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ARTICLE

Facing academic problems: Longitudinal relations between parental involvement and student academic achievement from a self-determination perspective

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Abstract

Background: The relation between parental involvement and student achievement has been of research interest for many decades. Although the idea of reciprocal processes between parent and child was proposed 40 years ago, very few efforts have been made to investigate reciprocal relations between parental involvement and student achievement.

Aims: Using self-determination theory, this study investigated the longitudinal associations of the manner of parental involvement (i.e., autonomy-supportive or controlling) in children's academic problems with children's academic achievement. This study further addressed the recently intensely debated methodological issue of examining reciprocal relations by comparing a random-intercept cross-lagged panel model (RI-CLPM) with the traditional cross-lagged panel model (CLPM).

Sample and Methods: A RI-CLPM and a traditional CLPM were applied to 5-year longitudinal data including 1465 secondary school students (M_{age} at T1 = 10.82 years, SD = 0.62). In both models, we controlled for students' gender, school type, socioeconomic status and cognitive ability.

Results: The results show that the RI-CLPM fitted the data better than the CLPM. Trait-like stability was found for both forms of parental involvement and academic achievement. At the between-person level, controlling involvement related to lower achievement, whereas no correlation between autonomy-supportive involvement and achievement was found. At the within-person level, there were positive reciprocal relations between autonomy-supportive involvement

and achievement, whereas controlling involvement was not associated with achievement.

Conclusions: This study contributes substantially to the understanding of the relations between parental involvement in children's academic problems and children's academic achievement by simultaneously taking between-person differences and within-person processes into consideration.

KEYWORDS

autonomy support, between-person and within-person levels, longitudinal study, parental support, reciprocal relations

INTRODUCTION

Parental involvement in children's education is widely acknowledged as a crucial factor influencing youth development. In particular, parental involvement has been found to coincide with children's academic achievement (Castro et al., 2015; Fan & Chen, 2001; Jeynes, 2003, 2012, 2015, 2016, 2017; Kim, 2020; Kim et al., 2019; Ma et al., 2016). After the transition from primary to secondary school, the importance of academic achievement continuously increases (e.g., Barber & Olsen, 2004). Academic problems, such as reduced school grades, become one of the most significant stressors for secondary school students across education systems (e.g., Huan et al., 2008; Pascoe et al., 2020). Failures to manage academic problems can increase the risk of school dropout and mental health problems (Eschenbeck et al., 2019; Walburg, 2014). When students face academic problems, the way parents help them manage these problems can have long-term impacts on their children's academic development (Wild & Walper, 2020). In this study, we focus on this specific form of parental involvement.

Based on self-determination theory (SDT; Deci & Ryan, 2000), parents can be involved in their children's education in a more autonomy-supportive or controlling manner (e.g., Dumont et al., 2014; Grolnick, 2016). Previous studies have demonstrated potential positive effects of autonomy-supportive involvement and detrimental effects of controlling involvement on children's academic development (e.g., Dumont et al., 2014; Grolnick, 2016; Lorenz & Wild, 2007; Wild & Walper, 2020). When children experience academic problems, some parents may be more autonomy-supportively involved by stimulating children's self-initiated solutions and perspective-taking on academic problems, whereas other parents may be more controllingly involved by inducing guilt, using performance-contingent regards and invalidating their children's feelings and perspectives (Lorenz & Wild, 2007; Wild & Walper, 2020). We suggest that the manner of parental involvement in children's academic problems relates to children's academic achievement. As units of the family, parents and children interact with each other and influence each other's behaviour (Bell, 1968; Kerr & Bowen, 1988). It has been documented that the manner of parental involvement can also be predicted by children's characteristics, such as learning behaviour and academic achievement (e.g., Dumont et al., 2014; Gershoff et al., 2009). However, less is known about whether there are similar reciprocal relations between parental involvement in children's academic problems and children's academic achievement.

For investigating reciprocal relations, the traditional CLPM has long been the method of choice (Hamaker et al., 2015; Orth et al., 2021). However, this model has recently been criticized for conflating between-person differences and within-person processes (Hamaker et al., 2015). This is problematic from statistical and theoretical perspectives (Berry & Willoughby, 2017; Mulder & Hamaker, 2020). This study examined longitudinal relations between parental involvement in children's academic problems and children's academic achievement from an SDT perspective and compared the controversial traditional CLPM with the RI-CLPM as an alternative model. In the following sections, we review the literature on parental involvement from an SDT perspective, rationalize the focus on reciprocal relations between

parental involvement and student achievement, and address theoretical and statistical issues related to the traditional CLPM.

