Author(s): Silinskas, Gintautas; Kikas, Eve

Title: Math homework : Parental help and children's academic outcomes

Year: 2019

Version: Accepted version (Final draft)

Please cite the original version:

Silinskas, G., & Kikas, E. (2019). Math homework : Parental help and children's academic outcomes. Contemporary Educational Psychology, 59, Article 101784. https://doi.org/10.1016/j.cedpsych.2019.101784

Highlights:

- ✓ Perceived parental support predicts an increase in task persistence during homework.
- ✓ Good math skills in Grade 6 predict an increase in perceived parental support in Grade 9.
- ✓ Poor math skills in Grade 3 predict an increase in perceived parental control in Grade 6.
- ✓ Perceived parental control in Grade 6 predicts an increase in perceived parental support in Grade 9.

Abstract

In the present study, we examined the longitudinal relations between child-perceived parental help with math homework (i.e., support and control), children's math skills, and mother-reported task persistent behavior in homework situations. A total of 624 mother–child dyads were followed across Grade 6 and Grade 9, controlling for Grade 3 variables. At each measurement point, children completed math tests, and their mothers evaluated task persistence during homework. In Grades 6 and 9, children reported their perceptions of their parents' help with math homework. First, the results showed that perceived support in Grade 6 predicted an increase in persistence during homework in Grade 9. Second, math skills in Grade 6 predicted an increase in perceived support in Grade 9. In addition, poor math skills in Grade 3 predicted an increase in perceived control in Grade 6. Finally, perceived control in Grade 6 predicted higher levels of perceived support in Grade 9. Overall, the results suggest that math skills in particular trigger certain types of parental helping behavior in children's math homework. In addition, a positive type of help with math homework—perceived autonomy-support—relates to motivational aspects of academic outcomes (i.e., task persistence in homework situations).

Keywords: homework, math, perceived parental support, perceived parental control, task persistence, evocative effect

Math Homework: Parental Help and Children's Academic Outcomes

Gintautas Silinskas [a] and Eve Kikas [b]

[a] University of Jyväskylä, Finland

[b] Tallinn University, Estonia

Gintautas Silinskas, Department of Psychology, University of Jyväskylä, Finland, gintautas.silinskas@jyu.fi; Eve Kikas, Institute of Natural Sciences and Health, Tallinn University, Estonia, ekikas@tlu.ee.

This study was supported by the Estonian Ministry of Education and Research (IUT 03-03) and by Academy of Finland (# 296082, 2016–2019).

For any correspondence, contact: Gintautas Silinskas, Department of Psychology, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland. E-mail: gintautas.silinskas@jyu.fi; phone: +3584080542215.

Math Homework: Parental Help and Children's Academic Outcomes

Homework—tasks assigned by schoolteachers to carry out during non-school hours—is considered a valuable method of improving students' learning and academic skills, and is widely used across countries (Cooper, Robinson, & Patall, 2006; Fan, Xu, Cai, He, & Fan, 2017; Núñez et al., 2015; Silinskas & Kikas, 2019; Trautwein, 2007; Trautwein, Schnyder, Niggli, Neumann, & Lüdtke, 2009). In this process, students are frequently helped by their parents (Jeynes, 2007; Moroni, Dumont, Trautwein, Niggli, & Baeriswyl, 2015; Patall, Cooper, & Robinson, 2008). While parents aim to enhance their children's skills, motivation, and engagement, they are not always successful. Namely, empirical findings on the efficiency of parental help in homework are inconsistent, specifically during the adolescence period (for overviews, see Cooper, Lindsay, & Nye, 2000; Hoover-Dempsey et al., 2001; Patall et al., 2008; Wilder, 2014). Studies that have differentiated between autonomy-supportive and controlling practices have provided more coherent results. It has been shown that while autonomy-supportive help tends to enhance children's academic, motivational, and behavioral outcomes, controlling help tends to have an inhibiting effect (Dumont et al., 2012; Gonida & Cortina, 2014; Moroni et al., 2015; Núñez et al., 2015, 2017; Pomerantz, Moorman, & Litwack, 2007; Pomerantz, Wang, & Ng, 2005). However, many previous studies have investigated cross-sectional associations between parental help with homework and children's math skills and motivation. Thus, there is a clear need for studies that provide longitudinal evidence on the tentative direction of associations, after controlling for the autoregressive effects. Also, much of the previous research has been conducted among elementary school students. Therefore, there is a clear need to clarify the longitudinal links among the middle school students.

Still, there are only a few longitudinal studies on the development of autonomy-supportive and controlling help and their mutual relations with students' skills and learning behavior (for exceptions, see Dumont, Trautwein, Nagy, & Nagengast, 2014; Viljaranta et al., 2018). In addition, most previous studies concentrate on homework assistance in early school

years, thus less is known about parental homework help in adolescence. As autonomy-building and independence become important for adolescents, the inhibiting effect of controlling help may have a strong detrimental effect at this age. In addition, parental help at this age differs in content and frequency from that in elementary grades (Cooper et al., 2000; Gonida & Cortina, 2014; Green, Walker, Hoover-Dempsey, & Sandler, 2007; Hill & Tyson, 2009). Knowledge about factors that enhance or inhibit students' academic development helps parents of adolescents to better avoid negative cycles that exacerbate children's difficulties and also to implement interventions to support students' achievement and engagement.

Thus, the aim of the current study is to examine mutual relations between autonomy-supportive and controlling parental help with math homework, adolescents' math skills, and persistence in completing homework. The study was carried out in Estonia, where according to international comparative studies, students' math knowledge (see Programme for International Student Assessment PISA; OECD, 2013, 2016) and homework loads (6.9 hours per week, see OECD, 2014) are high. Math was selected because an earlier study in Estonia suggested that the majority of help with middle school homework is provided in math (unpublished data). The current longitudinal study took place from the end of primary school until the end of middle school—from Grade 6 to Grade 9 (students' age 13–16 years). In Estonia, at the end of both Grades 6 and 9, students have to complete national tests in math, for which they are intensively prepared. This means that students may also be provided with significant homework loads with which they may need parental help.

We used child reports on parental support and control because this has been done in various studies on parental practices in the past (Dumont et al., 2012; Dumont et al., 2014; Moroni et al., 2015; Núñez et al., 2015, 2017; Silinskas & Kikas, 2019). Research has indicated that children's reports are more valid and reliable than parents' reports (Gonzales, Cauce, & Mason, 1996; Sessa, Avenevoli, Steinberg, & Morris, 2001). Moreover, sociocultural and

social cognitive frameworks emphasize that people's actions are influenced by their interpretations of situations, and each child actively organizes his or her experience (e.g., Bandura, 1993; Grolnick, Ryan, & Deci, 1991; Luria, 1976). In addition, empirical studies have shown that children's reports of parental behavior are more strongly related to their development than parents' actual behaviors (Grolnick et al., 1991; Grolnick & Slowiaczek, 1994).

Autonomy-Supportive and Controlling Help with Homework

It is widely known that parental homework help is a multidimensional construct with quantitative and qualitative aspects ranging from concrete support to complex instructional guidance with varying efficiency, and that the key aspect is the quality, not the frequency, of such help (Hoover-Dempsey et al., 2001; Moroni et al., 2015: Patall et al., 2008; Pomerantz et al., 2007). Most frequently, parents are involved in instructional practices that are aimed to improve their child's skills and/or motivation and engagement (Pomeratz et al., 2007). To be effective in this process, practices should consider the child's present skill and knowledge level (i.e., providing help in the zone of proximal development; Vygotsky, 1978). In this way, parents provide challenges that the child can meet, thus parents also support the child's adequate sense of competence (i.e., a basic need according to self-determination theory; see Grolnick & Slowiaczek, 1994; Pomeratz et al., 2007; Ryan & Deci, 2000). In addition, parents should take into account the child's motivation and developmental needs, such as attempts to gain autonomy during the adolescence period (Eccles et al., 1993; Ryan & Deci, 2000). With respect to how these aspects are met, two types of parental help with homework have been differentiated: autonomy-supportive and controlling instructional practices (further also 'support' and 'control'; Dumont et al., 2012, 2014; Grolnick & Pomerantz, 2009; Moroni et al., 2015; Pomerantz et al., 2005, 2007).

Autonomy support is defined as allowing children to explore their environment, initiate their own behavior, and take an active role in solving problems (Pomerantz et al., 2007). These practices provide children with the experience of solving challenges on their own, and thus develop learning and problem-solving skills in addition to academic knowledge (e.g., Ng, Kenney-Benson, & Pomerantz, 2004). In the context of homework, this means providing support when requested, discussing issues, giving hints and ideas, but not solving problems for children. Children with negative school experiences and low skills may particularly benefit from autonomy-supportive help that provides resources to develop skills and motivation (Ng et al., 2004).

Controlling behavior involves the exertion of pressure by parents to lead children toward particular outcomes (e.g., doing well in test) by regulating children throughout this process with commands and directives (Pomerantz et al., 2007). In the homework process, controlling behavior may also include providing correct answers such that children do not experience challenges and do not have to search for solutions on their own. Thus, children may not feel as autonomous, effective agents in their own learning process. Parents are specifically likely to control children when they feel pressure for child to meet some standards (Grolnick, Gurland, DeCourcey, & Jacob, 2002; Gurland & Grolnick, 2005) or when parents lack the skills to constructively guide children (Levin et al., 1997). This process may escalate conflicts and frustration (Levin et al., 1997; Pomerantz & Eaton, 2001; Silinskas, Kiuru, Aunola, Lerkkanen, & Nurmi, 2015) and thus may not meet the child's need for a sense of belonging, another basic need according to the self-determination theory (Ryan & Deci, 2000).

Relations between Parental Autonomy-Supportive and Controlling Help in Homework and Children's Task Persistence and Skills

Parental support and control differentially affect children's academic outcomes. A plethora of studies have shown that autonomy support is related to a higher achievement (for

reviews, see Patall et al., 2008; Pomerantz et al., 2007; for language and math, see Dumont et al., 2012; Gonida & Cortina, 2014). Still some math-specific studies have not revealed a positive effect of autonomy support on achievement (Karbach, Gottschling, Spengler, Hegewald,& Spinath, 2013; Levpuscek & Zupancic, 2009; Silinskas & Kikas, 2019). In contrast, controlling practices are negatively associated with academic skills and achievement (for reviews, see Patall et al., 2008; Pomerantz et al., 2007; for math, see Karbach et al., 2013; Levpuscek & Zupancic, 2009; Silinskas & Kikas, 2019).

Parental autonomy support and control also differ in their influence on students' motivation and engagement with learning, which, in turn, have an impact on achievement (e.g., Patall et al., 2008). The importance of engagement in learning outcomes was demonstrated by Dumont and colleagues (2012), who found that the relationship between parental homework help and students' homework behavior was stronger than the relationship between parental help and student achievement outcomes. That is, autonomy-supportive parenting practices enhance students' academic engagement (Roth, Assor, Niemiec, Ryan, & Deci, 2009). Similarly, observed teacher support for autonomy predicts child engagement (Jang, Reeve, & Deci, 2010). The importance of autonomy-supportive practices on engagement and reading skills was also shown in an experimental observational study with homework-like tasks (Doctoroff & Arnold, 2017). Controlling practices, in turn, may decrease interest, motivation, and engagement (Ng et al., 2004).

