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Maternal homework approach and adolescents' academic skills: The mediating role of task values

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The present study investigated the mediating role of the task values between the types of maternal homework approach (perceptions of their child's autonomy or direct involvement) and adolescents' academic skills. Data were utilized from 995 mother–child dyads followed across Grades 6, 7, and 9. At each time-point, mothers answered questionnaires on the types of their homework approach, adolescents answered questionnaires about their task values for math and Finnish, and adolescents' skills in math (arithmetic and multiplication) and reading (reading fluency and reading comprehension) were tested. Separate longitudinal structural equation models were estimated for math and for reading. The results showed, first, that maternal perceptions of their adolescents' autonomy positively predicted adolescents' task values but did not predict skills. Second, maternal direct involvement in homework completion negatively predicted adolescents' math and reading skills but did not predict task values. Finally, concerning the effect of task values between homework approach and skills, task values in Grade 7 played a role in the associations between perceptions of autonomy (but not direct involvement) in Grade 6 and adolescents' skills in Grade 9. Overall, the present study highlights the importance of student autonomy with regard to homework in promoting adolescents' task values as well as the role of adolescents' task values in the associations between maternal perceptions of autonomy and the development of adolescents' math and reading skills.

KEYWORDS

task values, direct involvement, perceptions of autonomy, reading, math, homework assistance, homework, homework approach

Introduction

One of the purposes of homework—that is, tasks set by teachers for students to do at home outside of school hours—is to promote students' school performance by consolidating their skill development (Cooper et al., 2006; Trautwein et al., 2006, 2009; Trautwein, 2007; Trautwein and Lüdtke, 2009; Núñez et al., 2015, 2017; Fan et al., 2017; Rosário et al., 2018). Parental involvement in their children's homework is often encouraged by school personnel as a means of supporting students' skills (Jeynes, 2007; Patall et al., 2008; Moroni et al., 2015). However, previous research has shown that parental homework approach can be differentially related to students' academic skills: a positive increasing effect, a negative decreasing effect, or no documentable association (Cooper et al., 2000; Pomerantz and Eaton, 2001; Pomerantz et al., 2007; Patall et al., 2008; Hill and Tyson, 2009; Levpušček and Zupančič, 2009; Dumont et al., 2012; Silinskas, 2012; Wilder, 2014; Castro et al., 2015; Silinskas and Kikas, 2019a,b). These mixed findings may be partly due to the approach parents take concerning their children's homework—autonomy granting versus direct parental involvement (Pomerantz et al., 2007)—and thus these two forms of parental homework approach will be investigated in the present study. In addition, mixed findings on the associations between parental homework involvement and their children's skills may be due to the effect of students' motivation (Xu and Corno, 2022). The motivational construct of task values (i.e., the extent to which an individual values a task or subject in terms of liking it, or seeing it as important or useful for achieving current or future goals; Eccles et al., 1983, 1993; Wigfield and Eccles, 1992, 2000) has been put forward as a mechanism to explain children's performance. It has been argued that task values are sensitive to socialization influences (Eccles et al., 1983, 1993; Wigfield and Eccles, 1992, 2000), for example, the support and attitudes of parents, and, therefore, it may also be influenced by the nature and frequency of parental homework approach. There are several other explanations of the inconsistent previous findings on the links between parental homework approach and students' skills. First, operationalization of homework approach varies across studies. That is, the inconsistent findings in the literature on the links between parental homework approach and students' performance can partly be explained by the differences in how homework approach is operationalized in each study (e.g., granting adolescent autonomy versus direct parental involvement; Pomerantz et al., 2007). Second, children's performance outcomes may vary across the studies (e.g., reading and math). Finally, the results may be different at different ages (primary school versus middle school). Consequently, the present study investigated the mediating role of task values between the types of maternal approach to homework, as perceived by the mothers (perceptions of their child's autonomy or as direct involvement), and academic skills in math and reading.

Maternal approach to their children's homework and students' skills

According to the Self-Determination theory (Ryan and Deci, 2000), parental practices that support children's intrinsic motivation are the ones that promote positive child outcomes, such as performance. When describing the types of parental homework involvement, of crucial importance are the three basic needs and their satisfaction: a need for autonomy, a need for competence, and a need for relatedness. Although those particular needs were not measured in the present study, they provide an important background information when distinguishing between two distinct forms of parental homework approach: autonomy granting and direct involvement (Cooper et al., 2000; Pomerantz and Eaton, 2001; Pomerantz et al., 2007). In the present study, autonomy granting is understood as parental perceptions of their child's autonomy. Parental perceptions of autonomy in homework context represents parents' views that their children are capable of being autonomous and independent in homework situations and that the children themselves bear primary responsibility for their homework, without the need for direct parental involvement or help (Pomerantz et al., 2007). This trust and the granting of autonomy should not be confused with not being interested in or neglecting child's school-related issues. In contrast to applying autonomy granting, parents can actively assist their children with homework. This direct involvement with adolescents' homework has been conceptualized in terms of parent-reported monitoring (e.g., parents taking the initiative to check their children's homework to ensure that it is completed and correct) and helping (e.g., parents take the initiative to actively teach, instruct or guide the adolescent in doing his or her homework) (Pomerantz and Eaton, 2001). In the present study, we do not make a distinction between monitoring and help but refer to them both as direct involvement (Pomerantz and Eaton, 2001). Also, we used parental reports of their direct involvement. One important characteristic of the concept of direct homework involvement is that it does not make assumptions about the source of the involvement; that is, it may be unsolicited by the adolescent and represent a somewhat intrusive form of parental engagement in their homework completion or it may be requested by the adolescents themselves.

A plausible explanation for the conflicting findings on the efficacy of parental homework approach is the different types of such approach (see Patall et al., 2008; Castro et al., 2015; Barger et al., 2019). It has been suggested that parental autonomy granting (i.e., perceptions of a child's capability for autonomous management of the assigned tasks, and practices that promote autonomy in homework completion) may result in increased skill development (Xu et al., 2018). Cooper et al. (2000), for instance, demonstrated that supporting

autonomy was positively associated with better end-of-year grades and better standardized test scores. Similarly, Ng et al. (2004) found that encouraging autonomy enhanced children's skills, especially the skills of children with learning difficulties. It should be noted, however, that most of the previous research has conceptualized autonomy as parental practices, whereas the present study focuses on autonomy as a representation of parental perceptions that their children are able to do their homework independently. In contrast, various researchers (Cooper et al., 2000; Patall et al., 2008; Hill and Tyson, 2009; Levpušček and Zupančič, 2009) have found that direct involvement might lead, paradoxically, to negative outcomes in terms of skill development.

Another possible explanation for the conflicting findings of parental homework approach and children's skills can be related to the age of the children. Most studies on homework have examined children of primary school age—the developmental period when parental involvement in homework is at its highest and when children are learning to be independent in their homework completion. We know that homework approach in terms of direct involvement tends to decrease with time (Cooper et al., 2000; Green et al., 2007; Gonida and Cortina, 2014; Silinskas et al., 2015b), but less is known about parental homework approach and its relationship to academic outcomes in adolescence. There is, however, some evidence to suggest that children of primary and higher secondary school benefit more from parental homework involvement than children of lower secondary school (Cooper et al., 2000; Green et al., 2007; Gonida and Cortina, 2014). In addition, particularly among lower secondary school students, direct parental homework help may have negative associations with children's performance (Patall et al., 2008; Hill and Tyson, 2009). Consequently, examining longitudinal relations between different types of homework approach and adolescent performance was among the aims of the current longitudinal investigation.

The mediating role of task values in the associations between homework approach and children's skills

According to the Expectance–Value theory (Eccles et al., 1983; Wigfield and Eccles, 1992, 2000; Eccles and Wigfield, 2002), students' motivation to approach a task is dependent on the value that they place on the task. The task value is often defined as the extent to which an individual values a task or subject in terms of liking it, or seeing it as important or useful for achieving current or future goals (Eccles et al., 1983, 1993; Wigfield and Eccles, 1992, 2000). Thus, overall task value has been suggested to contain several aspects, most typically *intrinsic value* or interest, which refers to the student's enjoyment while performing the activity; *attainment value* or importance, which refers to the perceived personal importance of doing well in the task; and *utility value*, which refers to the perceived importance of the activity for current and future plans and goals. Students in primary and lower secondary school are not likely to distinguish between the different aspects of task values, which is why researchers often refer to one collapsed construct (Jacobs et al., 2002; Viljaranta et al., 2009b; Chow et al., 2012).