Parental involvement from an SDT perspective

Parental involvement has been conceptualized in many ways to capture a broad range of parental activities related to their children's education (Grolnick & Slowiaczek, 1994; Lerner et al., 2022). Most empirical work divides parental involvement into two main categories: school-based involvement (e.g., attending parent-teacher conferences, communicating with teachers and volunteering in school activities) and home-based involvement (e.g., assisting with homework, discussing school-related issues and exposing children to cognitively stimulating activities; Epstein & Sanders, 2002; Grolnick, 2016; Hill & Tyson, 2009; Hoover-Dempsey & Sandler, 2005). Decades of research on parental involvement show that parental involvement does not always correspond to positive child development and that not all involvement behaviours are equally effective. Grolnick (2016) concludes that involvement that includes parent–child interactions are most effective and that the effectiveness of involvement depends on how it is conveyed.

For understanding the effectiveness of parental involvement, SDT provides a useful theoretical framework. According to SDT, parental involvement should meet children's needs for autonomy (the sense of psychological freedom), competence (the sense of mastery) and relatedness (the sense of being bonded, loved and valued; Deci & Ryan, 2000). Among them, the need for autonomy is central to children's internalization of social norms and the development of motivational orientations (Ryan et al., 2006). Without the need for autonomy being satisfied, the experience of competence and relatedness cannot facilitate motivation, self-regulation and well-being (Deci & Ryan, 2000).

Drawing on SDT, Lorenz and Wild (2007) proposed a four-dimensional model of parental involvement, which is explicitly designed to investigate parental involvement including parent–child interactions. The first dimension is *autonomy-supportive involvement*, describing parents' encouragement of the child's self-initiated learning activities, perspective-taking on academic problems and appropriate assistance with academic tasks and problems. This type of parental involvement can meet children's needs for autonomy. The second factor is *controlling involvement*, including parents' excessive pressure on their children to complete assignments, the use of performance-contingent regards, and the application of direct instruction that leads to children's dependence on the help of others. This type of parental involvement undermines children's needs for autonomy. Although autonomy support and control have been described as two sides of the same coin (Joussemet et al., 2008), the authors suggest considering them as two separate but interrelated constructs rather than combining them into one scale because low psychological control does not equal autonomy granting. The third dimension is *structure*, referring to parents' provision of clear and consistent expectations, rules and guidelines in the home learning environment. This kind of involvement meets the need for competence. The fourth dimension is *responsiveness*, involving parents' expression of interest in their children's schooling. This kind of involvement contributes to satisfying the need for relatedness. Given the central role of autonomy in youth development (Ryan et al., 2006), we focus on parents' autonomy-supportive involvement and controlling involvement when their children face academic problems.

Using 5-year data of 791 German 3rd-graders, Lorenz and Wild (2007) examined the relations between parents' involvement in children's academic problems (autonomy-supportive vs. controlling), children's learning motivation and their value of homework. They found that the more children perceived their parents as autonomy-supportive, the more motivated they were in an identified way for homework. In contrast, controlling involvement was positively related to external motivation over time. In another longitudinal study, Dumont et al. (2014) investigated the relations of parental involvement in homework with children's academic functioning among 2830 lower secondary school students and their parents. Their results showed that greater controlling involvement was associated with lower academic functioning in the subject of reading (e.g., reading grade and reading effort). Likewise, however, most previous studies examining parental involvement from an SDT perspective have focused on homework-like parent–

child interactions (e.g., Dettmers et al., 2019; Doctoroff & Arnold, 2017; Dumont et al., 2014; Grolnick et al., 2002).

Reciprocal relations and within-person dynamics

Whereas most previous researchers were interested in the potential effects of parental involvement on child outcomes, some researchers (Bell, 1968, 1979; Sameroff, 2010) proposed the idea of reciprocal relations between parent and child. In terms of parental involvement, students' academic performance shapes parental involvement (e.g., time spent on learning activities, the value of education and educational expectations), which, in turn, predicts subsequent achievement (Englund et al., 2004; Hong et al., 2010; Sy et al., 2013). Other scholars have revealed a scaffolding effect of parental involvement. That is, parental involvement predicts higher student achievement, which is tied to reduced parental learning support because less support is necessary (e.g., Gershoff et al., 2009). From an SDT perspective, parents' controlling behaviours in response to their child's academic problems are negatively linked to the child's self-efficacy, academic self-concept and, in turn, academic achievement (e.g., Otterpohl et al., 2019, 2020). On the other hand, parents' ability to provide autonomy support to their children can be interfered with by 'pressure from below' (i.e., children's behaviours and characteristics; Grolnick, 2003, p. 81). For instance, previous longitudinal and experimental findings indicate that lower academic achievement or lower levels of child competence can cause more controlling parental involvement (e.g., Dumont et al., 2014; Grolnick et al., 2002).