Important indicators of motivation and behavioral engagement include a child's efforts and persistence, as well as their ability to stay on task, even in face of challenges (i.e., task persistence; Onatsu-Arvilommi & Nurmi, 2000; Zhang, Nurmi, Kiuru, Lerkkanen, & Aunola, 2011). Task persistence has consistently been found to be related to children's math achievement (Kikas & Mägi, 2016; Kikas, Peets, & Hodges, 2014; Kikas, Peets, Palu, & Afanasjev, 2009). In addition, parental support has been found to increase and parental control

was found to decrease homework-related task persistence (Silinskas & Kikas, 2019; Viljaranta et al., 2018). Thus, task persistence during homework was chosen as one motivation-related variable for further investigation in the present study.

Typically, parental help has been considered a predictor of childhood academic development. However, it is equally likely that childhood achievement and/or behavior transacts with parent help over time (Sameroff, 2010) or precedes parental help; that is, that characteristics of children evoke certain reactions from their interpersonal environments (i.e., parents and teachers; Bell, 1968; Nurmi, 2012; Nurmi & Kiuru, 2015; Silinskas et al., 2015). Longitudinal studies on transactional processes between children's achievement and parental practices in homework have indicated that prior poor academic performance elicits a heightened use of intrusive-controlling practices (e.g., checking children's homework) and explicit teaching, even when children do not ask for such assistance (Dumont et al., 2014; Grolnick et al., 2002; Hoglund, Jones, Brown, & Aber, 2015; Ng et al., 2004; Núñez et al., 2017; Pomerantz & Eaton, 2001; Silinskas, Kiuru, Aunola, Lerkkanen, & Nurmi, 2015; Silinskas et al., 2013). Furthermore, children showing low effort with homework also elicit controlling behaviors from parents in the reading domain (Dumont et al., 2014). Silinskas and Kikas (2019) found that lower task-persistent behavior was related to higher parental controlling behavior three years later, but only for boys. These parental practices, in turn, may influence the child's subsequent behavior and academic outcomes (Pomerantz & Eaton, 2001; Silinskas et al., 2013). For instance, Dumont and colleagues (2014) found reciprocal relations between parental homework help and children's reading achievement between Grades 5 and 7, such that skills were negatively related to control and positively related to autonomy support. So far, mutual relations between parental homework help and academic outcomes have not been examined for middle school math.

Specifics of Help in Middle School Math Homework

In middle school, great changes take place both in children (onset of puberty) and school (new subjects, teachers, and advanced topics; e.g., Hill & Tyson, 2009). It is widely known that, during the transition to and throughout middle school years, many children experience a decline in school performance, motivation (Eccles et al., 1993), and help seeking (Ryan & Shim, 2012). In contrast, skills regarding problem solving, planning, and decision-making increase during adolescence (Keating, 2004). Thus, autonomy-supportive help may become specifically effective, and controlling help specifically ineffective, during the middle school years. Moreover, in middle school, the emphases on support strategies for homework tend to change due to different skills that students need to acquire (e.g., basic academic and learning skills in elementary schools vs. reasoning skills in middle schools), as well as the importance of discussions and negotiations in adolescence (Hill & Tyson, 2009). Cooper and colleagues (2000) showed that in high school, as compared to elementary school, parents were less likely to be directly involved with homework (i.e., taking active part in child's homework completion, perceiving that a child needs help from other adults or siblings, attributing child's request for help to the confusion in understanding the homework), but were more likely to give autonomy support (i.e., not helping in homework that a child is supposed to complete alone, not helping just for the reason that the child finishes the homework faster) when helping in homework activities.

Empirical findings on the effect of parental homework help are inconsistent, specifically for middle school. For instance, in their 2008 meta-analysis, Patall et al. found consistent evidence that parental help with homework had positive effects for elementary and high school students, while such positive effects were not visible in middle school. The finding may be partially related to the fact that providing autonomy and control were not differentiated in earlier studies. Sy, Gottfried, and Gottfried (2013) found that parental academic instruction (more related to control than to autonomy support) directly predicted children's reading

achievement in early childhood, but not in middle childhood or adolescence. In contrast, children's reading achievement negatively predicted parents' academic instruction only later, not in early childhood. The authors argued that parents start to react to children's achievement only once they begin receiving sufficient information about their children's performance.

Patall et al. (2008) also emphasized that reasons for positive findings in elementary and high school may be different. Namely, in elementary years, parents master school topics and deal not only with academics but also with learning and self-management skills. Parent help decreases as children grow older (Cooper et al., 2000; Gonida & Cortina, 2014; Green et al., 2007) and may be highly specialized. That is, parents may become directly involved in homework only when they have particular expertise to share with their child. However, due to the increased academic demands of junior high school, parents are not always capable of helping (see Patall et al., 2008). Moreover, math content at the end of middle and high school is quite advanced and demands high expertise from parents. In line with this notion, Patall et al. (2008) found that, as opposed to verbal subject matters, help with math homework was negatively related to children's achievement. They argue that math may be more difficult for parents, and therefore, they encounter difficulties when attempting to assist their children. The authors also refer to the possibility that children who struggle more with math may seek help from their parents more frequently than in language studies. As described before, prior findings have not been very consistent or applicable to the math domain.

Aims and Hypotheses

The aim of the current study is to examine mutual relations between autonomy-supportive and controlling parental help with regard to math homework, children's math skills, and persistence in completing homework. Mutual relations were examined in Grades 6 and 9 while controlling for Grade 3 math skills, persistence, and background characteristics, such as

the child's general ability, gender, and maternal education. The following research questions and hypotheses were investigated.

First, to what extent is perceived parental help in math homework in Grade 6 related to children's math skills and task persistence in Grade 9? Based on previous research, we expected perceived parental support would be positively related to the children's performance and persistence (Cooper et al., 2000; Pomerantz et al., 2007), and we expected perceived parental control to be negatively related to children's skills and task persistence (Hill & Tyson, 2009; Silinskas et al., 2015; Silinskas & Kikas, 2019).

Second, what effect(s) do math skills and task persistence in Grade 6 have on parental help in Grade 9? We expected low skills and low persistence to be negatively related to a perceived parental support in Grade 9 and to be positively related to perceived parental control (Levin et al., 1997; Silinskas et al., 2015).

Finally, we explored the stability of children's perceptions of support and control over time, and to what extent perceived parental support and control mutually affect each other.

In addition, we controlled our results for previous levels of math skills, task-persistent behavior, and background characteristics such as cognitive ability, gender, and maternal education. This decision was based on earlier studies which demonstrated that math skills can be related to children's general ability (Karbach et al., 2013; Silinskas et al., 2013; Silinskas & Kikas, 2019; Su, Doerr, Johnson, Shi, & Spinath, 2015) and parental education (Karbach et al., 2013; Silinskas & Kikas, 2019; Su et al., 2015). Moreover, higher parental education has been shown to be related either with higher (Moroni et al., 2015; Su et al., 2015) or lower (Silinskas & Kikas, 2019) homework support. Furthermore, studies have consistently shown that, compared to boys, girls show higher task persistence (Kikas et al., 2014; Onatsu-Arvilommi & Nurmi, 2000), are less frequently controlled by their parents concerning homework (Bhanot & Jovanovic, 2005; Carter & Wojtkiewicz, 2000; Dumont et al., 2012), and are more frequently

provided autonomy (Dumont et al., 2012). Findings regarding relations between child gender and math skills are inconsistent, showing either no differences between genders (e.g., Kikas et al., 2009; Lachance & Mazzocco, 2006), or small differences favoring girls (see Halpern et al., 2007) or boys (Dumont et al., 2012).

Method

Participants and Procedure

This study comprised part of a large-scale longitudinal investigation (Kindergarten-School Study) following children from kindergarten until Grade 9. The participating 28 schools (52 classrooms) were from different parts of Estonia, including both urban and rural areas. The sample was highly homogeneous in regard to children's ethnic and cultural backgrounds; for example, all schools and students were Estonian-speaking. Parents were asked to provide written consent for their own and their child's participation in the study. Only children with written consent were included to our study (93%). 376 families (out of 624) answered to the question about family structure. Of these, 293 children lived in the nuclear families, 68 of children lived with only mother (also mother and grandparents), 10 children lived with father (also father and grandparents), 4 children lived with grandparents, and 3 children lived with other caregivers.

Children. In the present study, 624 children (314 boys, 310 girls) were tested three times: at the end of Grade 3 (9–10 years-olds; April 2010 and 2011; n = 457); at the end of Grade 6 (12–13 year-olds; April 2013 and 2014; n = 622); and at the end of Grade 9 (15–16 year-olds; April 2016 and 2017; n = 492). In Grade 6 and Grade 9, we also invited the new classmates of the previous participants to take part in the study. Therefore, there were changes in the sample size across time. Math tests were administered by class teachers (in Grade 3) and research assistants (in Grades 6 and 9). All questionnaires were administered by trained research assistants in the classroom setting. In Grade 6 and 9, children answered a question on the

frequency of homework assistance they received from their parents or other people living in the same household on a scale from 0 (never) to 5 (each day). The results from Grade 6 ($M = 2.50$, $SD = 1.68$, *median* = 3, *range* 0–5) and Grade 9 ($M = 1.07$, $SD = 1.32$, *range* 0–5, *median* = 1) suggested a decrease in the frequency of homework assistance from parents or other people living in the same household.

For the present study, we used data from children who answered questionnaires in Grade 6 ($n = 624$). The attrition analysis showed that, out of the children who participated in Grade 3, children who also answered questionnaires in Grade 6 had mothers with lower education than those children who did not answer questionnaires in Grade 6 ($p < .05$). Thus, we included maternal education as a control variable in our analyses. When children participating in Grade 9 were compared to those not participating in Grade 9, no systematic differences in any of the study variables were detected.

Mothers. In the present study, mothers of the children were asked to fill out questionnaires three times: at the end of Grade 3 (April 2010 and 2011; $n = 413$); at the end of Grade 6 (April 2013 and 2014; $n = 504$); and at the end of Grade 9 (April 2016 and 2017; $n = 449$). The questionnaires were filled out at home at approximately the same time as the children's measurements took place. Out of 544 mothers' data, 59 mothers had a basic education (9 years or fewer of formal education); 346 mothers had completed secondary education (10–12 years of formal education); and 139 mothers either studied for or had completed a college or university degree.

