					
3. Utility value (G6)	.53	.56	--				
4. Intrinsic value (G7)	.58	.41	.36	--			
5. Attainment value (G7)	.39	.51	.35	.64	--		
6. Utility value (G7)	.35	.36	.48	.59	.61	--	
7. Arithmetic skills (G6)	.32	.27	.14	.24	.25	.15	--
Mean	2.99	3.96	3.86	2.94	3.86	3.73	16.43
SD	1.07	0.77	0.83	1.06	0.84	0.91	3.60
Min	1	1	1	1	1	1	4
Max	5	5	5	5	5	5	26

*Note.* All pairwise correlations are significant at the 0.001 level.

Table 2

Correlation Matrices for Students Manifesting High Level of Externalizing Problems ( $n = 63$ ) and Low externalizing Problems ( $n = 1,352$ ).

Variables	1	2	3	4	5	6	7
1. Intrinsic value (G6)	--	.48***	.42**	.52***	.34**	.06	.50***
2. Attainment value (G6)	.58***	--	.60***	.23	.26*	.16	.34**
3. Utility value (G6)	.53***	.56***	--	.14	.06	.08	.31*
4. Intrinsic value (G7)	.57***	.41***	.37***	--	.70***	.41**	.34**
5. Attainment value (G7)	.38***	.52***	.37***	.63***	--	.66***	.25*
6. Utility value (G7)	.36***	.36***	.50***	.59***	.60***	--	.01
7. Arithmetic skills (G6)	.30***	.26***	.13***	.23***	.24***	.15***	--

Note. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Students with high level of externalizing problems above and those with no such problems below diagonal. G = Grade.

Table 3

Mixed-Design Analyses of Covariances with Achievement Values in Math as Dependent Variables

Source	<i>df</i>	<i>F</i>	$\eta_p^2$	<i>p</i>
Dependent variable: Intrinsic value in math		Within subjects		
Time	1, 1410	2.21	.002	.137
Time x Gender	1, 1410	1.55	.001	.213
Time x Externalizing problems	1, 1410	2.99	.002	.084
Time x Gender x Externalizing problems	1, 1410	0.05	.000	.828
Time x Arithmetic skills	1, 1410	8.74	.006	.003
		Between subjects		
Gender	1, 1410	5.17	.004	.023
Externalizing problems	1, 1410	30.16	.021	.000
Gender x Externalizing problems	1, 1410	2.16	.002	.142
Arithmetic skills	1, 1410	142.78	.092	.000
Dependent variable: Attainment value in math		Within subjects		
Time	1, 1410	4.74	.003	.030
Time x Gender	1, 1410	4.67	.003	.031
Time x Externalizing problems	1, 1410	5.85	.004	.016
Time x Gender x Externalizing problems	1, 1410	3.48	.002	.062
Time x Arithmetic skills	1, 1410	0.03	.000	.856
		Between subjects		
Gender	1, 1410	1.52	.001	.217
Externalizing problems	1, 1410	26.34	.018	.000
Gender x Externalizing problems	1, 1410	0.28	.000	.597
Arithmetic skills	1, 1410	135.57	.088	.000
Dependent variable: Utility value in math		Within subjects		
Time	1, 1410	9.59	.007	.002
Time x Gender	1, 1410	6.08	.004	.014
Time x Externalizing problems	1, 1410	11.59	.008	.001
Time x Gender x Externalizing problems	1, 1410	4.26	.003	.039

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Time x Arithmetic skills	1, 1410	0.35	.000	.556
			Between subjects	
Gender	1, 1410	1.01	.001	.316
Externalizing problems	1, 1410	13.39	.009	.000
Gender x Externalizing problems	1, 1410	0.03	.000	.873
Arithmetic skills	1, 1410	41.11	.028	.000