The most common model for examining reciprocal relations between multiple constructs is the traditional CLPM, which has recently been criticized by several scholars (Berry & Willoughby, 2017; Hamaker et al., 2015; Mulder & Hamaker, 2020). The CLPM assumes that between-person relations are aggregated representations of within-person developmental processes. In other words, it is only possible to investigate the average relations in a population and explain the differences that emerge between individuals (Berry & Willoughby, 2017). Hamaker et al. (2015) further criticized the implausible assumption of the CLPM that each individual varies over time around the same mean values (i.e., there are no trait-like individual differences). Therefore, the autoregressive and cross-lagged parameters in the CLPM conflate between- and within-person processes, and these parameters can be essentially uninterpretable (Hamaker et al., 2015). Using the CLPM can be theoretically and empirically problematic due to the difference between individuals, parent–child dyads or families, and developmental nature over time (e.g., Keijsers, 2015). This critique is supported by several longitudinal person-oriented studies revealing that some parents are relatively consistent in their general and education-specific involvement during their children's development, whereas other parents adapt their behaviours more strongly to the developmental needs of their children (Teuber et al., 2022; Zhang et al., 2017). Academic achievement is also dynamic because it can be affected by internal and external factors. For example, after transferring to secondary school, social comparison processes affect students' academic self-concept and impact their academic achievement (Marsh & Craven, 2006).

To overcome the drawbacks of the CLPM, Hamaker and colleagues (Hamaker et al., 2015; Mulder & Hamaker, 2020) proposed a RI-CLPM, which is motivated by considering cross-lagged panel data from a multilevel perspective and enables the investigation of the relation between both forms of perceived parental involvement and student achievement on the between- and within-person levels. The RI-CLPM decomposes observed scores into grand means (i.e., means across all individuals per measurement occasion), time-invariant between-person components or random intercepts (i.e., trait-like features), and time-varying or fluctuating within-person components (i.e., state-like features). The random intercepts are individual time-invariant deviations from the grand means and are seen as the stable differences between individuals, whereas within-person components capture individual temporal deviations from the grand means. The individual temporal deviations are determined by the autoregressive and cross-lagged effects. These should not be confused with those in the traditional CLPM. In the RI-CLPM, the autore-

gressive effects are interpreted as additional within-person stability or within-person fluctuations, and the cross-lagged effects represent the extent to which a within-person change in one construct is related to a within-person change in a second or more constructs (Mulder & Hamaker, 2020).

Another advantage of the RI-CLPM is that it allows controlling time-invariant confounders. Previous findings suggest that parental involvement and student achievement vary systematically with students' gender, socioeconomic status (SES), school type and cognitive ability. In Germany, for example, girls and students from higher-SES families are more likely to be enrolled in academic track schools, whereas boys and students from lower-SES families are more likely to be enrolled in vocational track schools (Kessels et al., 2014). Regarding academic achievement, girls are more successful in school than boys, even after controlling for their cognitive ability (OECD, 2019). The manner of parental involvement is also associated with family SES and students' gender. Students from lower-SES families and boys are more likely to experience controlling parental involvement (e.g., Benner et al., 2016; Rogers et al., 2009). In this study, we included such time-invariant confounders as covariates.

CURRENT STUDY

The purpose of this study was twofold. First, we sought to investigate the longitudinal relations between parental involvement (i.e., autonomy-supportive or controlling) when their children face academic problems and their children's academic achievement. Second, we examined whether the CLPM is problematic and whether the RI-CLPM is a more suitable model when investigating these relations.

The RI-CLPM was expected to fit the data better than the CLPM (Hypothesis 1). In this case, we further hypothesized that both forms of parental involvement in children's academic problems and student achievement have a trait-like, stable nature (Hypothesis 2). At the between-person level, a positive relation between autonomy-supportive involvement and achievement, a negative relation between controlling involvement and achievement, and a negative association between both involvement forms were expected (Hypothesis 3). At the within-person level, we expected a positive relation of autonomy-supportive involvement with achievement and a negative relation of controlling involvement with achievement (Hypothesis 4).