Task values generally differ, depending on the subject matter. Two of the key domains that increase in importance during the transition from primary to secondary school and on into lower secondary school are math and reading. Studies have found that math skills (see, Aunola et al., 2004; Bailey et al., 2014; Watts et al., 2014; Korpipää et al., 2017) and reading skills (Landerl and Wimmer, 2008; Hulslander et al., 2010; Korpipää et al., 2017) are stable across time. Nevertheless, motivational processes, such as task values, may contribute to the development of these skills by supporting students' engagement and task persistence (cf. Lau and Roeser, 2002). According to the Expectancy–Value model of motivation (Eccles et al., 1983, 1984; Wigfield and Eccles, 1992, 2000; Wigfield, 1997), children's skills can indeed be explained by the extent to which they value the activity (Eccles et al., 1983; Wigfield and Eccles, 1992). Moreover, empirical evidence has shown that higher values are related to better skills in math (Aunola et al., 2006; Viljaranta et al., 2009a) and reading (Gottfried, 1990; Wigfield, 1997; Ecalle et al., 2006).

It has been shown that task values are influenced by a variety of socialization factors (Eccles et al., 1983, 1993; Wigfield and Eccles, 1992; Trautwein et al., 2006), and parental homework approach is one of them (Epstein, 1988, 2018; Grolnick and Slowiaczek, 1994; Trautwein et al., 2006; Cheung and Pomerantz, 2015). The relationship between parent-reported homework approach and adolescents' values may depend on the type of parental homework approach. If parents grant their children autonomy to do their homework, children's valuing of that particular subject may increase. This reason is particularly important in the Finnish context where support for autonomy on one's own learning is emphasized in the national core curriculum (Finnish National Agency for Education., 2014). Moreover, the curriculum highlights the importance of teachers being aware of each student's individual needs and interests (task values). It is expected that teachers would take that information into account when planning their teaching, learning contexts, and materials to support engagement (motivation) in learning. These aims are also stated in the recommendations for partnership between school and home, where it is described how parents can support their children's autonomy in learning (Finnish National Agency for Education., 2014). However, it is also possible that if parents are often directly involved in their children's homework, this may send the wrong message. For instance, parents may send the message that they do not believe that the adolescent is able to take care of his or her homework independently. This kind of mistrust on the part of the parents could then lead to valuing certain school subjects less, that is, to

dislike that particular subject and to question its usefulness and importance (e.g., Eccles et al., 1983, 2005).

The indirect pathways from types of homework approach to adolescents' skills through task values have not been previously investigated. However, based on previous research, we would expect that parent-reported perceptions of autonomy might benefit children's skills through supporting their task values in math and reading (e.g., Aunola et al., 2013). Parent-reported perceptions of autonomy allow the child to feel competent enough to handle their own homework and transmit the message that parents trust their child (Moorman and Pomerantz, 2008), and this makes it easier for the child to internalize the particular task values. Then, as a result of these internalized task values, the parental granting of autonomy with regard to homework completion may result in positive outcomes for adolescents' academic skills development (for a review, see Pomerantz et al., 2007; see also, Aunola et al., 2013). In contrast, frequent homework approach that is directly involving—directly helping and monitoring children's homework—may be against the child's wishes and can therefore have a negative impact on the child's academic skills (Patall et al., 2008; Silinskas et al., 2012, 2013). These findings of the negative effect of direct parental involvement on skills may be due to the fact that the involvement reduces adolescents' valuing of school subjects. That is, despite the best parental intentions to help their children with certain subject, frequent direct help may make children value certain subjects less. If the adolescent dislikes or does not value a specific subject, he or she will naturally put less effort into learning it. Therefore, low task values may result in the slower development of academic skills. Although often hypothesized, these indirect pathways have not been investigated empirically using a longitudinal design. Their investigation was therefore the main aim of the present study.

Transition to lower secondary school in Finland

In Finland, compulsory primary school consists of Grades 1–6 (ages 7–12) and lower secondary school consists of Grades 7–9 (ages 13–15). Thus, the transition from primary to lower secondary school happens at age 12–13. This transition can be challenging for some students and their parents for a variety of reasons. For instance, in most cases students join a different, bigger school community. Each lower secondary classroom group gets a designated home room teacher (typically remaining with the same group for the whole 3 years) who meets the student group regularly and is responsible for the management of student wellbeing issues, takes up potential student problems with the student support staff, and is actively involved in parent–teacher collaboration. Finnish schools are almost exclusively public schools, differences between the schools are minor. There are no high-stakes national standardized tests (the only exception being the matriculation examination at the end of upper secondary school) or test-based school accountability or inspection protocols. Instead, starting already in Grade 1, students are taught how to monitor and evaluate their progress, and take responsibility for their own learning. The National Core Curriculum for basic education (Finnish National Agency for Education., 2014) is followed by all schools. It emphasizes continuity from Grades 1 to 9, and responding to each student's learning, wellbeing and developmental needs.

Support for autonomy is emphasized in the Finnish core curriculum from the beginning of Grade 1 throughout the comprehensive school. This includes recommendations that teachers should support students' autonomy in taking responsibility of their own learning at school and at home, depending on children's developmental phase. Teachers play an important role in these processes, for example, in promoting autonomy by listening attentively to the learners, motivating them to take the initiative in their own learning, and supporting children in formulating learning goals for themselves. Teachers scaffold students' development and learning processes by interacting with them, giving feedback and building a contexts of learning, and making material available that facilitates student's learning. To successfully initiate this process, teachers must make students aware of autonomy and gradually entrust them with more and more responsibility for the learning process by practicing skills needed for autonomous learning. In Finland, collaboration between school and home is highly encouraged. Thus, is it expected that Finnish teachers communicate these ideas to parents very clearly. The main goal is that parents become aware of what is expected from their kids in school and they would, then, be able to support their children at home in an optimal way.

The present study

We investigated the mediating role of the task values in the associations between the types of maternal homework approach and adolescents' skills. Although recent research has investigated homework approach in the domain of math (Dumont et al., 2012) or reading (Dumont et al., 2014), analyzing both math and reading in parallel models with the same data is rare. However, due to subject specificity, it is possible that the results may be different depending on the subject matter (e.g., math or reading). Consequently, the present study focused on investigating types of maternal homework approach and their longitudinal effects on adolescents' math and reading skills.

In particular, we asked the following research questions:

1. To what extent does parental homework approach relate to the development of adolescents' task values and math and reading skills? We expected that parental perceptions of

autonomy would be related to greater task values in math and Finnish, whereas direct parental involvement would be related to a decrease in adolescents' task values in math and Finnish (Eccles et al., 1983, 2005; Pomerantz et al., 2007; Aunola et al., 2013). Similarly, we expected that parental perceptions of autonomy would be related to better math and reading skills, whereas direct involvement would be related to the slower development of math and reading skills across time (Patall et al., 2008; Silinskas et al., 2012, 2013, 2015b; Xu et al., 2018).

2. To what extent do task values in math and Finnish mediate the associations between parental homework approach and adolescents' math and reading skills? We expected that parental perceptions of autonomy would positively relate to the valuing of school subjects (math and Finnish) and therefore would further positively relate to the math and reading skills (Eccles et al., 1983, 2005; Pomerantz et al., 2007; Aunola et al., 2013). In contrast, we expected that direct involvement would negatively relate to adolescents' task values and thus would negatively relate to math and reading skills (Patall et al., 2008; Silinskas et al., 2012, 2013, 2015b; Xu et al., 2018).

Materials and methods

Participants and procedure

We used longitudinal data from 995 mother–adolescent dyads followed across Grades 6, 7, and 9. Only dyads with reports available from both the mother and her child in Grade 6 (T1) were selected for this longitudinal investigation. Data were drawn from a large-scale longitudinal study (The First Steps; Lerkkanen et al., 2006–2016) which followed about 2,000 Finnish children from the beginning of their kindergarten year to Grade 9. The original follow-up aimed to study the effect of school and home environment on students' development and behavior. Because the average number of students in Finnish first grade classrooms is 18, we ended up recruiting 160 teachers to reach around 2,000 students to the follow-up to be able to study the effect of teachers to the child outcomes.