We compared mothers who participated with mother who did not participate in our study at each time-point. In Grade 3, participating mothers had children with better math skills in Grade 3 compared with non-participating mothers ($p < .05$). In Grade 6, participating mothers had lower educational attainment than non-participating mothers ($p < .05$). And in Grade 9, participating mothers had children who reported less controlling parental behavior in

Grade 9, and children who scored higher on general ability in Grade 3 ($p < .05$), as compared with non-participating mothers in Grade 9. Furthermore, attrition analysis concerning mothers' participation in Grade 3 and Grade 6 revealed that mothers who participated in Grade 3, but dropped out of the study by Grade 6, had children with lower math skills in Grade 3 ($p < .05$) and lower scores of general ability in Grade 3 ($p < .05$), as comparison with mothers participating in both Grades 3 and 6. Attrition analysis between Grades 6 and 9 showed that children of mothers who dropped out had lower math skills in Grade 9 ($p < .01$), and reported less autonomy-granting and more controlling behaviors in Grade 9 ($p < .05$), as compared with children of mothers who participated in both Grades 6 and 9.

Measures

The psychometric properties of both the children's measures and the mothers' questionnaire are shown in Table 1 (i.e., valid number of cases, means, standard deviations, reliabilities [Cronbach's α], potential and actual ranges of the values, and skewness). The items of the questionnaires and their loadings on a higher-level construct are shown in Table 2.

Children's Questionnaire

Perceived parental help with homework: support and control (Grade 6 and Grade 9). Children were asked to report the ways parents help them with math homework (see Table 2 for the items presented to children). The questions were developed based on previous studies (Dumont et al., 2012, 2014) and were formulated to be math-specific. All questions have been previously published for Grade 6 students (Silinskas & Kikas, 2019). The questionnaire measured two dimensions of perceived parental help in math homework: (1) parental support, and (2) parental control. The scales were created based on self-determination theory (Ryan & Deci, 2000); the scale of perceived parental support relates to the scale of "support" (Dumont et al., 2012) and "responsiveness" (Dumont et al., 2014), whereas the scale of perceived parental control relates to the scale of "control" (Dumont et al., 2014). As reported by Silinskas and

Kikas (2019), a principal axis factor analysis with oblimin rotation on the eight items in Grade 6 extracted two distinct factors with eigenvalues greater than 1. In addition, the Confirmatory Factor Analysis (CFA) provided further support for the proposed factor structure. In the present study, the same factor structure was confirmed for the questionnaires in both Grades 6 and 9. At each time-point, the dimensions were assessed using four questions each, with responses provided on a four-point Likert-type scale ranging from 1 (completely disagree) to 4 (completely agree).

Children's Tests

Math skills (Grade 3, Grade 6, and Grade 9). Because no standardized achievement tests exist in Estonia, we developed math tests according to the academic demands laid out in Estonian National Curriculum (Vabariigi Valitsus, 2002/2011; 2011/2018). Grades 3, 6, and 9 are the final grades of school stages according to Estonian educational system (basic school is divided into three stages: Grades 1–3, 4–6, and 7–9), and Estonian National Curriculum presents explicit description of the demands for each stage. The tasks our math tests tapped both arithmetic (or calculation; modified according to the grade level) and word-problem solving skills. The math test in Grade 3 included 16 arithmetic tasks (e.g., *63 – 26* = ?) and 10 word problems (e.g., *"The heights of four girls are 75 cm, 100 cm, 125 cm, and 150 cm. We know that Liis is the tallest. Ann is the shortest. Kai is taller than Sandra. How tall is Sandra?"*). The math test in Grade 6 included eight calculations (including also multiplication and dividing) and six word problems; in Grade 9, the math test included seven tasks in arithmetic (including fractions) and 12 word problems. To create a total score of math skills, the scores of the arithmetic test and word problems test were first standardized to z-scores, and the latent variable of both standardized scores were specified (see Table 1 for descriptive statistics of the composite score; see Table 2 for the factor loadings of the CFA).

General ability (Grade 3). General ability of the child was assessed using the D-set of Raven progressive matrices (Raven, 1981). The set consisted of 12 items; the sum of the correct answers was used in subsequent analyses.

Mothers' Questionnaire

Task persistence (Grade 3, Grade 6, and Grade 9). Mothers were asked to rate their children's task-persistent behavior in the context of homework using the Behavioral Strategy Rating Scale (see Zhang et al., 2011). The scale has been previously used in several studies in Estonia (e.g., Kikas et al., 2014). Unlike Dumont et al. (2012, 2014), we decided to use mothers' (not children's) reports of children's homework behavior because Grade 3 students may not be very adept in evaluating their own behavior. Mothers were asked to remember how their children typically behaved when completing their homework, and then rated their children's behavior on a 5-point rating scale (1 = not at all; 5 = to a great extent). Two questions were positively worded and dealt with the degree to which children engaged in active and persistent behaviors (e.g., *"shows activity and persistence in activities and solving tasks"*); and three questions were negatively worded and assessed children's lack of persistence and helplessness (e.g., *"easily loses his/her focus when the activity or task is not going well"*). Before the analyses, the three negatively-worded items were reversed (see Table 2 for the exact items and factor loadings of the CFA).

Analysis Strategy

We utilized a structural equation modeling (SEM) approach to answer our research questions. The models were constructed in the following way. First, we estimated separate measurement models for each construct across Grades 3, 6, and 9 (the variables of perceived support and control had data for only two measurement points, i.e., Grade 6 and 9). To ensure metric equivalence across time-points, the factor loadings of the same items were set equal across the different measurement points. We also specified autocorrelations between the

residuals of the same items across time. In addition, latent factors were allowed to be correlated with each other. Second, all measurement models were combined into the final measurement model containing four latent constructs across three time-points for adolescents' persistence and math skills, and across two time-points for perceptions concerning maternal support and control. Third, we constructed a structural equation model including the stabilities of the same constructs across time and concurrent associations among the constructs of the same time-point. Fourth, we added all possible cross-lagged associations between perceptions of maternal support and control, adolescents' task persistence, and math skills across Grades 6 and 9. In addition, we also specified the paths between math skills and persistence in Grade 3 to predict all four constructs in Grade 6. Finally, three control variables (i.e., general ability, maternal education, and child gender) were entered into the model to predict all four latent variables in Grade 6 (i.e., math skills, task persistence, and perceived support and control) and to be concurrently correlated with each other and with math skills and persistence in Grade 3.

Statistical analyses were conducted using the Mplus statistical package (Version 8; Muthén & Muthén, 1998–2017). The proportions of missing data ranged from 0% to 33.8% (M = 20.83%, SD = 16.26%). Our data was not missing completely at random (Little's (1988) MCAR test: χ^2 (3003) = 3352.88, $p < .001$). We assumed that the data is Missing-At-Random (MAR) and applied a FIML (Full Information Maximum Likelihood) data analysis approach that uses all the data that are available in order to estimate the model without imputing data. Because the distributions of some variables were skewed, we chose the MLR (Maximum Likelihood estimation with Robust standard errors) estimator that is typically employed to estimate the standard errors and chi-square test statistics for missing data with non-normal outcomes.

Our study participants were nested within their classrooms. The intra-class correlations (*ICC*s) for all study variables ranged between non-significant .002 ($p > .10$) to significant .11 (p

= .003), (highest for math skills, general ability, and maternal education), suggesting that a part of variance at the classroom level (between-level variance) may have accounted for variance at the student level (within-student variance). Therefore, we took this into account in our analyses by applying the COMPLEX function of Mplus. Clustering was based on the adolescents' classroom membership in Grade 6 (n = 52). Model fit was examined using five indices: the chi-square (χ^2), the comparative fit index (*CFI*), Tucker-Lewis index (*TLI*), root mean square error of approximation (*RMSEA*), and standardized root mean square residual (*SRMR*). *CFI* and *TLI* values above .95, a *RMSEA* value below .06, and a *SRMR* value below .08 indicate excellent model fit (Hu & Bentler, 1999). Only *CFI* and *TLI* values below .90 and *RMSEA* and *SRMR* values above .10 are indications of poor model fit (Kline, 2015).

Results

Descriptive Analyses

The psychometric properties of all study variables are presented in Table 1. The paired-samples t-test was performed to compare mean values of the same construct across Grades 6 and 9. The results showed a significant decrease in perceived parental support, $\Delta M = .27$, $t(421) = 6.82$, $p < .001$, and perceived parental control, $\Delta M = .45$, $t(420) = 12.40$, $p < .001$, across time. In contrast, an increase in task persistence across Grades 6 and 9 was observed, $\Delta M = -.08$, $t(445) = -2.20$, $p < .05$.

Measurement Models

To answer our key research questions, we started by estimating separate measurement models for each construct. For all separate measurement models, factor loading were invariant across time to make sure that the measures evaluated the construct consistently at each time point. The measurement models of math skills (χ^2 [2] = 2.874, p = .238; *CFI* = 1.00, *TLI* = .99, *RMSEA* = .03, *SRMR* = .01) and task persistence (χ^2 [80] = 262.033, p < .001; *CFI* = .94, *TLI* = .92, *RMSEA* = .06, *SRMR* = .05) satisfied the criteria for a good model fit. However, the models

of perceived support (χ^2 [18] = 90.478, $p < .001$; *CFI* = .95, *TLI* = .92, *RMSEA* = .09, *SRMR* = .07) and perceived control (χ^2 [18] = 109.449, $p < .001$; *CFI* = .91, *TLI* = .86, *RMSEA* = .09, *SRMR* = .07) were modified to achieve a good model fit. A careful inspection of the modification indices revealed that correlating the second and third items of perceived support in Grade 6 would help to achieve a good model fit (χ^2 [17] = 56.604, $p < .001$; *CFI* = .97, *TLI* = .95, *RMSEA* = .06, *SRMR* = .05). In addition, correlating the first and second items of perceived control in Grade 6 provided a good model fit (χ^2 [17] = 67.240, $p < .001$; *CFI* = .95, *TLI* = .92, *RMSEA* = .07, *SRMR* = .06). In each case, the largest modification index (i.e., the value provided by Mplus by which the chi-square of the model would drop) were considered first. Moreover, we followed the rationale that the modifications should concern items from the same latent construct (based on the theory and preliminarily conducted exploratory factor analyses).

Finally, all previously-developed measurement models were combined into one final measurement model, and a good model fit was obtained (χ^2 [569] = 1060.542, $p < .001$; *CFI* = .94, *TLI* = .93, *RMSEA* = .04, *SRMR* = .05). Thus, no other modifications to the final measurement model were implemented. The standardized factor loadings of each construct from the final measurement model are presented in Table 2. The correlations between latent constructs and observed control variables are presented in Table 3.

Structural Model

Next, we constructed a set of structural equation models. First, stability paths across the time-points within the same constructs were specified. Second, all possible cross-lagged paths across subsequent time-points were estimated. Good model fits were obtained for both models (*CFI* > .95, *TLI* > .95, *RMSEA* < .06, *SRMR* < .08). Finally, we included three control variables (i.e., general ability, maternal education, child gender) to account for their effects on the variables in Grade 6. This was our final model, and it showed a good model fit (χ^2 [670] = 1191.79, $p < .001$; *TLI* = .94; *CFI* = .93; *RMSEA* = .04; *SRMR* = .05). Figure 1 depicts only the

significant associations of the standardized solution; all the estimated (significant and non-significant) paths and concurrent associations are presented in Table 4.