METHOD

Data collection and participants

The data stem from the three waves of Project 'Families' Support in the Acquisition of Discources- and Text Competence in Secondary School' (in German: *Die Rolle familialer Unterstützung beim Erwerb von Diskurs- und Schreibfähigkeiten in der Sekundarstufe 1*): Time 1 (T1, spring 2010; Grade 5, first year of secondary school), Time 3 (T3, spring 2012; Grade 7) and Time 4 (T4, spring 2014; Grade 9). The sample consisted of 1465 students (at T1: M_{age} = 10.97 years, SD = 0.68, 45% girls). These students attended 81 classes in 29 secondary schools in North-Rhine Westphalia, Germany. Within the sample, 580 participants were *Hauptschule* (i.e., the lowest track secondary school, vocational track) students, whereas the other 885 participants were *Gymnasium* (i.e., the highest track secondary school, academic track) students. About 40% of the respondents at T1 had a migration background (i.e., the student or at least one of their parents was not born in Germany).

The participants completed the questionnaires during regular school hours under the guidance of trained assistants. Participation in the project was voluntary, and all participants and their legal guardians provided written informed consent forms. This project was reviewed and approved by the ethics review committee of Bielefeld University.

Measures

Parental involvement in children's academic problems

Perceived parental involvement in children's academic problems was assessed with the German Parental Help in Home Learning Questionnaire (Lorenz & Wild, 2007). Five items captured autonomy-supportive parental involvement (e.g., 'When I get a bad grade in a class test, my parents try to find out its reason together with me'), whereas six items captured controlling parental involvement (e.g., 'When I get a bad grade in a class test, my parents scold me and require me to learn harder'). All responses were scored on a 4-point scale (1 = *strongly disagree*, 4 = *strongly agree*). In this study, we regarded both forms of parental involvement as two separate but correlated factors. The results of confirmatory factor analyses supported this structure at all three measurement occasions. Evidence of longitudinal measurement invariance was also found (see Table 1 for details). Cronbach's alpha ranged from .71 to .75 and from .75 to .76 for autonomy-supportive involvement and controlling involvement, respectively.

Academic achievement

Participants were asked to disclose their grade point average (GPA) on their last report card in mathematics and German. In Germany, school grades are classified into six levels (1 = *excellent*, 6 = *insufficient*) regardless of school type. To facilitate interpretation, we reverse coded the GPA: higher scores indicate higher achievement. Previous longitudinal studies have demonstrated the validity of self-reported school grades (e.g., Juang & Silbereisen, 2002; Veas et al., 2019). The average grades (i.e., the mean scores of the math and German grades) at all three measurement occasions (a = .60 to .62) were used in the data analysis.

Covariates

Covariates included students' gender, school type, SES and cognitive ability. Gender was dummy coded (0 = *girl*, 1 = *boy*). School type was coded as 0 = *Hauptschule* (i.e., the lowest school track, vocational track)

TABLE 1 Results from cross-sectional confirmatory factor analyses and longitudinal measurement invariance of autonomy-supportive involvement and controlling involvement

Model	*N*	χ^2	*df*	*p*	CFI	RMSEA [90% CI]	SRMR
Cross-sectional confirmatory factor analysis analyses (two-factor model)							
T1: Grade 5	1449	292.50	43	<.001	.91	.06 [.06/.07]	.06
T3: Grade 7	1068	205.97	43	<.001	.93	.06 [.05/.07]	.05
T4: Grade 9	955	315.28	43	<.001	.90	.08 [.07/.09]	.07
Longitudinal measurement invariance (two-factor model)							
Configural invariance	1465	1224.42	447	<.001	.92	.03 [.03/.04]	.05
Factorial invariance	1465	1291.65	469	<.001	.92	.04 [.03/.04]	.06
Partial scalar invariance	**1465**	**1330.63**	**475**	**<.001**	**.92**	**.04 [.03/.04]**	**.06**
Scalar invariance	1465	2521.02	491	<.001	.80	.04 [.05/.06]	.08

Note: In the configural invariance model, all parameters were freely estimated. In the factorial invariance model, factor loadings were held equal over time. In the scalar invariance model, indicator intercepts were additionally constrained to be equal over time. The final longitudinal measurement invariance model is in boldface.