The data was age cohort data from four different size municipalities (one urban, one rural, and two municipalities containing both urban, and semi-rural environments) in different parts of Finland (South, Middle, and East). However, the data was not randomly selected, as we did not have data from metropolitan area or North part of Finland (Lapland) which limits the generalization. However, the sample was highly homogeneous in its ethnic and cultural characteristics; all the children were Finnish speaking and attended Finnish-speaking schools. Parents were asked to give their written consent to their child's and their own participation in the study; only adolescents whose parents gave this consent (80%) were asked to fill in the questionnaires and provided test data from assessments carried out in the classroom. The statement from the Ethics Committee of University of Jyväskylä was received on 6 June 2006.

Adolescents

Adolescents answered questionnaires on their task values in math and Finnish three times: at the end of Grade 6 [12–13 year-olds; April, 2013; n = 995 (n = 546 boys; n = 449 girls)], at the end of Grade 7 (13–14 year-olds; April, 2014; n = 956), and at the end of Grade 9 (15–16 year-olds; April, 2016; n = 938). The adolescents' age ranged from 11.67 to 14.17 years (M_{age} = 12.71, SD = 0.32) on the assessment day in April 2013 (Grade 6). In addition, at each of these time-points, adolescents' skills in math and in reading were assessed using group-administered tests in classroom situations. Trained research assistants gave the questionnaires in the classroom settings and administered the group tests in math and reading. Attrition analyses revealed that those adolescents whose reports were available in Grade 6 but not in Grade 7 had mothers who reported less autonomy in Grade 6 (p = 0.03; d = −0.26) and more direct involvement in math in Grade 6 (p = 0.03; d = 0.25). In addition, adolescents whose reports were available in Grade 7 but not anymore in Grade 9 had mothers who reported less autonomy in Grade 7 (p < 0.001; d = −0.48).

Mothers

Mothers answered questionnaires on the types of their homework three times: at the end of Grade 6 (March–April, 2013; n = 995), at the end of Grade 7 (March–April, 2014; n = 702), and at the end of Grade 9 (March–April, 2016; n = 769). Mothers were instructed to complete the questionnaires at home, without consulting other members of the family. The mothers' educational achievement level varied as follows: 2.4% of mothers had no vocational education, 1.8% of mothers had completed a short vocational course, 25.3% of mothers had a vocational school qualification, 24.6% of mothers had a vocational college degree, 11.6% of mothers had a bachelor's degree or equivalent from a polytechnic or other college of higher education, 27.6% of mothers had a master's degree, and 6.7% of mothers had a licentiate or doctoral degree.

Attrition analysis showed that mothers whose self-reports were available in Grade 6 but not in Grade 7 did not differ from mothers whose reports were available at both time points. Analyses of the mothers' attrition from Grade 7 to Grade 9 showed that mothers who dropped out of the study reported less autonomy in Grade 6 (p = 0.03; d = −0.24) and Grade 7 (p < 0.001; d = −0.34). The children of families which dropped out of the study in Grade 9 valued math in Grade 7 less (p < 0.01; d = −0.31) and Finnish in Grade 7 less (p = 0.03; d = −0.23) than those children whose families continued to participate in

the study. Also, the children of families who dropped out of the study had lower skills in arithmetic (Grade 6: $p < 0.01$; $d = -0.33$; Grade 7: $p < 0.01$; $d = -0.32$) and lower skills in multiplication (Grade 6: $p = 0.04$; $d = -0.22$; Grade 7: $p = 0.03$; $d = -0.26$) in comparison to those whose families continued their participation in the study up to Grade 9.

Measures

The measures used to assess maternal homework approach and adolescents' task values were identical across all three measurement points. Alternative forms of the same test were used to assess adolescents' math and reading skills. The psychometric properties of the mothers' and adolescents' questionnaires and adolescents' skill measures [i.e., the valid number of cases, means, standard deviations, reliabilities (Cronbach's α), potential and actual ranges of the values, and skewness] are presented in Table 1.

Mothers' questionnaire

Mothers' homework approach (Grades 6, 7, and 9)

To measure maternal perceptions of the frequency and types of homework approach—granting autonomy or direct involvement—mothers were asked to answer a set of 10 questions on a 5-point scale (1 = never, 5 = always). The items and their loadings of the Confirmatory Factor Analysis

TABLE 1 Psychometric properties of all study variables.

Variable	*n*	*M*	*SD*	Reliability (Cronbach's α)	Range Potential	Range Actual	Skewness
Maternal homework approach							
Perceptions of child's autonomy (Grade 6)	995	4.08	0.80	0.86	1–5	1.33–5	-0.79
Perceptions of child's autonomy (Grade 7)	702	4.08	0.83	0.87	1–5	1–5	-0.88
Perceptions of child's autonomy (Grade 9)	768	4.17	0.83	0.86	1–5	1–5	-0.94
Direct involvement in math (Grade 6)	995	2.55	0.60	0.84	1–5	1–4.50	-0.13
Direct involvement in math (Grade 7)	702	2.32	0.60	0.84	1–5	1–4.50	-0.02
Direct involvement in math (Grade 9)	769	2.01	0.59	0.84	1–5	1–4	0.32
Direct involvement in reading (Grade 6)	995	2.53	0.60	0.85	1–5	1–4.50	-0.08
Direct involvement in reading (Grade 7)	702	2.33	0.60	0.85	1–5	1–4.50	-0.08
Direct involvement in reading (Grade 9)	769	2.03	0.59	0.84	1–5	1–4.17	0.31
Adolescent task values							
Value in math (Grade 6)	994	3.58	0.78	0.87	1–5	1–5	-0.52
Value in math (Grade 7)	941	3.50	0.81	0.89	1–5	1–5	-0.38
Value in math (Grade 9)	938	3.54	0.91	0.91	1–5	1–5	-0.53
Value in Finnish (Grade 6)	994	3.43	0.75	0.86	1–5	1–5	-0.46
Value in Finnish (Grade 7)	941	3.38	0.76	0.87	1–5	1–5	-0.25
Value in Finnish (Grade 9)	938	3.39	0.81	0.88	1–5	1–5	-0.37
Adolescent skills							
Arithmetic (Grade 6)	995	16.69	3.56	0.81[a]	0–28	3–26	-0.13
Arithmetic (Grade 7)	945	14.15	3.68	0.93[a]	0–28	1–27	-0.08
Arithmetic (Grade 9)	935	15.27	3.85	0.91[a]	0–28	2–27	-0.17
Multiplication (Grade 6)	995	41.62	17.01	0.85[a]	0–120	7–117	0.87
Multiplication (Grade 7)	944	40.72	17.62	0.98[a]	0–120	4–116	0.99
Multiplication (Grade 9)	938	41.68	18.89	0.99[a]	0–120	6–117	0.91
Reading fluency (Grade 6)	995	47.73	10.93	0.98 [a]	0–80	10–80	-0.01
Reading fluency (Grade 7)	954	38.29	8.23	0.99 [a]	0–80	7–65	-0.17
Reading fluency (Grade 9)	934	42.46	8.89	0.80[a]	0–80	11–71	-0.01
Reading comprehension (Grade 6)	995	31.40	7.40	0.98[a]	0–69	4–62	0.14
Reading comprehension (Grade 7)	956	33.62	7.58	0.96[a]	0–70	0–57	-0.15
Reading comprehension (Grade 9)	931	38.40	8.65	0.96[a]	0–70	0–70	-0.02

[a]The Kuder–Richardson reliability, a measure of internal consistency for dichotomous variables.

are presented in **Table 2**. The frequency of perceptions of autonomy was assessed by 3 items, and of direct involvement by 7 items. The scale was based on items used previously by Pomerantz and Ruble (1998) and Pomerantz and Eaton (2001). The items have been published in previous studies on maternal homework approach for primary school children; i.e., items forming the scale of maternal perceptions of their children's autonomy concerning homework completion (Silinskas et al., 2015b) and items for scales of help and monitoring (Silinskas et al., 2013, 2015a,b). The composite scores used in the present study were somewhat modified. In Grades 6, 7, and 9, a Principal Axis Factor analysis with oblimin rotation was performed for the 10 items, which resulted in two factors. As can be seen in **Table 2**, one factor (3 items) corresponded to the perceptions of autonomy scale; another factor (7 items) included all of the items that corresponded to the separate scales of help and monitoring. In line with the literature showing that parental homework involvement declines with time, especially for children approaching adolescence (Cooper et al., 2000; Green et al., 2007; Gonida and Cortina, 2014), and especially direct involvement, the scales of help and monitoring were combined into one construct—direct involvement. In addition, in the help scale, one item was math-specific and one item was reading-specific. Because we ran math and reading models separately, only the item specific to the corresponding model was used for further analyses of the two models.