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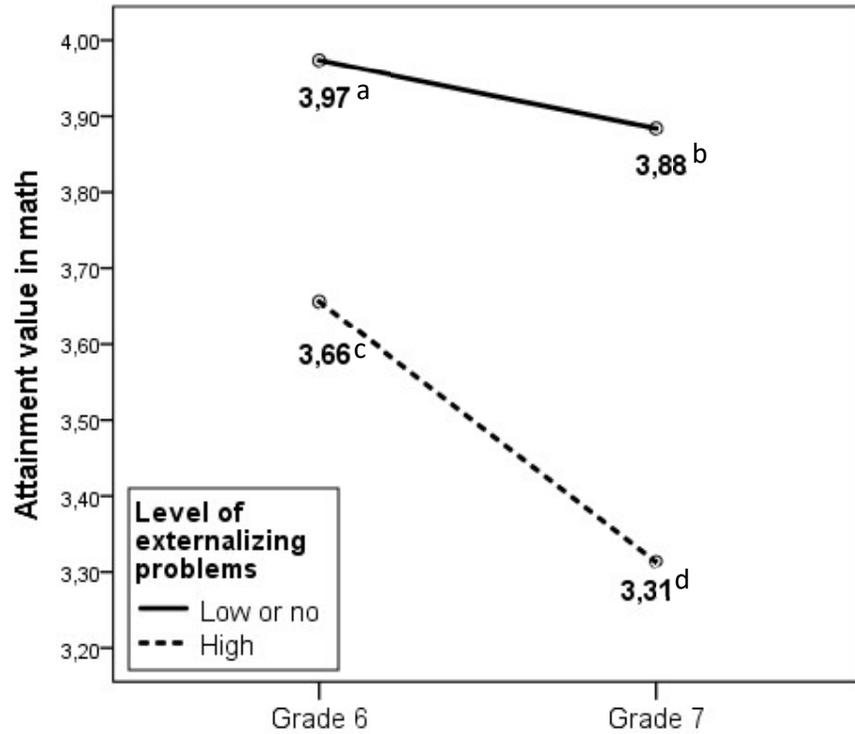


Figure 1. Significant interaction among change in attainment value in math and the level of externalizing problems. The group means are adjusted for the covariate of arithmetic skills. The 95% CIs [3.93, 4.01], [3.84, 3.93], [3.47, 3.84] and [3.11, 3.52] were found for a, b, c, and d, respectively.

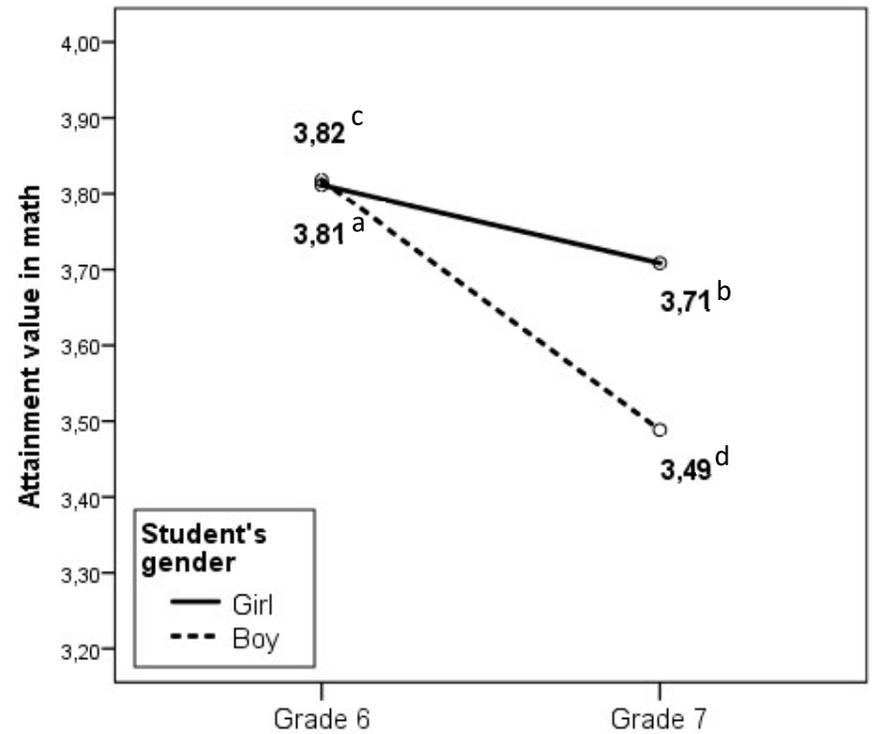


Figure 2. Significant interaction among change in attainment value in math and student's gender. The group means are adjusted for the covariate of arithmetic skills. The 95% CIs [3.67, 3.96], [3.55, 3.87], [3.70, 3.94] and [3.36, 3.62] were found for a, b, c, and d, respectively.