In relation to our first research question, the results (Figure 1) showed that parental support in Grade 6 positively predicted adolescents' persistence in Grade 9. That is, the more perceived support reported by adolescents in Grade 6, the greater task persistence they exhibited in home learning situations in Grade 9.

In relation to our second research question, the results (Figure 1) showed that math skills in Grade 6 positively predicted adolescents' perceived parental support in Grade 9. That is, the better adolescents' math skills were, the more they perceived their parents as assisting with homework in a supportive way.

In relation to our third research question, the results (Figure 1) showed that perceived parental control in Grade 6 positively predicted perceived parental support in Grade 9. That is, the more adolescents perceived their parents as controlling concerning homework in Grade 6, the more perceived support they reported later on in Grade 9.

In addition, some of the Grade 3 control variables and demographic predictors yielded important and interesting results. Math skills in Grade 3 negatively predicted perceived parental control in Grade 6; that is, the better the adolescents' math skills were, the less they perceived their parents as involved in their homework in a controlling way. In addition, child gender positively predicted task persistence in Grade 6, showing that girls were more likely to be persistent in comparison to boys. Finally, child gender directly predicted perceived control in Grade 6, indicating that boys (versus girls) were more likely to perceive parental help as controlling.

Discussion

This study aimed to examine the longitudinal links between autonomy-supportive and controlling parental help during math homework, and adolescents' math skills and persistence

in completing homework across Grade 6 and Grade 9. The most important findings showed that perceived parental support in Grade 6 positively predicted children's persistence in completing homework in Grade 9, and that higher math skills in Grade 6 related to higher perceived parental support in Grade 9. In addition, lower math skills in Grade 3 predicted higher perceived control in Grade 6. Moreover, perceived control was somewhat more stable than perceived autonomy support, and higher control in Grade 6 predicted higher autonomy support in Grade 9.

Perceived Homework Help and Children's Academic Outcomes

As expected (Cooper et al., 2000; Ng et al., 2004; Silinskas & Kikas, 2019; Viljaranta et al., 2018), we found that perceived parental support in Grade 6 related to higher task persistence while doing homework in Grade 9. This result is not surprising given that supporting children's autonomy is emphasized throughout middle school (cf. Cooper et al., 2000). During this developmental period, adolescents improve their skills in planning and arguing, and typically increase their requests for autonomy (Hill & Tyson, 2009; Keating, 2004). Therefore, parental trust in children's abilities to take care of their homework, and their willingness to provide help when requested, can result in children showing persistence to complete their homework on their own. This result is also in accordance with self-determination theory, since adolescents' sense of autonomy and competence are among the most crucial ones concerning their self-regulated behavior (Ryan & Deci, 2000). Thus, by allowing their children to take care of their own homework independently, parents communicate their support for autonomy and confirmation of competence. In this way, parents strengthen adolescents' feeling of individual control, which then increases the effort that the adolescent invests in solving challenging problems (Pomerantz et al., 2007). The present study also adds to prior findings by demonstrating that the enhancing effects of parental support can be demonstrated longitudinally, across three years from Grade 6 to Grade 9 (rather than just

cross-sectionally, e.g., Cooper et al., 2000; Gonida & Cortina, 2014; Silinskas & Kikas, 2019). Moreover, the present study adds longitudinal evidence to support the notion that autonomy-supportive parental help may serve to prevent adolescents' motivational decline (Eccles et al., 1993).

However, our results did not indicate that parental support related to the development of math skills in Grade 9. This result is similar to that of Karbach et al. (2013), who did not find any relation between children's perceptions of support (i.e., autonomy and responsiveness) and math performance, after controlling for children's cognitive ability and parental education. In addition, Dumont et al., (2012) found no link between perceived parental support during homework in Grade 5 and math grades in Grade 8. It is worth noting that math skills develop in a cumulative fashion; that is, they are dependent on complex cognitive antecedents, and individuals need to first master basic operations to be able to later acquire more advanced math skills (Jordan, Kaplan, Ramineni, & Locuniak, 2009; Korpipää et al., 2017). Thus, as was also the case in our study, math skills are quite stable across time (Watts, Duncan, Siegler, & Davis-Kean, 2014). Therefore, while the effect of parental support may be specifically important when building math competence in the early years of schooling (Watts et al., 2014), the effect of parental support may become less observable in later grades. Another reason for the non-significant association between autonomy granting and math skills relates to the fact that many parents may not feel confident helping their children with advanced math, as parents may lack sufficient knowledge and expertise (Jeynes, 2007; Patall et al., 2008; Wilder, 2014). Therefore, even when asked for help, parents might not be able to contribute to the adolescents' math skill development.

Against our expectations and the findings of previous studies, we did not find any effect of perceived parental control in Grade 6 on children's math skills or task persistence in Grade 9. This result contradicts previous research findings, which consistently demonstrate that higher

parental control relates to lower math performance (Dumont et al., 2012; Hill & Tyson, 2009; Núñez et al., 2015; Silinskas et al., 2013, 2015) and lower motivation-related factors, such as task persistence (Levpuscek & Zupancic, 2009; Rogers, Theule, Ryan, Adams, & Keating, 2009; Viljaranta et al., 2018). One explanation could be that the role of perceived control is different in adolescence than it is in childhood. Indeed, some recent meta-analyses (Jeynes, 2007; Patall et al., 2008) and one recent meta-synthesis (Wilder, 2014) suggested that, while parental help in primary school appears to have a strong impact on children's achievement, this effect becomes less significant in later grades. In addition, it has been shown that the amount of perceived control declines with time (Cooper et al., 2000; Silinskas et al., 2015), probably due to adolescents' increased requests for autonomy and parents' limited abilities to understand math and help with math homework. These may comprise just some of the reasons why parental controlling practices do not have as strong effect on academic outcomes among middle school students, as compared with children in primary school.

Taken together, our results suggest that, across Grades 6 and 9, perceived parenting in homework situations is related to enhanced motivational behavior rather than skills. This has also been suggested by previous empirical research (e.g., Dumont et al., 2012; Rogers et al., 2009) and meta-analyses (e.g., Patall et al., 2008). For instance, Patall et al. (2008) suggested that parental homework help promotes proximal performance-related outcomes (e.g., motivation and motivation-related factors) rather than the performance itself. Our results also suggest that benefits for children's academic outcomes depend on the type of parental help (Cooper et al., 2000; Moroni et al., 2015; Silinskas et al., 2015). It has been proposed that it is not the frequency, but the quality of parental homework help that matters (see Pomerantz et al., 2007, for a review; Moroni et al., 2015). In particular, parental help in homework that supports autonomy, competence, and provides emotional responsiveness to children's needs promotes children's motivational behavior. In contrast, parental help in homework that is controlling,

intrusive, interfering, and accompanied by negative emotions may result in no effect or negative effect on academic outcomes, such as diminished persistence during homework (Cooper et al., 2000; Dumont et al., 2012, 2014; Grolnick & Pomerantz, 2009; Hill & Tyson, 2009; Silinskas et al., 2015).

Our results also support some of the claims of self-determination theory (Ryan & Deci, 2000). Based on the theory, parental assistance with homework contributes to children's intrinsic motivation by satisfying children's basic psychological needs (e.g., needs of competence, autonomy, and relatedness). Our results support this theory, suggesting that perceived parental support may increase children's intrinsic motivation to learn in terms of task-persistent behavior during homework (e.g., ability to learn and to perform certain tasks). However, we found limited support for the diminishing role of control on motivational behavior. Previous studies of different types of parental homework help mainly investigated the development of children's skills, whereas the present study is among the few that relate parental homework help with adolescents' motivational behavior.

When trying to explain our results between parental help and math homework, one needs to take beliefs about math into account. In particular, parents and children may hold many math-related beliefs, attitudes, cognitions about math that can play an important part in determining their behavior (Bandura, 1993; Grolnick et al., 1991; Luria, 1976). According to the expectancy–value theory (Eccles, 1983; Eccles et al., 1993; Trautwein et al., 2012; Trautwein & Lüdtke, 2009; Wigfield & Eccles, 2000), individuals may hold beliefs about their success in math in a short-term or long-term future and value math as a subject because it is interesting, important or useful for their future. Moreover, parents and children may think that math is difficult and stressful, they may think that some people are good in math and some people are not (e.g., you must have math abilities), it is not easy to learn and develop math skills, math is for boys, etc (Eden, Heine, & Jacobs, 2013). Therefore, the message that parents

transmit to their children may include information on the values and expectations they attach to math. The message may not be explicitly communicated and become clear only by the certain type parental helping behavior in relation to math homework. However, such message may relate to children's motivation to be persistent in homework and to succeed in math. Although the current study did not include any of those beliefs, they may have important implications for our results. For instance, if parents are encouraging children to figure out solutions on their own and support this process (if requested by the child), as opposed to providing correct answers, they are sending a message that math is something you can understand with effort. This can be the reason of why children's task persistence increase. If, on the other hand, children believe that math is simply full of things to memorize and they struggle to successfully do so, then they may be left to think that effort is not playing a role. As a result, children may not persist on difficult tasks. Consequently, considering parental and children's beliefs is important in understanding the relations between parental help concerning math homework and children's task persistent behavior.

Math Skills, Task Persistence, and Children's Perceptions of Parental Help

As expected (Levin et al., 1997; Silinskas et al., 2015), higher math skills in Grade 6 were related to higher perceived parental support in Grade 9, but not related to parental control. Instead, although not explicitly stated in the research questions, one additional result emerged concerning control variables in Grade 3: lower math skills in Grade 3 related to higher perceived control in Grade 6. Contrary to our expectations (Dumont et al., 2012, 2014; Viljaranta et al., 2018), task persistence in homework did not predict perceived support or perceived control across any of the three time-points. Taken together, these results lend some support to the transactional theories of human development (Sameroff, 2010) and theories on the evocative effects of child-related factors on parental responses (Bell, 1968; Nurmi, 2012; Nurmi & Kiuru, 2015; Scarr & McCartney, 1983; Stattin & Kerr, 2000). In addition, the results

emphasize that children's skills may have different effects on parental responses, depending on the child's age.