Adolescents' questionnaire

Task values in math and Finnish (Grades 6, 7, and 9)

To measure adolescents' task values, we employed the Task Value Scale for Children (TVS-C; Nurmi and Aunola, 1999; see also Nurmi and Aunola, 2005). The questions were based on the ideas of Eccles et al. (1983) concerning children's interest in different school subjects and the importance they attach to them. The students were asked to mark their responses on a 5-point scale (1 = not at all, 5 = very much). The questionnaire consisted of two sets of items: six items for values in math and six items for values in Finnish. Both sets of items measured three separate achievement values, each value by two questions (**Table 2**). For example, the task value in math was measured by 6 items: (1) interest in or liking for math (*intrinsic value*; 2 items, e.g., *"How much do you like math tasks at school?"*), (2) the importance of doing well in math (*attainment value*; 2 items, e.g., *"How important is it for you to get good grades in math?"*), and (3) the importance of math for one's personal goals (*utility value*; 2 items, e.g., *"How useful is math for your future goals?"*). The same structure was followed for the task value in Finnish. For Grades 6, 7, and 9 we performed a Principal Axis Factor analysis with oblimin rotation for the 12 items and found only two factors: (1) task value of math and (2) task value of Finnish. In another set of analyses, Principal Axis Factoring for the 6 items for math

TABLE 2 Standardized factor loadings of the confirmatory factor analysis for the math and reading models.

Items	Grade 6		Grade 7		Grade 9	
	Math	Reading	Math	Reading	Math	Reading
Maternal homework approach						
Perceptions of autonomy						
1. *Do you know that the child remembers to do his/her home assignments?*	0.85	0.85	0.86	0.86	0.87	0.86
2. *Do you trust that the child takes care of his/her home assignments by himself/herself?*	0.91	0.91	0.92	0.92	0.91	0.91
3. *Do you have to force your child to do the home assignments?*	0.70	0.70	0.71	0.72	69	0.69
Direct involvement						
1. *Do you make sure that your child has done his/her homework?*	0.42	0.44	0.44	0.45	0.42	0.44
2. *Do you check your child's homework?*	0.64	0.64	0.67	0.67	0.73	0.72
3. *Do you check your child's homework together with your child?*	0.63	0.64	0.67	0.68	0.72	0.72
4. *Do you instruct your child in his/her homework?*	0.78	0.77	0.79	0.78	0.77	0.77
5. *Do you help or guide your child in his/her homework?*	0.82	0.80	0.81	0.82	0.76	0.78
6. *Do you help your child in his/her reading homework?*		0.74		0.75		0.74
7. *Do you help or guide your child in his/her math homework?*	0.72		0.70		0.69	
Adolescent task values						
1. *How much do you like doing math/Finnish?*	0.69	0.67	0.75	0.69	0.79	0.69
2. *How much do you like mathematics/Finnish?*	0.68	0.65	0.74	0.68	0.82	0.67
3. *How important is it for you to get good grades in math/Finnish?*	0.68	0.62	0.71	0.65	0.74	0.65
4. *How important is it for you to succeed in math/Finnish?*	0.79	0.75	0.80	0.75	0.81	0.74
5. *How useful do you find mathematics/Finnish?*	0.69	0.78	0.70	0.76	0.74	0.78
6. *How useful is mathematics/Finnish for you?*	0.73	0.72	0.73	0.71	0.78	0.74

showed that all six items loaded on only one factor; in a separate analysis, 6 items for Finnish also loaded on only one factor. Thus, composite scores for two subjects/domains (i.e., math and Finnish) were used in the further analyses, each measured by 6 items. The items and their loadings of the Confirmatory Factor Analysis are presented in **Table 2**.

Adolescents' tests

Math skills (Grades 6, 7, and 9)

At each measurement point, math skills were measured by two group-administered tests, in arithmetic and multiplication. There is a lack of standardized tests in mathematics for every grade level. Therefore, we used tests which has been widely used in Finnish studies concerning the math skill development (Korpipää et al., 2017; Zhang et al., 2017). To distinguish between different subskills, both tests were entered to the models separately. The decision to enter the skills separately was further supported by the low internal consistency of the two tests (0.38, 0.37, and 0.38 in Grades 6, 7, and 9, respectively).

Arithmetic

In Grades 6, 7, and 9 the students' skills in arithmetic were assessed using the group test of the Basic Arithmetic Test (Aunola and Räsänen, 2007). This speed test consists of a maximum of 28 items, with 14 items for addition (e.g., 4 + 1 = __-21 = ___) and 14 for subtraction (e.g., 106.20-30.04 = ___), to be completed within a 3-min time limit. The difficulty of the tasks gradually increases throughout the test. The final score is the total number of correct answers.

Multiplication

In Grades 6, 7, and 9 the students' multiplication skills were measured with a group test of multiplication (Koponen and Mononen, 2010). The children were given an exercise book with example multiplications on the front page followed by two pages each with 60 multiplications arranged in three columns, so there were altogether 120 multiplication exercises. Both the multiplicand and the multiplier were single digit numbers from 1 to 9 (e.g., 5 × 6 = ___). Students were instructed to do the multiplications as quickly as possible and to write the answers next to the tasks. The time limit for the test was 2 min.

Reading skills (Grades 6, 7, and 9)

At each measurement point, adolescents' reading performance was measured by 2 group-administered tests: (1) reading fluency and (2) reading comprehension. Both tests are standardized tests for all grade levels in Finland. Internal consistency between the tests was 0.74, 0.83, and 0.82 in Grades 6, 7, and 9, respectively. However, as with math, to distinguish between different subskills, both tests were entered to the models separately.

Reading fluency

Reading fluency was assessed using a word-reading fluency task, which is a subtest of the nationally normed reading test batteries for Grade 6 (ALLU; Lindeman, 1998) and for Grades 7 and 9 (YKÄ; Lerkkanen et al., 2018). Each of the 80 items consisted of a picture with four phonologically similar words attached to it. The test-taker silently read the four words and then drew a line connecting the picture with the word, semantically matching it. The words and pictures were easy and frequently used words familiar to adolescents. The score was the number of correct answers given within a 2-min time limit.

Reading comprehension

Reading comprehension was assessed by tests similar to or based on the Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner et al., 2009; Finnish version by Lerkkanen and Poikkeus, 2009). In Grade 6, a similar task to TOSREC was used, the Salzburg Lese-Screening test (SLS; Landerl et al., 1997), which is similar to the Woodcock–Johnson sentence verification task (Woodcock et al., 2001). Respondents were given 2 min to read 69 sentences and determine whether the sentences were true or false. In Grades 7 and 9, a sentence verification test drawn up by the Niilo Mäki Institute (YKÄ; Lerkkanen et al., 2018) was used. Respondents were given 2 min to read 70 sentences and, again, determine whether the sentences were true or false. All three tests had the same aim and the same instructions but although they were similar, different items and a different number of items were used in each case.

Analysis strategy

The Structural Equation Modeling (SEM) framework was applied using the M*plus* statistical package (Version 8; Muthén and Muthén, 1998–2017). First, separate measurement models for perceptions of autonomy, direct involvement and task values were constructed across Grades 6, 7, and 9. When constructing the longitudinal measurement models (for perceptions of autonomy, direct involvement, and values), the factor loadings of the same items were set at equal across all three measurement points (Grades 6, 7, and 9) to ensure time invariance. We also specified the autocorrelations of the residuals of the same items across time. Second, all 3 measurement models were combined into one final measurement model consisting of 3 latent constructs across 3 time-points. Then, skills followed across three time-points were added to the final measurement model, and the correlations among all latent and observed constructs were identified. Third, a structural equation model was constructed by including the stabilities of the constructs and the concurrent associations among all constructs of the same time-point. Finally, cross-lagged associations between subsequent measurement points were specified. In particular, perceptions of autonomy and direct involvement were specified

to predict values and all skills; values were specified to predict perceptions of autonomy and direct involvement and all skills; and each skill variable was specified to predict perceptions of autonomy, direct involvement and values at the subsequent measurement point.