Abbreviations: χ^2, chi-square; CFI, comparative fit index; CI, confidence interval; *df*, degree of freedom; *N*, sample size; *p*, *p*-value; RMSEA, root mean square error of approximation; SRMR, standardized root mean residual.

and 1 = *Gymnasium* (i.e., the highest school track, academic track). SES was determined by asking students to rate the number of books in the household (OECD, 2009; 1 = *0–10 book*s, 5 = *more than 200 books*). This item captures cultural capital (Bourdieu, 1986), serves as a valid economic indicator of social status in general and has been frequently used in German and international studies (Bos et al., 2007; Paulus, 2009; Stubbe et al., 2012). To control for cognitive ability, a verbal subscale (V1; 30 tasks for verbal analogies) and a nonverbal subscale (N2; 25 tasks for figural analogies in geometric figures) of a cognitive ability test for 4–12th graders (KFT 4–12+ R; Heller & Perleth, 2000) were used at T1. Both subscales have shown high test reliability and validity in previous studies (e.g., Gogolin et al., 2021). Participants solved as many tasks as possible within 7.5 min for both subscales. We standardized the results in percentage (e.g., 80% means that a participant correctly solved 80% of all tasks). Internal consistency estimates were $a = .79$ for V1 and $a = .94$ for N2 in this study.

Dropout analysis

A total of 1075 students remained in T3-survey and 957 students in T4-survey. A Little's test (MCAR; Little, 1988) revealed that the data were not missing completely at random. Overall, boys ($\chi^2 = 14.48$, $p < .001$), *Hauptschule* students ($\chi^2 = 156.3$, $p < .001$), and students with lower SES ($t = -10.47$, $p < .001$) showed a higher tendency to drop out. Compared to students who stayed in all three occasions, students who dropped out (at either T3 or T4) reported lower academic achievement ($t = -10.88$, $p < .001$) and higher controlling parental involvement ($t = 6.89$, $p < .001$), whereas no difference was found in autonomy-supportive involvement ($t = -1.14$, $p = .25$). The full-information robust maximum likelihood estimator was used to handle non-normality and missing data. This way, participants with missing values are retained, and the results are less biased and more reliable than conventional methods of handling missing data (e.g., listwise deletion; Schafer & Graham, 2002). In our data, *Gymnasium* students, girls and students with higher SES were overrepresented. To minimize potential biases in the results, we controlled for these time-invariant cofounders throughout the data analyses.

Analytical strategies

Data analyses were guided by a demonstration paper by Mulder and Hamaker (2020) and a previous study (Seddig, 2020) and were carried out in *M*plus 8.7 (Muthén & Muthén, 2022). We applied 'TYPE = COMPLEX' (cluster = class) to account for the nested data structure. Since the traditional CLPM is nested within the RI-CLPM, we first performed the RI-CLPM.

This study included three repeated measures each for autonomy-supportive parental involvement, controlling parental involvement and academic achievement. Four steps were undertaken to specify the RI-CLPM. First, for each between-person component, a latent variable was created with the three repeated measures as its indicators, with all factor loadings constrained to 1. For each within-person component, a latent variable for each measurement was created, and its measurement error variance was constrained to 0. Second, the autoregressive and cross-lagged relations between the within-person components were specified, and they were freely estimated. Third, all random intercepts were allowed to be correlated, and all residuals of the within-person components within an occasion were allowed to be freely correlated. Finally, the basic RI-CLPM was extended by including time-invariant predictors directly influencing the manifest variables to control for students' gender, school type and SES. Each indicator of academic achievement was controlled additionally for cognitive ability. The CLPM was performed by constraining the variances of all three random intercepts and their covariances within the RI-CLPM to 0.

To evaluate the model fit, we relied on the recommendations by Hu and Bentler (1999) with a non-significant Satorra-Bentler scaled χ^2-value, comparative fit index (CFI) $\geq .95$, root means square error of approximation (RMSEA) $\leq .06$ and standardized root mean square residual (SRMR) $\leq .05$ indicating good model fit. Model comparison was made based on the Satorra-Bentler scaled chi-square difference

test ($\Delta\chi^2_{SB}$; Satorra & Bentler, 2010). A non-significant $\Delta\chi^2_{SB}$ indicates that the more restrictive model (i.e., the traditional CLPM) does not fit the data sustainably less well than the alternative model and should be preferred.