Several explanation can be discussed to account for the findings. First, it may be that parents modify their behavior based on clearly-observable and interpretable indicators (performance versus motivation-related factors). That is, low math skills are easier to understand as they are reflected in school grades, thus low school grades may trigger parental support more than low persistence in homework situations. This explanation can be further supported by taking the educational context of Estonia into account. In Estonia, grading generally begins in elementary school, and parents interpret poor grades as a sign of low skills. Although math tests were used in this study, the correlations between tests scores and teacher evaluations of students' skills were high ($r = .65$, $p < .001$; unpublished data). Thus, the knowledge that their child has difficulties in math may evoke specific practices from parents (e.g., checking homework, helping to complete homework, not drawing on child initiative) that can be perceived as low in autonomy support and high in control. The reason poor math skills were not related to later perceived control in adolescence (Grades 6 to 9) may be due to parents' difficulties in understanding advanced math tasks towards the end of middle school. In other words, even if parents notice their children's difficulties, they may be unable to help. In contrast, while perceived support was not predicted by skills in primary school, strong math skills predicted an increase in perceived support throughout middle school. There may be a few possible explanations for this finding. First, it is possible that adolescents with better knowledge and skills are also more self-confident and more eager to search for help. Such adolescents can discuss solutions with their parents, even if their parents are unable to provide the solutions themselves. However, it is also possible that more skillful children tend to have parents with better math knowledge, thereby providing adolescents the confidence that, once requested, relevant/appropriate help will be provided. These findings may also be due to the

unique characteristics of the Estonian education school system, where there is strong emphasis on grades, where national tests are carried out in several grades, and where the math curriculum is quite advanced. Thus, these results await replication in future studies in different countries/cultures.

Associations between Perceived Support and Perceived Control

We found that perceived control was somewhat more stable than perceived autonomy support, and higher control in Grade 6 predicted higher autonomy support in Grade 9. At the mean-level, the amount of both forms of parental homework help (support and control) decreased with time. These results confirm prior findings that homework help decreases in middle school as compared to primary school (Cooper et al., 2000; Gonida & Cortina, 2014; Green et al., 2007; Hill & Tyson, 2009). In addition, although parents provide more control in Grade 6, they gradually start to grant more support for autonomy as children progress through middle school. The fact that parents provide less homework help (i.e., controlling help) as children grow older is very well understood by taking into account children's developmental stage. In particular, students in elementary school need more help with math homework, but students in the middle school are expected to take care of their homework on their own. Therefore, there might be parents who are used to helping their children, but change their behavior concerning homework help. For instance, math topics become more difficult with each grade and parents might not be able to understand and help with all math topics. Also, with math topics becoming more complicated, parental own math anxiety may provoke more frequent autonomy granting concerning math homework. It is also possible that other motivational variables (task values, self-concept of ability; Eccles et al., 1993), not assessed in the current study, are mediating the association between parental homework help and parental support. That is, if parents notice that their child is interested in math and expresses competence in math tasks, then the controlling help transforms into supportive help. Finally,

these results may also suggest that, with age, children's judgements of controlling parental help become more tempered, thus what was once considered controlling is now considered supportive. That is, children's perceptions may become more accurate with time, children may begin to differentiate the two types of parental help better, and children may begin to interpret parental help more positively (rather than perceiving all parental help as controlling help).

Effect of Background Characteristics

All results of this study were controlled for background characteristics, such as children's cognitive ability, maternal education, and child gender. Consistent with our expectations and previous research, math skills in Grade 3 related to children's general ability (Karbach et al., 2013; Silinskas et al., 2013; Silinskas & Kikas, 2019; Su et al., 2015) and parental education (Karbach et al., 2013; Silinskas & Kikas, 2019; Su et al., 2015). In addition, general ability was related to the gender of the child (girls scored higher on the general ability tasks in Grade 3 than boys) as well as higher task persistence in homework in Grade 3. However, neither general ability nor maternal education predicted any of the variables in Grade 6 (math skills, persistence, or perceived parental support or control).

The most interesting results concerning background characteristics relate to the effects of child gender on task-persistent behavior and perceived control. Similar to previous studies, we found that girls (versus boys) showed higher task persistence in homework situations (Kikas et al., 2014; Onatsu-Arvilommi & Nurmi, 2000), as reported by mothers. This suggests that, when faced with a difficult task, boys may give up easier and lose focus or interest, both during lessons at school and when completing homework assignments at home; girls, on the other hand, display significantly better self-regulation, allowing superior performance in completing homework tasks than boys (Pajares, 2002; Zimmerman & Martinez-Pons, 1990). Another gender-related finding showed that boys (versus girls) reported more control by their parents during homework (Bhanot & Jovanovic, 2005; Carter & Wojtkiewicz, 2000; Dumont et al.,

2012). These results highlight the tendency for boys to perceive parental homework help as controlling. Consistent with previous literature, in comparison to girls, boys indeed get more help with homework, which can often be more controlling and intrusive (Bhanot & Jovanovic, 2005; Cooper et al., 2000; Dumont et al., 2012, 2014). Boys' propensity to attract controlling reactions from their parents, as well as their lack of persistence when completing difficult homework tasks, needs to be addressed when providing advice for parents about the most optimal ways of supporting children with their homework.

Limitations

Some limitations should be noted before generalizations about the findings can be made. First, albeit we collected longitudinal data across three time-points and implemented cross-lagged design, our study is correlational in nature. Therefore, the study does not imply causality beyond tentative longitudinal relations. Moreover, as is the case with correlational research, multiple models could have fitted our data equally well (MacCallum, Roznowski, & Necowitz, 1992). This applies also to the issue of model modification, as with large number of modifications, almost all models can reach adequate fit to the data (MacCallum et al., 1992). However, to prevent the latter problem, we took a very conservative approach and considered only minimum amount of the modifications (one for support and one for control) and only those modifications that could be explained theoretically or methodologically. Because the initial model was modified to improve its fit in a single sample, the resulting modified model may not generalize to other samples. Thus, the models obtained here should be evaluated in future studies.

Second, the data concerning parental help was collected from children; however, we would gain more insight into parenting as it relates to homework if empirical studies would measure both children's perceptions and actual parental behaviors (see, e.g., Dinkelmann & Buff, 2016; Gonida & Cortina, 2014). In the present study, our use of children's reports on their

parental math homework help was based on the idea that what matters the most is not an objective measure of parental homework help, but rather children's perceptions and interpretations of parental homework help (cf. Bandura, 1993; Luria, 1976). Compared with parental reports, children's reports are less influenced by social desirability (Sessa et al., 2001). Furthermore, children's reports on parental homework control often correlate strongly with parental reports of perceived homework control (r = .67, Su et al., 2015; r = .43, Dinkelmann & Buff, 2016), suggesting a strong relation between children's and parents' reports.

Third, while all variables in our study were math-related, task persistence was measured as a general measure of children's behavior in homework situations. This could have decreased the chances of finding significant results, compared with variables that are math-specific. The decision to use a general task-persistence measure was made because parents often take math-related task persistence into account when evaluating their children's overall task persistence when doing homework. In addition, the task persistence of a specific subject often correlates highly across domains (e.g., around .62 in Grade 6 and .58 in Grade 9 between math and language teachers; unpublished data). However, future studies should consider estimating all constructs as subject-specific.

Fourth, the math tests we used were based on the Estonian National Curriculum but were not standardized for the Estonian population. Although we did our best to calibrate the test to represent the breadth and difficulty level of the curriculum, and to make the math tests' difficulty levels equivalent across time-points, creating and using standardized math tests for Estonian population are clearly needed for the future research. Also, our math variable had a somewhat low internal consistency across all time-points. One reason for this could be the fact that our math measure was a combination of 'calculation' test and 'word problems' test. While calculation test became more complex as the test progressed, the tasks in the word problems test remained less complicated. Thus, it may be that students were able to perform simple

operations in the word problems test but not difficult operations in the calculation test. Also, it is possible that reading skills affect solving word problems more than solving calculations.

Finally, the study was conducted in Estonia, thus the specifics of the Estonian cultural environment must be noted. Throughout Estonian schooling, children are expected to do homework (6.9 hours per week; see OECD, 2014), and homework load increases with time. As our study took place at the end of Grade 6 and at the end of Grade 9, right when Estonian students are intensively preparing for compulsory national testing in math, parents may feel a strong obligation to get involved in their children's homework to help them prepare for these tests. The math curriculum becomes quite advanced by the end of Grade 9 and may be incomprehensible for some parents, thereby rendering them incapable of supporting their children with math homework properly, even if they so desire. While the results of the present study suggest some similarities with other countries (e.g., Finland: Silinskas et al., 2013; Germany: Dumont et al., 2012; Karbach et al., 2013; the United States: Cooper et al., 2000), a more thorough investigation of differences between countries in parental homework help remains a challenge for future research.

Conclusions

We conducted a longitudinal investigation of the reciprocal relations between perceived parental help and children's task persistent behavior and math skills among middle school children. Our results add to existing literature in several ways. First, the results emphasize the importance of differentiating between various types of parental homework help (i.e., children's perceptions of parental control and support), as they relate to child outcomes differently. That is, in middle school, perceived parental support in math homework promotes children's persistence in homework, whereas perceived control does not show clear connections to children's motivation or achievement outcomes. Second, the results highlight the importance of taking into account each child's unique developmental stage when understanding how their

math skills affect certain kinds of parental practices and child perceptions concerning parental homework help. That is, poor math skills predict children's perceptions of their parents' help as controlling in primary school (Grades 3–6), whereas children with good math skills perceive parental help as providing autonomy in completing math homework across middle school (Grades 6–9). Finally, across middle school, perceived control seems to be somewhat more stable than perceived support, and perceived control predicts perceived support. In addition, we found that boys in particular (versus girls) are less persistent in homework and tend to interpret parental support as controlling.

In Grades 6 to 9, the math curriculum becomes significantly more demanding than before. In addition, children start getting more math homework than in previous grades, partially due to preparations for national testing at the end of Grades 6 and 9. Thus, more parental support may be necessary for children to approach math homework with higher persistent behavior. Task persistent behavior in math homework is especially important given its relations to the better math skills (as also shown by the concurrent correlations of our study). Thus, parents should be encouraged to get involved with math homework in such a way that promotes children's task persistence when approaching math tasks. Based on our results, parents should be advised that their efforts to help with math homework may be perceived in at least two ways: as autonomy supporting or as controlling. This adolescent interpretation—not parental intentions or amount of help—impacts academic outcomes (e.g., task persistence during homework). Given our results, strong cooperation between teachers and parents can act as an important factor toward improving the quality of parental help in children's homework.

References

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*, 117–148. doi:10.1207/s15326985ep2802_3

Bell, R. Q. (1968). A reinterpretation of the direction of effects in studies of socialization. *Psychological Review*, *75*, 81–95.

Bhanot, R., & Jovanovic, J. (2005). Do parents' academic gender stereotypes influence whether they intrude on their children's homework? *Sex Roles*, *52*, 597–607. doi:10.1007/s11199-005-3728-4

Carter, R. S., & Wojtkiewicz, R. A. (2000). Parental involvement with adolescents' education: Do daughters or sons get more help? *Adolescence*, *35*, 29–44.