The proportion of missing data for the main study variables ranged from 0 to 30.15% (M = 9.01%, SD = 10.17%). The data were not missing completely at random: Little's (1988) MCAR test was significant, χ^2 (1160) = 1381.458, $p < 0.001$. Therefore, we assumed that the data were Missing-At-Random (MAR, not MCAR), and the standard procedure of full-information maximum-likelihood (FIML) was applied. FIML estimates a likelihood function for each individual person based on all the available data, without imputing data (Collins et al., 2001). Because the distributions of the variables were skewed, the model parameters were estimated using the MLR estimator (maximum likelihood with robust standard errors), which is implemented in M*plus* and provides less biased estimates than, for example, listwise deletion (Enders, 2001). The MLR estimator produces standard errors and Chi-square test statistics even when the sample contains missing data, non-normal outcomes or non-independent observations.

Adolescents were nested within their classes. As suggested by intraclass correlations (ICCs ranging from $p > 0.10$ to $p < 0.001$), part of the variance at the class level (between-level variance) may have accounted for variance at the student level (within-level variance). Therefore, the M*plus* function "TYPE = COMPLEX" was employed to control for the hierarchical structure of the data (i.e., to account for the nesting of multiple adolescents in each class). Clustering was based on the adolescents' class membership in Grade 6 (n = 135). As we had clear hypotheses for our results, a one-tailed test of statistical significance was employed for all the SEM models. Model fit was examined using 4 indices: 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 0.95, a RMSEA value below 0.06 and a SRMR value below 0.08 indicate an excellent model fit (Muthén and Muthén, 1998–2017; Hu and Bentler, 1999). Also, CFI and TLI values above 0.90 and RMSEA and SRMR values below 0.10 indicate a good model fit (Kline, 2015). Only CFI and TLI values below 0.90 and RMSEA and SRMR values above 0.10 are indications of poor model fit (Kline, 2015).

Results

Measurement models

Math model

We started with the separate measurement models of each construct across three time-points. The model of perceptions of autonomy showed an excellent fit to the data (CFI = 0.98, TLI = 0.97, RMSEA = 0.05, SRMR = 0.05). The model for direct involvement did not have a good model fit. The suggestions of the three modification indices were therefore implemented, namely items 6 and 7 (see **Table 2**) were correlated at each time-point (in Grade 6, Grade 7, and Grade 9). This gave a good model fit (CFI = 0.95, TLI = 0.93, RMSEA = 0.06, SRMR = 0.08). For the model of task values, six modifications were implemented: we correlated items 1 and 2 and items 3 and 4 at each measurement point (see **Table 2**). A good model fit was obtained (CFI = 0.96, TLI = 0.94, RMSEA = 0.06, SRMR = 0.05). After that, all three separate measurement models were combined. Next, the arithmetic and multiplication skills followed across three time-points were added. A good model fit was obtained (CFI = 0.95, TLI = 0.94, RMSEA = 0.04, SRMR = 0.05). Factor loadings of all the measures of the math model are presented in **Table 2**. Correlations between latent constructs and observed skills are presented in **Table 3**.

Reading model

When constructing the final model for reading, we followed exactly the same procedure as in the case of math. The model of perceptions of autonomy showed an excellent model fit (CFI = 0.98, TLI = 0.97, RMSEA = 0.05, SRMR = 0.05). To obtain a good model fit for direct involvement (CFI = 0.95, TLI = 0.93, RMSEA = 0.06, SRMR = 0.08), items 6 and 7 (see **Table 2**) were correlated with each other at all three measurement points. The same six modifications as in the math model were applied to task values: correlating items 1 and 2 and items 3 and 4 (see **Table 2**) at each time-point resulted in a good model fit to the data (CFI = 0.95, TLI = 0.94, RMSEA = 0.06, SRMR = 0.05). Then, all three separate measurement models were combined. After that, the reading fluency and reading comprehension from Grades 6, 7, and 9 were added to the model, and a good model fit was obtained (CFI = 0.95, TLI = 0.94, RMSEA = 0.04, SRMR = 0.05). Factor loadings of all measures of the reading model are presented in **Table 2**. Correlations between latent constructs and observed skills are presented in **Table 4**.

Structural equation models

Math model

The final longitudinal cross-lagged model for math had a good model fit (CFI = 0.94, TLI = 0.93, RMSEA = 0.04, SRMR = 0.06). The results are presented in **Figure 1**. Note that all cross-lagged paths were somewhat weak (βs ranged 0.07–0.13, $p < 0.05$). Looking at our first research question, perceptions of autonomy positively predicted children's values across both Grades 6 and 7 and Grades 7 and 9: the more mothers perceived their children as being able to work on homework independently, the more the children valued math as a subject. Maternal direct involvement in Grade 6 negatively predicted arithmetic and multiplication in Grade 7,

TABLE 3 Correlations between the latent constructs of homework approach and values in math and observed math skills.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Direct involvement in math (Grade 6)														
2	Direct involvement in math (Grade 7)	0.72***													
3	Direct involvement in math (Grade 9)	0.59***	0.72***												
4	Perceptions of autonomy (Grade 6)	−0.32***	−0.31***	−0.23***											
5	Perceptions of autonomy (Grade 7)	−0.33***	−0.37***	−0.26***	0.81***										
6	Perceptions of autonomy (Grade 9)	−0.25***	−0.33***	−0.27***	0.65***	0.76***									
7	Value in math (Grade 6)	−0.14***	−0.13**	−0.10*	0.12**	0.12**	0.17***								
8	Value in math (Grade 7)	−0.15***	−0.17***	−0.17***	0.16***	0.21***	0.24***	0.66***							
9	Value in math (Grade 9)	−0.19***	−0.16***	−0.17***	0.22***	0.26***	0.31***	0.46***	0.65***						
10	Arithmetic (Grade 6)	−0.34***	−0.27***	−0.20***	0.20***	0.16***	0.20***	0.31***	0.29***	0.28***					
11	Arithmetic (Grade 7)	−0.36***	−0.30***	−0.22***	0.18***	0.20***	0.21***	0.33***	0.36***	0.32***	0.72***				
12	Arithmetic (Grade 9)	−0.40***	−0.31***	−0.26***	0.19***	0.17***	0.23***	0.32***	0.34***	0.37***	0.72***	0.76***			
13	Multiplication (Grade 6)	−0.24***	−0.18***	−0.15***	0.25***	0.22***	0.20***	0.23***	0.21***	0.23***	0.58***	0.50***	0.47***		
14	Multiplication (Grade 7)	−0.27***	−0.22***	−0.18***	0.23***	0.22***	0.21***	0.28***	0.31***	0.27***	0.57***	0.56***	0.53***	0.83***	
15	Multiplication (Grade 9)	−0.29***	−0.22***	−0.20***	0.22***	0.22***	0.23***	0.32***	0.34***	0.32***	0.59***	0.60***	0.60***	0.78***	0.83***

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

and maternal direct involvement in Grade 7 negatively predicted arithmetic in Grade 9. That is, the less directly involved mothers were in their children's homework, the better the children's skills were later on (except that direct involvement in Grade 7 did not predict multiplication in Grade 9). In addition, values in Grade 7 positively predicted perceptions of autonomy in Grade 9, indicating that the more adolescents valued math, the more their mothers perceived that their adolescents were able to complete their homework independently.

Our second and main research question was concerned with the indirect longitudinal paths from maternal homework approach in Grade 6 to adolescents' math skills in Grade 9 *via* task values in math in Grade 7. The indirect paths, perceptions of autonomy→values→arithmetic (standardized estimate = 0.007, S.E. = 0.004, p = 0.042) and perceptions of autonomy→values→multiplication (standardized estimate = 0.007, S.E. = 0.004, p = 0.022), were significant. Indirect paths from direct involvement to math skills through values in math were not significant.