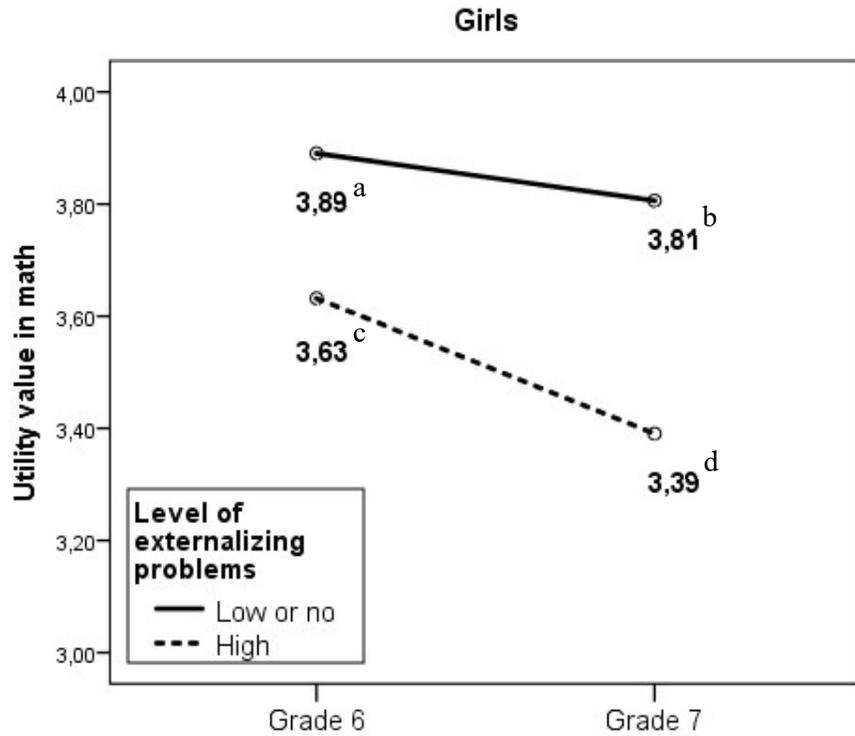


Figure 3. Significant interaction among change in utility value in math, the level of externalizing problems, and student’s gender. The group means are adjusted for the covariate of arithmetic skills. The 95% CIs [3.83, 3.95], [3.74, 3.87], [3.32, 3.95] and [3.05, 3.74] were found for a, b, c, and d, respectively.

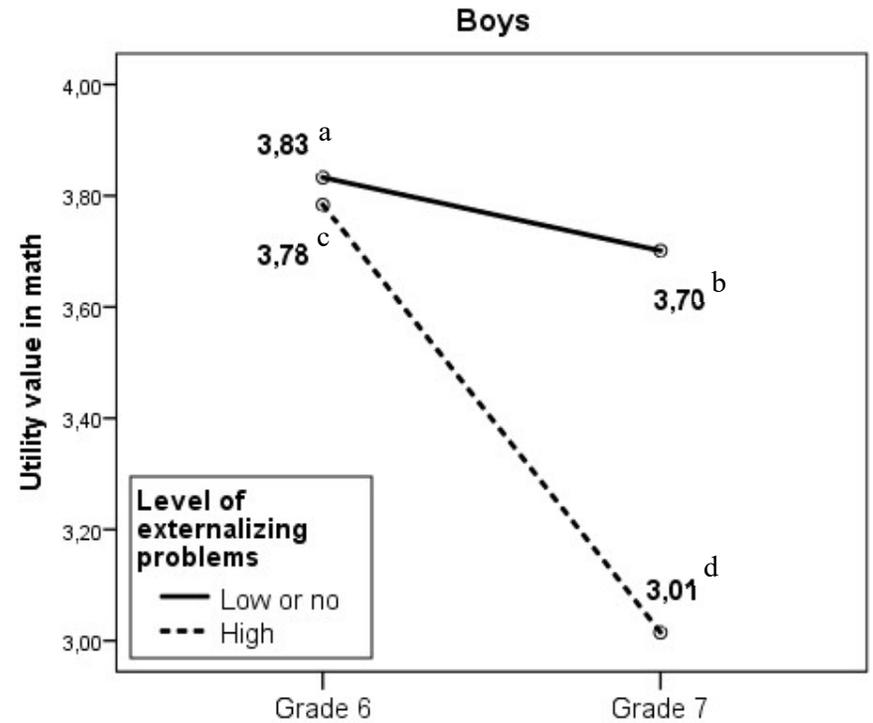


Figure 4. Significant interaction among change in utility value in math, the level of externalizing problems, and student’s gender. The group means are adjusted for the covariate of arithmetic skills. The 95% CIs [3.77, 3.90], [3.63, 3.77], [3.52, 4.05] and [2.73, 3.30] were found for a, b, c, and d, respectively.