Cooper, H., Lindsay, J. J., & Nye, B. (2000). Homework in the home: How student, family, and parenting-style differences relate to the homework process. *Contemporary Educational Psychology*, *25*, 464–487. doi:10.1006/ceps.1999.1036

Cooper, H., Robinson, J. C., & Patall, E. A. (2006). Does homework improve academic achievement? A synthesis of research, 1987–2003. *Review of Educational Research*, *76*, 1–62. http://www.jstor.org/stable/3700582

Dinkelmann, I., & Buff, A. (2016). Children's and parents' perceptions of parental support and their effects on children's achievement motivation and achievement in mathematics. A longitudinal predictive mediation model. *Learning and Individual Differences*, *50*, 122–132. doi:10.1016/j.lindif.2016.06.029

Doctoroff, G. L., & Arnold, D. H. (2017). Doing homework together: The relation between parenting strategies, child engagement, and achievement. *Journal of Applied Developmental Psychology*, *48*, 103–113. doi:10.1016/j.appdev.2017.01.001

Dumont, H., Trautwein, U., Lüdtke, O., Neumann, M., Niggli, A., & Schnyder, I. (2012). Does parental homework involvement mediate the relationship between family background

and educational outcomes? *Contemporary Educational Psychology*, *37*, 55–69. doi:10.1016/j.cedpsych.2011.09.004

Dumont, H., Trautwein, U., Nagy, G., & Nagengast, B. (2014). Quality of parental homework involvement: Predictors and reciprocal relations with academic functioning in the reading domain. *Journal of Educational Psychology*, *106*, 144–161. doi:10.1037/a0034100

Eccles, J. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and sociological approaches* (pp. 75–146). San Francisco, CA: W. H. Freeman.

Eccles, J. S., Midgley, C., Wigfield, A.,Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist*, *48*, 90–101. doi:10.1037/0003-066X.48.2.90

Eden, C., Heine, A., & Jacobs, A. M. (2013). Mathematics anxiety and its development in the course of formal schooling—a review. *Psychology*, *4*, 27–35.

Fan, H., Xu, J., Cai, Z., He, J., & Fan, X. (2017). Homework and students' achievement in math and science: A 30-year meta-analysis, 1986–2015. *Educational Research Review*, *20*, 35–54. doi:10.1016/j.edurev.2016.11.003

Gonida, E. N., & Cortina, K. S. (2014). Parental involvement in homework: Relations with parent and student achieve- ment-related motivational beliefs and achievement. *British Journal of Educational Psychology*, *84*, 376–396. doi:10. 1111/bjep.12039

Gonzales, N. A., Cauce, A. M., & Mason, C. A. (1996). Interobserver agreement in the assessment of parental behavior and parent-adolescent conflict: African American

mothers, daughters, and independent observers. *Child Development*, *67*, 1483–1498. doi:10.2307/1131713

Green, C. L., Walker, J. M., Hoover-Dempsey, K. V., & Sandler, H. M. (2007). Parents' motivations for involvement in children's education: An empirical test of a theoretical model of parental involvement. *Journal of Educational Psychology*, *99*, 532–544. doi:10.1037/0022-0663.99.3.532

Grolnick, W., Gurland, S., DeCourcey, W., & Jacob, K. (2002). Antecedents and consequences of mothers' autonomy support: An experimental investigation. *Developmental Psychology*, *38*, 143–155. doi:10.1037/0012-1649.38.1.143

Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives*, *3*, 165–170. doi:10.1111/j.1750-8606.2009.00099.x

Grolnick, W. S., Ryan, R. M., & Deci, E. L. (1991). Inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *Journal of Educational Psychology*, *83*, 508–517. doi:10.1037/0022-0663.83.4.508

Grolnick, W. S., & Slowiaczek, M. L. (1994). Parents' involvement in children's schooling: A multidimensional conceptualization and motivational model. *Child Development*, *65*, 237–252. doi:10.1111/1467-8624.ep9406130692

Gurland, S., & Grolnick, W. (2005). Perceived threat, controlling parenting, and children's achievement orientations. *Motivation and Emotion*, *29*, 103–121. doi:10.1007/s11031-005-7956-2

Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest*, *8,* 1–51. doi:10.1111/j.1529-1006.2007.00031.x

Harris, A., & Goodall, J. (2008). Do parents know they matter? Engaging all parents in learning. *Educational Research*, *50*, 277–289. doi:10.1080/00131880802309424

Hill, E. N., & Tyson, D. F. (2009). Parental involvement in middle school: A meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology*, *45*, 740–763. doi:10.1037/a0015362

Hoglund, W., Jones, S., Brown, J., & Aber, L. (2015). The Evocative Influence of Child Academic and Social-Emotional Adjustment on Parent Involvement in Inner-City Schools. *Journal of Educational Psychology*, *107*, 517–532. doi:10.1037/a0037266

Hoover-Dempsey, K. V., Battiato, A. C., Walker, J. M. T., Reed, R. P., De Jong, J. M., & Jones, K. P. (2001). Parental involvement in homework. *Educational Psychologist*, *36*, 195–209. doi:10.1207/S15326985EP3603_5

Hu, L. -T., & Bentler, P. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55. doi:10.1080/10705519909540118

Jang, H., Reeve, J., & Deci, E. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology*, *102*, 588 – 600. doi:10.1037/a0019682

Jeynes, W. H. (2007). The relationship between parental involvement and urban secondary school student academic achievement: A meta-analysis. *Urban Education*, *42*, 82–110. doi: 10.1177/0042085906293818

Jordan, N. C., Kaplan, D., Ramineni, C., & Locuniak, M. N. (2009). Early math matters: Kindergarten number competence and later mathematics outcomes. *Developmental Psychology*, *45*, 850–867. doi:10.1037/a0014939

Karbach, J., Gottschling, J., Spengler, M., Hegewald, K., & Spinath, F. M. (2013). Parental involvement and general cognitive ability as predictors of domain-specific academic

achievement in early adolescence. *Learning and Instruction*, *23*, 43–51. doi:10.1016/j.learninstruc.2012.09.004

Keating, D. P. (2004). Cognitive and brain development. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (2nd ed., pp. 45–84). Hoboken, NJ: Wiley.

Kikas, E., & Mägi, K. (2017). Does self-efficacy mediate the effect of primary school teachers' emotional support on learning behavior and academic skills? *Journal of Early Adolescence*, *37*, 696–730. doi:10.1177/0272431615624567

Kikas, E., Peets, K., & Hodges, E. (2014). Collective student characteristics alter the effects of teaching practices on academic outcomes. *Journal of Applied Developmental Psychology*, *35*, 273–283. doi:10.1016j.appdev.2014.04.004

Kikas, E., Peets, K., Palu, A., & Afanasjev, J. (2009). The role of individual and contextual factors in the development of maths skills. *Educational Psychology*, *29*, 541–560. doi:10.1080/01443410903118499

Kikas, E., & Silinskas, G. (2016). Task persistence mediates the effect of children's literacy skills on mothers' academic help. *Educational Psychology*, *36*, 975–991. doi:10.1080/01443410.2015.1045836

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). New York, NY: Guilford Press.

Korpipää, H., Koponen, T., Aro, M., Tolvanen, A., Aunola, K., Poikkeus, A. M., ... & Nurmi, J. E. (2017). Covariation between reading and arithmetic skills from Grade 1 to Grade 7. *Contemporary Educational Psychology*, *51*, 131–140. doi:10.1016/j.cedpsych.2017.06.005

Lachance, J. A., & Mazzocco, M. M. (2006). A longitudinal analysis of sex differences in math and spatial skills in primary school age children. *Learning and Individual Differences*, *16*, 195–216. doi:10.1016/j.lindif.2005.12.001

Levin, I., Levy-Shiff, R., Applebaum-Peled, T., Katz, I., Komar, M., & Merian, N. (1997). Antecedents and consequences of maternal involvement in children's homework: A longitudinal analysis. *Journal of Applied Developmental Psychology*, *18*, 207–227. doi:10.1016/S0193-3973(97)90036-8

Levpušček, M. P., & Zupančič, M. (2009). Math achievement in early adolescence: The role of parental involvement, teachers' behavior, and students' motivational beliefs about math. *Journal of Early Adolescence*, *29*, 541–570. doi:10.1177/0272431608324189

Little, R. J. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, *83*, 1198–1202. doi:10.2307/2290157

Luria, A. R. (1976). *Cognitive development and its cultural and social foundations.* Cambridge, MA: Harvard University Press.

MacCallum, R. C., Roznowski, M., & Necowitz, L. B. (1992). Model modifications in covariance structure analysis: The problem of capitalization on chance. *Psychological Bulletin*, *111*, 490–504.

Moroni, S., Dumont, H., Trautwein, U., Niggli, A., & Baeriswyl, F. (2015). The need to distinguish between quantity and quality in research on parental involvement: The example of parental help with homework. *Journal of Educational Research*, *108*, 417–431. doi:10.1080/00220671.2014.901283

Muthén, L.K., & Muthén, B.O. (1998–2017). *Mplus user's guide.* (8th ed.). Los Angeles, CA: Muthén & Muthén.

Ng, F., Kenney-Benson, G., & Pomerantz, E. (2004). Children's achievement moderates the effects of mothers' use of control and autonomy support. *Child Development*, *75*, 764–780. doi:10.1111/j.1467-8624.2004.00705.x

Núñez, J. C., Epstein, J. L., Suárez, N., Rosário, P., Vallejo, G., & Valle, A. (2017). How do student prior achievement and homework behaviors relate to perceived parental involvement in homework? *Frontiers in Psychology*, *8*, 1217. doi:10.3389/fpsyg.2017.01217

Núñez, J. C., Suárez, N., Rosário, P., Vallejo, G., Valle, A., & Epstein, J. L. (2015). Relationships between perceived parental involvement in homework, student homework behaviors, and academic achievement: Differences among elementary, junior high, and high school students. *Metacognition and Learning*, *10*, 375–406. doi:10.1007/s11409-015-9135-5

Nurmi, J. E. (2012). Students' characteristics and teacher-child relationships in instruction: A meta-analysis. *Educational Research Review*, *7*, 177–197. doi:10.1016/j.edurev.2012.03.001

Nurmi, J. E., & Kiuru, N. (2015). Students' evocative impact on teacher instruction and teacher–child relationships: Theoretical background and an overview of previous research. *International Journal of Behavioral Development*, *39*, 432–444. doi:10.1177/0165025415592514

OECD (2013). *PISA 2012 results: Ready to learn: Students' engagement, drive and self-beliefs (Volume III), PISA*. OECD Publishing. http://dx.doi.org/10.1787/9789264201170-en

OECD (2014). Education at a Glance 2014. OECD indicators. OECD Publishing. https://www.oecd.org/edu/Education-at-a-Glance-2014.pdf

OECD (2016). *PISA 2015 Results (Volume I): Excellence and Equity in Education*. OECD Publishing. http://dx.doi.org/10.1787/9789264266490-en

Onatsu-Arvilommi, T., & Nurmi, J.-E. (2000). The role of task-avoidant and task-focused behaviors in the development of reading and mathematical skills during the first school

year: A cross-lagged longitudinal study. *Journal of Educational Psychology*, *93*, 478–491. doi:10.1037/0022-0663.92.3.478

Pajares, F. (2002). Gender and perceived self-efficacy in self-regulated learning. *Theory into Practice*, *41*, 116–125. doi:10.1207/s15430421tip4102_8

Patall, E. A., Cooper, H., & Robinson, J. C. (2008). Parent involvement in homework: A research synthesis. *Review of Educational Research*, *78*, 1039–1101. doi:10.3102/0034654308325185

Pomerantz, E. M., & Eaton, M. M. (2001). Maternal intrusive support in the academic context: Transactional socialization process. *Developmental Psychology*, *37*, 174–186. doi:10.1037/0012-1649.37.2.174

Pomerantz, E. M., Moorman, E. A., & Litwack, S. D. (2007). The how, whom, and why of parents' involvement in children's academic lives: More is not always better. *Review of Educational Research*, *77*, 373–410. doi:10.3102/003465430305567

Pomerantz, E. M., Wang, Q., & Ng, F. F. Y. (2005). Mothers' affect in the homework context: The importance of staying positive. *Developmental Psychology*, *41*, 414–427. doi:10.1037/0012-1649.41.2.414

Raven, J. (1981). *Manual for Raven's progressive matrices and Mill Hill vocabulary scales.* Oxford: Oxford Psychologists Press.