Reading model

The final longitudinal cross-lagged model for reading had a good model fit (CFI = 0.93, TLI = 0.92, RMSEA = 0.04, SRMR = 0.06). The results are presented in **Figure 2**. Note that all cross-lagged paths were somewhat weak (βs ranged 0.05–0.12, $p < 0.05$). Concerning our first research question, perceptions of autonomy positively related to children's values across both Grade 6 and Grade 7, and Grade 7 and Grade 9: the more mothers perceived that their children could be autonomous in completing homework, the more adolescents valued Finnish as a subject. Moreover, perceptions of autonomy in Grade 6 positively predicted reading fluency in Grade 7: the more autonomy mothers reported, the better children's reading skills were. Maternal direct involvement negatively predicted reading fluency and reading comprehension across both Grades 6 and 7, and Grades 7 and 9: the less direct involvement mothers exercised in homework situations, the better adolescents' reading skills were later on. In addition, values in Grade 7 positively predicted perceptions of autonomy in Grade 9, suggesting that the more adolescents valued Finnish, the more mothers perceived their children as autonomous as far as homework was concerned across lower secondary school.

Following our second and main research question, we also investigated the indirect effect from maternal homework approach in Grade 6 to adolescents' reading skills in Grade 9 *via* task values in Finnish in Grade 7. The indirect paths, perceptions of autonomy→values→reading fluency (standardized estimate = 0.008, S.E. = 0.005, p = 0.042) and perceptions of autonomy→values→reading comprehension (standardized estimate = 0.006, S.E. = 0.003, p = 0.043), were significant. Indirect paths from direct involvement to reading skills through values in Finnish were not significant.

TABLE 4 Correlations between the latent constructs of homework approach and values in Finnish and observed reading skills.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Direct involvement in reading (Grade 6)														
2	Direct involvement in reading (Grade 7)	0.72***													
3	Direct involvement in reading (Grade 9)	0.60***	0.72***												
4	Perceptions of autonomy (Grade 6)	−0.35***	−0.32***	−0.21***											
5	Perceptions of autonomy (Grade 7)	−0.35***	−0.38***	−0.23***	0.81***										
6	Perceptions of autonomy (Grade 9)	−0.27***	−0.33***	−0.26***	0.65***	0.76***									
7	Value in Finnish (Grade 6)	−0.05	−0.05	−0.05	0.22***	0.19***	0.22***								
8	Value in Finnish (Grade 7)	−0.06*	−0.09*	−0.11*	0.21***	0.22***	0.25***	0.63***							
9	Value in Finnish (Grade 9)	−0.09*	−0.05	−0.09*	0.25***	0.22***	0.28***	0.37***	0.63***						
10	Reading fluency (Grade 6)	−0.29***	−0.22***	−0.15***	0.14***	0.11**	0.12***	0.04	0.06	0.07*					
11	Reading fluency (Grade 7)	−0.27***	−0.23***	−0.15***	0.17***	0.16***	0.19***	0.06	0.12**	0.14***	0.63***				
12	Reading fluency (Grade 9)	−0.29***	−0.26***	−0.22***	0.15***	0.16***	0.20***	0.11**	0.18***	0.23***	0.61***	0.71***			
13	Reading comprehension (Grade 6)	−0.31***	−0.24***	−0.17***	0.19***	0.16***	0.19***	0.08**	0.15***	0.18***	0.62***	0.66***	0.61***		
14	Reading comprehension (Grade 7)	−0.28***	−0.24***	−0.16***	0.19***	0.19***	0.23***	0.11**	0.18***	0.20***	0.54***	0.70***	0.63***	0.75***	
15	Reading comprehension (Grade 9)	−0.28***	−0.23***	−0.14***	0.17***	0.20***	0.23***	0.13***	0.21***	0.21***	0.61***	0.64***	0.69***	0.68***	0.77**

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Differences in math and reading models for different subskills

The results for the math and reading models were very similar. The differences in the models as far as the relationship to skills is concerned included only two extra predictive paths in the reading model: (1) reading comprehension in Grade 6 predicted values in Grade 7 (in the math model, skills did not predict values) and (2) maternal direct involvement was negatively related to all reading skills – and maternal direct involvement did not predict multiplication skills across Grades 7 and 9.

Discussion

The present study aimed to investigate the mediation of task values in the relationship between maternal homework approach and adolescents' skills. The results showed, first, that maternal reports of perceptions of autonomy consistently positively predicted adolescents' task values but did not relate to their skills. Second, higher maternal direct involvement in homework situations related to a lower increase in adolescents' math and reading skill development, and maternal direct involvement did not relate to the development of task values. Finally, and most importantly, our findings showed that the association between maternal reports of their homework approach and adolescents' skills went through adolescents' task values. In particular, we found significant indirect paths from perceptions of autonomy in Grade 6 (but not direct involvement) *via* task values in Grade 7 to math skills and reading skills in Grade 9.

Maternal homework approach and adolescents' task values and skills

As expected, our results showed that mother-reported perceptions of their adolescents' autonomy in completing homework positively predicted adolescents' task values. In particular, in both the math and reading models, mother-reported perceptions of autonomy were found to consistently enhance adolescents' task values in math and Finnish across Grades 6 and 7 and across Grades 7 and 9. This result is not surprising, given that previous literature has shown that encouraging autonomy promotes motivation also in terms of other motivational constructs, such as the individual's task persistence or self-concept of ability (Marsh, 1986; Pomerantz et al., 2007; Dumont et al., 2012, 2014; Viljaranta et al., 2018; Silinskas and Kikas, 2019a,b). Thus, although measured by maternal perceptions of their children's ability to be autonomous in their homework, our results closely resemble those where autonomy was measured in terms of actual practices. However,

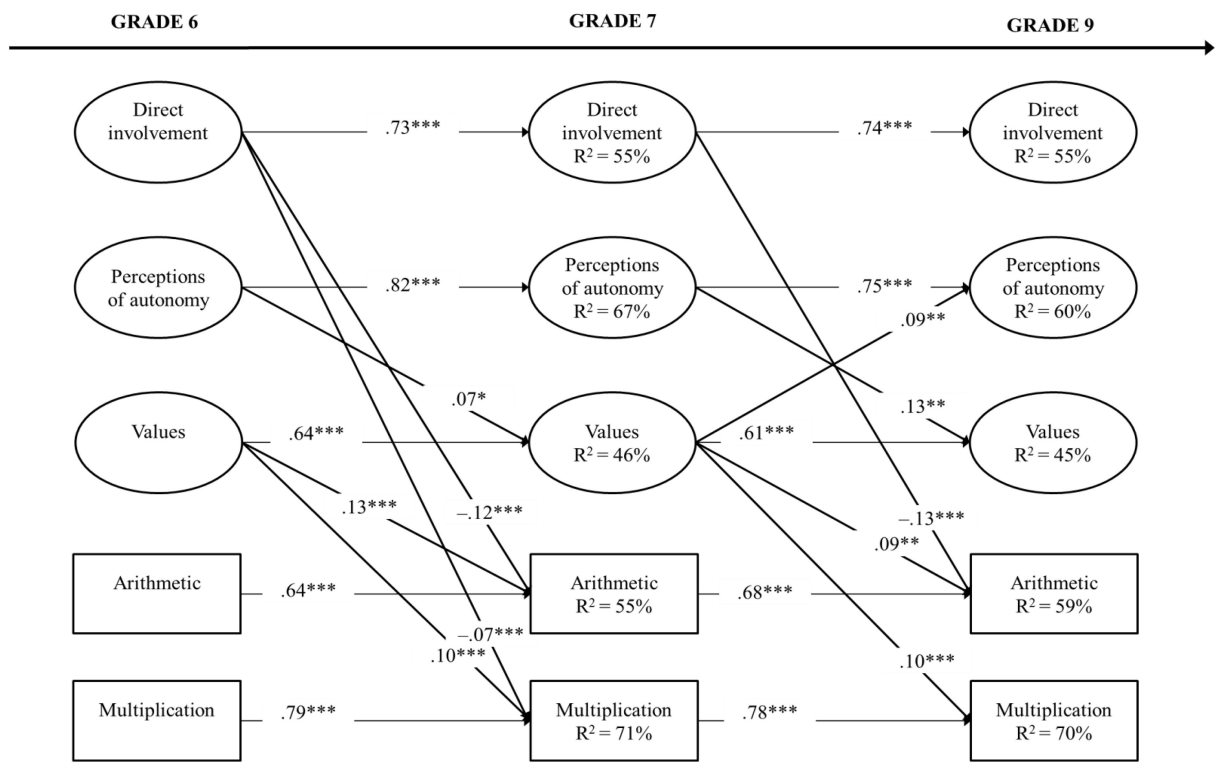

FIGURE 1
Math model. Longitudinal associations between mothers' direct involvement and perceptions of their child's autonomy and adolescents' task values in math and math performance. Standardized solution, concurrent associations and non-significant cross-lagged paths are not shown. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

maternal perceptions of their children's ability to be autonomous did not predict adolescents' math or reading skills. This result is in line with some previous findings (Silinskas and Kikas, 2019a,b), providing support for the suggestion that parental perceptions of autonomy with regard to homework may relate more to learners' motivation (Patall et al., 2008).