Rogers, M. A., Theule, J., Ryan, B. A., Adams, G. R., & Keating, L. (2009). Parental involvement and children's school achievement. *Canadian Journal of School Psychology*, *24*, 34–57. doi:10.1177/0829573508328445

Roth, G., Assor, A., Niemiec, C., Ryan, R., & Deci, E. (2009). The emotional and academic consequences of parental conditional regard: Comparing conditional positive regard, conditional negative regard, and autonomy support as parenting practices. *Developmental Psychology*, *45*, 1119–1142. doi:10.1037/a0015272

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*, 68–78. doi:10.1037/0003-066X.55.1.68

Ryan, A., & Shim, S. (2012). Changes in help seeking from peers during early adolescence: Associations with changes in achievement and perceptions of teachers. *Journal of Educational Psychology*, *104*, 1122–1134. doi:10.1037/a0027696

Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child Development*, *81*, 6–22. doi:10.1111/j.1467-8624.2009.01378.x

Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype→ environment effects. *Child Development*, *54*, 424–435. doi:10.2307/1129703

Sessa, F. M., Avenevoli, S., Steinberg, L., & Morris, A. S. (2001). Correspondence among informants on parenting: Preschool children, mothers, and observers. *Journal of Family Psychology*, *15*, 53–68. doi:10.1037/0893-3200.15.1.53

Silinskas, G., & Kikas, E. (2019). Parental involvement in math homework: Links to children's performance and motivation. *Scandinavian Journal of Educational Research*, 1–21. *In press*. doi:10.1080/00313831.2017.1324901

Silinskas, G., Kiuru, N., Aunola, K., Lerkkanen, M. K., & Nurmi, J. E. (2015). The developmental dynamics of children's academic performance and mothers' homework-related affect and practices. *Developmental Psychology*, *51*, 419–433. doi:10.1037/a0038908

Silinskas, G., Niemi, P., Lerkkanen, M.-K., & Nurmi, J.-E. (2013). Children's poor academic performance evokes parental homework assistance—But does it help? *International Journal of Behavioral Development*, *37*, 44–56. doi:10. 1177/0165025412456146

Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development*, *71*, 1072–1085. http://www.jstor.org/stable/1132345

Su, Y., Doerr, H. S., Johnson, W., Shi, J., & Spinath, F. M. (2015). The role of parental control in predicting school achievement independent of intelligence. *Learning and Individual Differences*, *37*, 203–209. doi:10.1016/j.lindif.2014.11.023

Sy, S., Gottfried, A. W., & Gottfried, A.E. (2013). A transactional model of parental involvement and children's achievement from early childhood through adolescence. *Parenting: Science and Practice*, *13*, 133–152, doi:10.1080/15295192.2012.709155

Trautwein, U. (2007). The homework-achievement relation reconsidered: Differentiating homework time, homework frequency, and homework effort. *Learning and Instruction*, *17*, 372–388. doi:10.1016/j.learninstruc.2007.02.009

Trautwein, U., & Lüdtke, O. (2009). Predicting homework motivation and homework effort in six school subjects: The role of person and family characteristics, classroom factors, and school track. *Learning and Instruction*, *19*, 243–258. doi:10.1016/j.learninstruc.2008.05.001

Trautwein, U., Marsh, H. W., Nagengast, B., Lüdtke, O., Nagy, G., & Jonkmann, K. (2012). Probing for the multiplicative term in modern expectancy–value theory: A latent interaction modeling study. *Journal of Educational Psychology*, *104*, 763–777.

Trautwein, U., Schnyder, I., Niggli, A., Neumann, M., & Lüdtke, O. (2009). Chameleon effects in homework research: The homework–achievement association depends on the measures used and the level of analysis chosen. *Contemporary Educational Psychology*, *34*, 77–88. doi.org/10.1016/j.cedpsych.2008.09.001

Vabariigi Valitsus. (2002/2010). *Põhikooli ja gümnaasiumi riiklik õppekava [National curriculum for basic schools and upper secondary schools]*. Riigi Teataja I, 6(21). Retrieved from https://www.riigiteataja.ee/akt/13276017

Viljaranta, J., Silinskas, G., Lerkkanen, M. K., Hirvonen, R., Pakarinen, E., Poikkeus, A. M., & Nurmi, J. E. (2018). Maternal homework assistance and children's task-persistent behavior in elementary school. *Learning and Instruction*, *56*, 54–63. doi:10.1016/j.learninstruc.2018.04.005

Vygotsky, L. (1978). *Mind in society. Development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Watts, T. W., Duncan, G. J., Siegler, R. S., & Davis-Kean, P. E. (2014). What's past is prologue: Relations between early mathematics knowledge and high school achievement. *Educational Researcher*, *43*, 352–360. doi:10.3102/0013189X14553660

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology*, *25*, 68–81. doi:10.1006/ceps.1999.1015

Wilder S. (2014). Effects of parental involvement on academic achievement: A meta-synthesis. *Educational Review*, *66*, 377–397. doi:10.1080/00131911.2013.780009

Zhang, X., Nurmi, J.-E., Kiuru, N., Lerkkanen, M.-K., & Aunola, K. (2011). A teacher report measure of children's task-avoidant behavior: A validation study of the Behavioral Strategy Rating Scale. *Learning and Individual Differences*, *21*, 690–698. doi:10.1016/j.lindif.2011.09.007

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology*, *82*, 51–59. doi:10.1037/0022-0663.82. 1.51

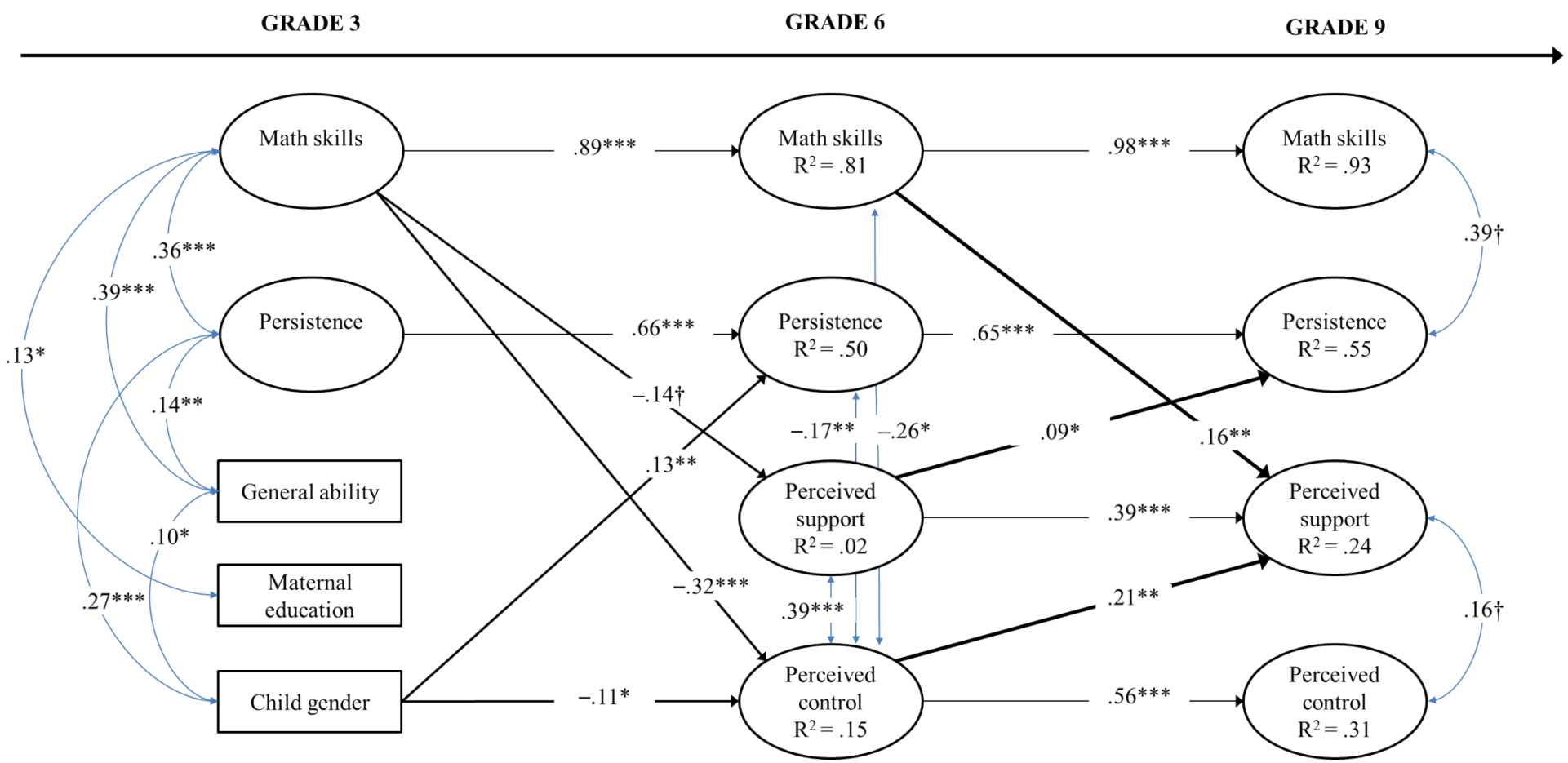

Figure 1. Children's math skills, task persistence in homework, and perceived parental support and control, after controlling for child general ability, maternal education, and child gender (N = 624). Standardized solution of Structural Equation Model (χ^2 [670] = 1191.79, $p < .001$; *TLI* = .94; *CFI* = .93; *RMSEA* = .04; *SRMR* = .05). Only significant paths and correlations are shown in the Figure 1; all paths and concurrent associations are presented in the Table 4. † $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 1