Parental perceptions of their child's ability to complete their homework independently are important for promoting children's task values (interest) in math and Finnish. There may be several reasons for this. First, parental perceptions of autonomy granting may maintain or enhance adolescents' feelings of autonomy (Ryan and Deci, 2000), and that is how autonomy granting facilitates the process of adolescents' internalization of values with regard to academic subjects and learning (Grusec and Goodnow, 1994; Cheung and Pomerantz, 2015). Second, the Finnish curriculum emphasizes the support for student's autonomy and interest in the academic learning at school. The Finnish curriculum also advises that teachers should communicate the content of the curriculum to parents, and parents are expected to act in a similar autonomy-granting way (Finnish National Agency for Education., 2014). In practice, following these recommendations, parents may discuss their child's school work in a respectful and encouraging way, show interest in and curiosity about their children's schooling, and support child's autonomy and child's own interests in academic learning. Thus, this autonomy-granting behavior (measured by maternal perceptions of their children's ability to be autonomous in their homework) may result in adolescents placing higher value on academic subjects at school.

Another important finding was related to another type of homework involvement—maternal reports of direct involvement in their adolescent's homework. We did not find evidence that maternal reports of direct involvement in homework would be longitudinally related to adolescents' task values. However, we found that mother-reported direct involvement in homework situations negatively related to the subsequent math and reading skills. Specifically, greater maternal direct involvement negatively predicted arithmetic, multiplication, reading fluency, and reading comprehension skills across Grades 6 and 7 and across Grades 7 and 9. This result is in line with previous research reporting negative relations between direct parental involvement with children's homework and their skills among students in lower secondary school (Cooper et al., 2000; Hill and Tyson, 2009; Levpušček and Zupančič, 2009; Dumont et al., 2012; Karbach et al., 2013; Núñez et al., 2015, 2017). Previous research has offered various

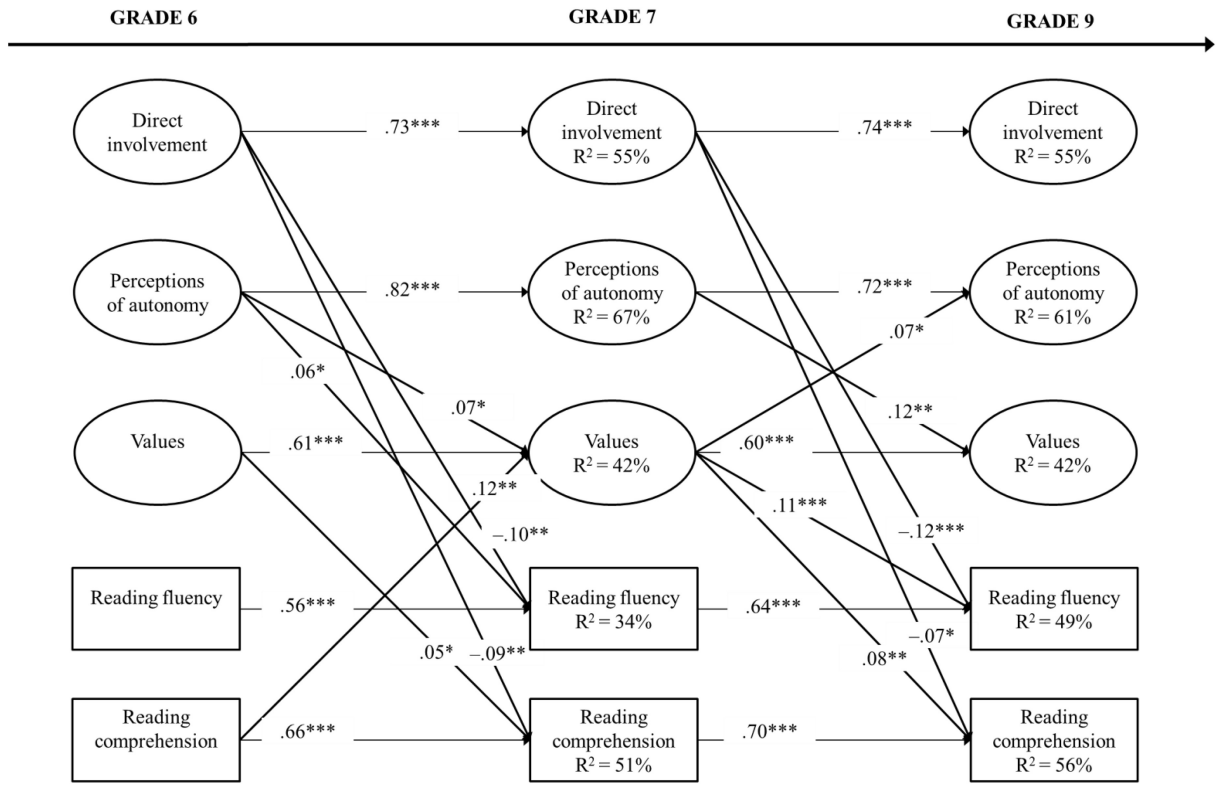

FIGURE 2
Reading model. Longitudinal associations between mothers' direct involvement and perceptions of their child's autonomy and adolescents' task values in Finnish and performance in reading. Standardized solution, concurrent associations and non-significant cross-lagged paths are not shown. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

explanations for these results. For instance, parents may get directly involved more with low performing students, and these practices may be disproportionately high in comparison to the gains the students are able to achieve (Epstein and Van Voorhis, 2001, 2012; Pomerantz and Eaton, 2001; Grolnick et al., 2002; Pomerantz et al., 2005). It is also possible that parents lack the confidence and competence to assist their child with their homework in other ways than by directly involving themselves in it (Hoover-Dempsey and Sandler, 1997; Hoover-Dempsey et al., 2001; Pomerantz and Eaton, 2001). Parents may also lack knowledge and expertise in the lower secondary school homework assignments in math and Finnish (Patall et al., 2008). Homework situations can create negativity in the parent–adolescent relationship by exposing feelings of frustration, stress or helplessness (Levin et al., 1997; Pomerantz et al., 2005; Silinskas et al., 2015a,b). Finally, if direct involvement is understood as intrusive (without being requested by children), it can undermine adolescents' basic needs for autonomy, relatedness and competence, and this may result in slower gains in performance (Ryan and Deci, 2000). These explanations remain to be tested in the future. That is, future research needs to measure and analyze a wider range of mother-related variables that can explain their choice of their homework approach. In that way, we will get better understanding about the mechanisms behind the negative associations between direct involvement and performance.

One important reason for the results we obtained is that the two types of parental approach to their children's homework (perceptions of autonomy and direct involvement) were reported my mothers, not perceived by their children. However, the value of the tasks was reported by adolescents. This might have had a significant impact on the results obtained. In particular, previous studies (e.g., Grolnick et al., 1991; Grolnick and Slowiaczek, 1994; Dumont et al., 2012, 2014) reported that students' perceptions of their parent behavior (not parental perceptions) have an effect on their homework engagement. This discrepancy relates to the possibility that what parents think they do and what their children interpret are two distinctly different concepts, differentially related to children's outcomes. Had we measured adolescents' perceptions about their mothers' homework involvement, stronger association between homework approach and adolescent outcomes, especially task values, could have been found. Unfortunately, we did not collect adolescents' perceptions about their parents' homework approach; this remains the challenge for future research.