Psychometric Properties of All Study Variables

Variable	*n*	*M*	*SD*	Reliability (Cronbach's α)	Range		Skewness
					Potential	Actual	
Perceived parental homework help during math homework							
Support (Grade 6)	624	3.44	.65	.82	1–4	1–4	–.1.51
Control (Grade 6)	623	2.00	.80	.80	1–4	1–4	.48
Support (Grade 9)	422	3.18	.80	.88	1–4	1–4	–1.04
Control (Grade 9)	421	1.52	.61	.78	1–4	1–4	1.18
Child outcomes							
Math skills (Grade 3)	457	.07	.78	.63		-3.67–1.42	–1.18
Math skills (Grade 6)	622	-.01	.82	.54		-2.98–1.86	–.22
Math skills (Grade 9)	492	.01	.90	.76		-1.75–1.98	.15
Task persistence (Grade 3)	413	3.35	.75	.89	1–5	1–5	–.14
Task persistence (Grade 6)	504	3.60	.82	.88	1–5	1–5	–.32
Task persistence (Grade 9)	449	3.67	.83	.91	1–5	1–5	–.42
Control variables							
General ability (Grade 3)	443	7.41	2.64	.90	0–12	0–12	–.88
Maternal education:	544	2.14	.58		1–3	1–3	–.03
Low	59						
Medium	346						
High	139						
Gender:	624	1.49	.50		1–2	1–2	.01
Boys	314						
Girls	310						

Table 2

Standardized Factor Loadings of the Confirmatory Factor Analysis for Major Study Variables

Items	Grade 3	Grade 6	Grade 9
Perceived parental homework help during math homework			
Support			
1. *My parents help me with math homework, if I ask them*		.63	.75
2. *When I'm doing math homework, I can ask my parents for help at any time*		.72	.88
3. *When I'm doing math homework, I can ask my parents for help if I do not understand something*		.76	.92
4. *My parents help me with math homework, if I'm having difficulties.*		.71	.68
Control			
1. *My parents help me with math homework even when I don't need any help*		.62	.71
2. *My parents often interfere when I'm doing math homework*		.50	.61
3. *When I'm doing math homework, my parents ask if I need help*		.80	.77
4. *My parents afford opportunity to do math homework together*		.78	.72
Child outcomes			
Math skills			
1. *Arithmetics/calculation*	.60	.52	.68
2. *Word problems*	.77	.72	.91
Task persistence during homework			
1. *If difficulty arises in doing assignments, does the child easily start doing something else?* (reversed)	.79	.77	.82
2. *Does the child actively try to manage even the difficult assignments?*	.75	.74	.83
3. *Does the child easily give up trying?* (reversed)	.79	.78	.85
4. *Does the child show activeness or endurance when doing the assignments?*	.76	.76	.77
5. *If the assignment does not go well, does the child begin to busy her/himself with this and that?* (reversed)	.79	.78	.81

Table 3

Correlations between All Latent Constructs and Observed Control Variables

		1	2	3	4	5	6	7	8	9	10	11	12
	Perceived parental homework help during math homework												
1	Support (Grade 6)												
2	Control (Grade 6)	.40***											
3	Support (Grade 9)	.45***	.29***										
4	Control (Grade 9)	.15*	.53***	.24***									
	Child outcomes												
5	Math skills (Grade 3)	–.11†	–.34***	–.02	–.17*								
6	Math skills (Grade 6)	–.09	–.39***	.05	–.28***	.87***							
7	Math skills (Grade 9)	–.06	–.35***	.05	–.24***	.88***	.93***						
8	Task persistence (Grade 3)	–.07	–.23***	–.09†	–.11	.36***	.31***	.26***					
9	Task persistence (Grade 6)	–.02	–.31***	.01	–.21***	.34***	.30***	.32***	.72***				
10	Task persistence (Grade 9)	.05	–.26***	.09†	–.18**	.29***	.33***	.38***	.56***	.68***			
	Control variables												
11	General ability (Grade 3)	.02	–.15*	.08†	–.21**	.39***	.39***	.35***	.14**	.12†	.13†		
12	Maternal education	.02	.01	.09	.07	.12*	.14*	.16**	.01	.04	.05	–.01	
13	Gender (1 = boy; 2 = girl)	.02	–.11*	–.07	–.18**	–.05	.01	–.08	.27***	.28***	.24***	.10*	.03

Note. † $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4

Standardized and Unstandardized Estimates for the Final Model (N = 624)

			Unstand. estimate	*SE*	*Stand. estimate*	*SE*	*p*-value
Stability paths							
Math skills (Grade 3)	→	Math skills (Grade 6)	.832	.102	.891	.077	**<.000**
Math skills (Grade 6)	→	Math skills (Grade 9)	1.317	.098	.981	.047	**<.000**
Persistence (Grade 3)	→	Persistence (Grade 6)	.711	.054	.659	.051	**<.000**
Persistence (Grade 6)	→	Persistence (Grade 9)	.664	.059	.648	.045	**<.000**
Perceived support (Grade 6)	→	Perceived support (Grade 9)	.525	.110	.391	.075	**<.000**
Perceived control (Grade 6)	→	Perceived control (Grade 9)	.449	.073	.558	.076	**<.000**
Cross-lagged paths							
Persistence (Grade 3)	→	Math skills (Grade 6)	–.024	.050	–.035	.071	.626
General ability (Grade 3)	→	Math skills (Grade 6)	.008	.014	.039	.070	.580
Maternal education (Grade 3)	→	Math skills (Grade 6)	.004	.040	.045	.045	.316
Child gender (Grade 3)	→	Math skills (Grade 6)	–.013	.052	–.013	.050	.802
Math skills (Grade 3)	→	Persistence (Grade 6)	.169	.122	.119	.085	.163
General ability (Grade 3)	→	Persistence (Grade 6)	–.010	.017	–.034	.056	.541
Maternal education (Grade 3)	→	Persistence (Grade 6)	.012	.056	.009	.042	.831
Child gender (Grade 3)	→	Persistence (Grade 6)	.197	.067	.125	.042	**.003**

Math skills (Grade 3)	→	Perceived support (Grade 6)	–.126	.067	–.143	.077	***.062***
Persistence (Grade 3)	→	Perceived support (Grade 6)	–.029	.045	–.043	.067	.516
General ability (Grade 3)	→	Perceived support (Grade 6)	.016	.011	.088	.063	.158
Maternal education (Grade 3)	→	Perceived support (Grade 6)	.038	.044	.046	.053	.382
Child gender (Grade 3)	→	Perceived support (Grade 6)	.013	.044	.013	.046	.768
Math skills (Grade 3)	→	Perceived control (Grade 6)	–.318	.084	–.318	.072	**<.000**
Persistence (Grade 3)	→	Perceived control (Grade 6)	–.070	.045	–.093	.059	.119
General ability (Grade 3)	→	Perceived control (Grade 6)	–.003	.013	–.012	.064	.852
Maternal education (Grade 3)	→	Perceived control (Grade 6)	.054	.050	.057	.053	.284
Child gender (Grade 3)	→	Perceived control (Grade 6)	–.117	.054	–.105	.048	**.028**
Persistence (Grade 6)	→	Math skills (Grade 9)	.008	.046	.009	.053	.870
Perceived support (Grade 6)	→	Math skills (Grade 9)	.106	.077	.011	.054	.840
Perceived control (Grade 6)	→	Math skills (Grade 9)	.065	.079	.052	.064	.414
Math skills (Grade 6)	→	Persistence (Grade 9)	.141	.094	.090	.059	.128
Perceived support (Grade 6)	→	Persistence (Grade 9)	.152	.080	.092	.046	**.045**
Perceived control (Grade 6)	→	Persistence (Grade 9)	–.081	.085	–.055	.058	.347
Math skills (Grade 6)	→	Perceived support (Grade 9)	.198	.080	.156	.060	**.009**
Persistence (Grade 6)	→	Perceived support (Grade 9)	.021	.053	.025	.064	.696
Perceived control (Grade 6)	→	Perceived support (Grade 9)	.243	.092	.206	.075	**.006**

Math skills (Grade 6)	→	Perceived control (Grade 9)	–.013	.056	–.015	.065	.818
Persistence (Grade 6)	→	Perceived control (Grade 9)	–.025	.031	–.045	.055	.413
Perceived support (Grade 6)	→	Perceived control (Grade 9)	–.078	.060	–.086	.063	.171
Covariances/correlations							
Math skill (Grade 3)	↔	Persistence (Grade 3)	.145	.032	.359	.061	**.000**
Math skill (Grade 3)	↔	General ability (Grade 3)	.569	.106	.389	.064	**.000**
Math skill (Grade 3)	↔	Maternal education (Grade 3)	.041	.020	.126	.055	**.023**
Math skill (Grade 3)	↔	Child gender (Grade 3)	–.011	.016	–.040	.058	.491
Persistence (Grade 3)	↔	General ability (Grade 3)	.263	.102	.136	051	**.008**
Persistence (Grade 3)	↔	Maternal education (Grade 3)	.006	.023	.013	.052	.805
Persistence (Grade 3)	↔	Child gender (Grade 3)	.097	.018	.266	.048	**.000**
General ability (Grade 3)	↔	Maternal education (Grade 3)	–.018	.080	–.012	.052	.824
General ability (Grade 3)	↔	Child gender (Grade 3)	.129	.064	.098	.048	**.041**
Maternal education (Grade 3)	↔	Child gender (Grade 3)	.009	.013	.030	.044	.493
Math skills (Grade 6)	↔	Persistence (Grade 6)	.020	.016	.166	.136	.224
Math skills (Grade 6)	↔	Perceived support (Grade 6)	.002	.018	.020	.168	.903
Math skills (Grade 6)	↔	Perceived control (Grade 6)	–.030	.016	–.262	.130	**.044**
Persistence (Grade 6)	↔	Perceived support (Grade 6)	.017	.017	.069	.065	.287

Persistence (Grade 6)	↔	Perceived control (Grade 6)	–.045	.018	–.167	.062	**.007**
Perceived support (Grade 6)	↔	Perceived control (Grade 6)	.095	.017	.387	.052	**.000**
Math skills (Grade 9)	↔	Persistence (Grade 9)	.042	.021	.391	.231	***.091***
Math skills (Grade 9)	↔	Perceived support (Grade 9)	–.005	.019	–.050	.179	.782
Math skills (Grade 9)	↔	Perceived control (Grade 9)	–.006	.014	–.091	.203	.652
Persistence (Grade 9)	↔	Perceived support (Grade 9)	.033	.021	.101	.063	.106
Persistence (Grade 9)	↔	Perceived control (Grade 9)	.002	.015	.007	.070	.915
Perceived support (Grade 9)	↔	Perceived control (Grade 9)	.034	.018	.159	.086	***.063***

Note. Unstand. estimate – unstandardized coefficient, *Stand. estimate* – standardized coefficient, *SE* – standard error

In **bold** – $p < .05$; in ***bold and italics*** – $p < .10$