The results showing the main effects of maternal reports on their homework approach and adolescents' task values and skills should also be interpreted in the light of adolescents' stage of development. That is, the transition to and studying in lower secondary school coincides with the onset of puberty, changes in the school environment, and young people's increasing desire to distance themselves from their parents (Steinberg and Silk, 2002; Hill and Tyson, 2009; Smetana, 2011). Therefore, since becoming autonomous and creating one's own identity are crucial during adolescence, parental perceptions of autonomy with regard to homework also become crucial during this time.

The mediating role of task values in the associations between homework approach and skills

Our most important result was that task values in Grade 7 mediated the associations between maternal perceptions of their children's autonomy with regard to homework in Grade 6 and adolescents' skills in Grade 9. In particular, the indirect paths in both the math model and the reading model were significant, albeit weak. The results were statistically weak because stabilities of the constructs were relatively high, and the measurement points spanned across 3 years. Therefore, it was difficult to detect cross-lagged associations across time, and there is a possibility that other factors not measured in this study may have had their influences. Nevertheless, our findings are important and interesting, not only showing the main effects in the complex interrelation between homework approach, task values and skills, but also providing evidence for the longitudinal chains of indirect effect connecting the three variables across a period of 3 years. This result provides empirical evidence for theories on task values (i.e., the Expectance–Value theory; Eccles et al., 1983; Wigfield and Eccles, 1992, 2000; Eccles and Wigfield, 2002) by showing that task values do indeed relate to skills in both math (Aunola et al., 2006; Viljaranta et al., 2009a,b) and reading (Gottfried, 1990; Wigfield, 1997; Ecalle et al., 2006). Moreover, the results show that task values are shaped by socialization factors, so the parental approach to their adolescents' homework does indeed play a role in promoting the adolescents' valuing of the specific school subject. One such approach—parental perceptions of their adolescents' being able to complete homework autonomously—does not imply that parents neglect their children's academic development or refrain from helping them with homework. Instead, perceptions of adolescents' autonomy may be accompanied by other aspects of parent–adolescent communication, such as discussion about the adolescents' schooling, the importance of education, their liking for certain subjects, or the importance of reading and math for future careers. Thus, although not examined in the present study, investigation of other beliefs and practices that coincide with parental perceptions of autonomy could broaden our understanding of the mechanisms behind parental homework approach and adolescent task values. This could be among the goals of future research.

Maternal reports of their perception that adolescents are able to complete their homework autonomously were shown to predict math and reading skills through task values; however, no such evidence was found for maternal reports of direct involvement. Although it has previously been proposed that direct involvement may reduce motivation, which may lead to slower progress in skill development (Ryan and Deci, 2000; Aunola et al., 2013), our study suggests only a direct link from direct involvement to children's math and reading skills. One reason for this result could be that the link between direct involvement and skills may be mediated by other motivational variables than task values, for instance, task persistence (Viljaranta et al., 2018; Silinskas and Kikas, 2019a,b), which were not investigated in the present study. Second, parental direct involvement in homework can be perceived by adolescents differently, depending on the source of initiation (i.e., if it was initiated by the adolescent or by the parent). Thus, if adolescents tend to perceive parental homework approach as intrusive (not requested by them, initiated by parents), it is not surprising that this kind of approach with homework directly negatively relates to performance in reading and math.

Another important aspect of the present results is its subject specificity, that is, its differentiation between math and reading. Learning math depends on complex cognitive antecedents (Korpipää et al., 2017) and math skills develop cumulatively, that is, basic skills need to be mastered before more complex skills can be learned (Jordan et al., 2009; Watts et al., 2014; Korpipää et al., 2017). For example, children learn addition before subtraction, and multiplication is taught only after the children have mastered addition and subtraction. In the domain of reading, the process is more linear: after mastering accuracy in reading, one needs to drill fluency and develop reading comprehension strategies. However, the longitudinal links between parental homework approach, task values and skills were relatively consistent across measures of math and reading fluency. This suggests that despite subject-specificity of the task values, the way parents approach homework situations is fundamentally important for the children's valuing of certain school subjects and skills in those subjects. In particular, granting adolescents autonomy concerning their homework is likely to result in higher valuing of at least two main school subjects—reading and math.

Limitations

Our study has limitations that need to be taken into account before any generalizations can be made. First, all the constructs were either math- or reading-specific, except for the items of homework approach, especially perceptions of autonomy. This

could have had the effect of diminishing the strength of the associations found in the present study. However, in primary and lower secondary school, math and Finnish continue to be the most important school subjects, which allows us to assume that parents mostly help their children with math and reading homework. However, future studies need to address subject specificity in all of the constructs they measure.

Second, we used mothers' self-reports to examine their homework approach, and this exposes our results to the risk of social desirability bias. It has been shown, for instance, that maternal reports of child behavior carry the risk of bias (Durbin and Wilson, 2012). Also, self-reports may not fully capture everything that is important in the homework situation. In addition, we used a measure of frequency of certain types of homework approach (perceptions of autonomy and direct involvement). Future studies should investigate qualitative aspects of homework approach; for instance, observational studies could explore mother–child interaction in homework situations (e.g., Xu and Corno, 1998). Finally, we do not know how adolescents themselves perceive their mothers' approach to homework. Recent studies emphasize that it is not necessarily what parents think or do with regard to homework that affect learning motivation and skills, but rather it is children's perceptions of their parents' approach toward homework that do so (Grolnick et al., 1991; Grolnick and Slowiaczek, 1994; Dumont et al., 2012, 2014; Rosário et al., 2018). Thus, in future research it would be important to include data from multiple informants, such as the adolescents themselves or trained observers.

Third, our test of math skills assessed only arithmetic and multiplication and did not measure more advanced math topics (e.g., geometry, pre-algebra). Our rationale for including tests of arithmetic and multiplication was based on previous research which showed that competence in math during comprehensive school is severely compromised if children have difficulties in learning arithmetic facts and achieving fluency in arithmetic calculations (Geary, 1993). Fluency is also a major problem in math disability (Zhang et al., 2017). Thus, in the present study, we used fluency measures as key criterion variables for time-limited math tasks (arithmetical calculation), because more advanced mathematical skills are based on calculation fluency (Lerkkanen et al., 2004; Jordan et al., 2009; Watts et al., 2014; Korpipää et al., 2017). Our math measures of arithmetic and multiplication became more difficult as the tests progressed (including arithmetic and multiplication with fractions, negative numbers, and large numbers). Although we were able to find clear differences between students' arithmetic fluency using these tests, more advanced mathematics skills should be assessed in future research.

Fourth, out of a wide range of motivational constructs, we chose to investigate the role of task values. Although they are interesting, we did not investigate the effect of other motivational constructs, such as task persistence or self-concept (Marsh, 1986; Dumont et al., 2012, 2014; Viljaranta et al., 2018; Silinskas and Kikas, 2019a,b). Expectancy is another important construct in the expectancy–value theory (Eccles et al., 1983), in the original homework model by Trautwein et al. (2006), and the extended homework model by Xu and Corno (2022). These theories suggest that expectancy can be a strong predictor of homework commitment, homework completion, and academic performance. Moreover, the interaction between expectancy and task values can also appear as a powerful predictor of students' performance. Reporting results on more than one motivational construct, especially expectancy, would add considerably to our current understanding of the role of motivation in the relation between parental homework approach and adolescent academic skills.

Conclusion

To conclude, the present study highlights the mediating role of adolescents' task values in the relationship between maternal perceptions of autonomy with regard to adolescents' homework and adolescents' math and reading skills. It also highlights the importance of parental perceptions of autonomy with regard to homework in promoting adolescents' valuing of math and Finnish.

From the practical point of view, parents and educators need to acknowledge the role of adolescents' task values in enhancing adolescents' math and reading skills. That is, when adolescents value academic subjects (math and reading), they are also more likely to develop their academic skills. Similarly, parents should be encouraged to assist their adolescents with homework in such a way that it helps their child to appreciate that particular school subject and the range of activities related to it. It seems that when parents report that they give their adolescents autonomy in relation to homework (as opposed to direct involvement), adolescents report that they value academic subjects such as math or reading.

Data availability statement

The raw data supporting the conclusions of this article are not publicly available, but are available from the corresponding author, upon reasonable request.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of University of Jyväskylä. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

GS conducted the analyses and together with JV wrote an initial draft of the manuscript. A-MP and M-KL provided the feedback. All authors have read and approved the content of the submitted manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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