RESULTS

Table 2 presents the means and standard deviations of the observed variables. Figure 1 illustrates the results of both cross-lagged panel models, whereas Tables 3 and 4 provide detailed information on the parameter estimates. The fit indices suggest that both RI-CLPM ($\chi^2_{SB} = 34.53$, $df = 9$, $p < .001$, CFI = .99, RMSEA = .04, 90% CI for RMSEA [.03, .06], SRMR = .02) and CLPM ($\chi^2_{SB} = 86.59$, $df = 15$, $p < .001$, CFI = .97, RMSEA = .06, 90% CI for RMSEA [.05, .07], SRMR = .03) showed reasonable model fit. Yet, the CLPM fitted the data substantially less well than the RI-CLPM ($\Delta\chi^2_{SB} = 50.98$, $\Delta df = 6$, $p < .001$; Hypothesis 1).

Within the RI-CLPM (Figure 1a, Table 3), all random intercepts had significant variance, indicating that there were stable, trait-like differences between students in academic achievement and perceived parental involvement (Hypothesis 2). Both forms of parental involvement were negatively associated. Hence, students who experienced more autonomy-supportive involvement reported lower controlling involvement in general (compared to the other students). Controlling involvement and achievement were negatively associated, indicating that stable between-person differences in the perception of controlling involvement varied systematically with stable between-person differences in achievement. However, no association was found between autonomy-supportive involvement and achievement (Hypothesis 3). At the within-person level, the positive autoregressive coefficients for autonomy-supportive involvement over time indicate that students who reported autonomy-supportive involvement above their expected scores likely again reported above their expected scores at subsequent occasions. We found a positive autoregressive coefficient for controlling involvement from Grade 5 to Grade 7 and a positive autoregressive coefficient for achievement from Grade 7 to Grade 9. The consistently positive cross-lagged effects of achievement on autonomy-supportive involvement suggest that a higher value on achievement (relative

TABLE 2 Zero-order correlations and descriptive statistics

			1	2	3	4	5	6	7	8	9
T1	1	Autonomy-supportive parental involvement									
	2	Controlling parental involvement	−.16**								
	3	Student achievement	.01	−.26**							
T3	4	Autonomy-supportive parental involvement	.37**	−.19**	.08*						
	5	Controlling parental involvement	−.16**	.52**	−.18**	−.33**					
	6	Student achievement	.00	−.23**	.59**	.09*	−.23**				
T4	7	Autonomy-supportive parental involvement	.24**	−.19**	.03	.45**	−.24**	.10*			
	8	Controlling parental involvement	−.11*	.45**	−.14**	−.19**	.51**	−.19**	−.32**		
	9	Student achievement	.04	−.22**	.48**	.12**	−.24**	.64**	.12**	−.25**	
		Mean	3.10	2.07	4.36	2.90	1.87	4.19	2.70	1.87	4.13
		SD	.64	.70	.77	.67	.64	.73	.68	.63	.81

Note: SD, standard deviation; T1, Grade 5; T3, Grade 7; T4, Grade 9.

*$p < .01$; **$p < .001$.

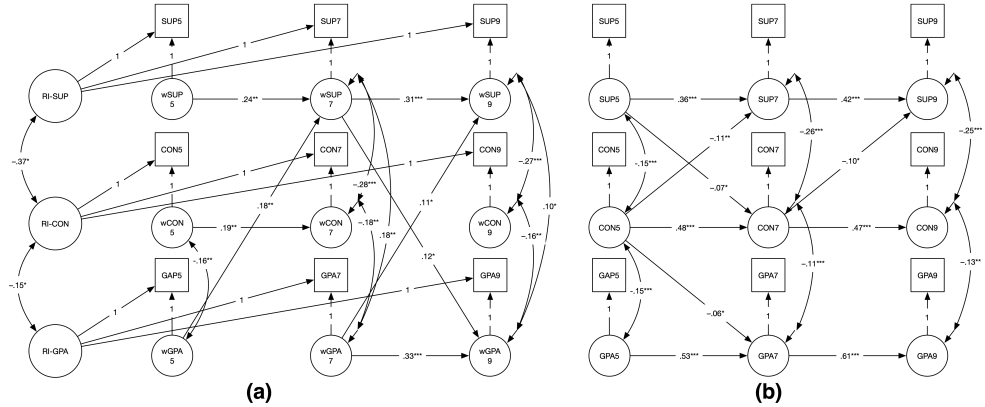

FIGURE 1 Estimating the relations between parental involvement and student achievement using RI-CLPM and CLPM. (a) RI-CLPM (random-intercept cross-lagged panel model). (b) CLPM (traditional cross-lagged panel model). CON, controlling involvement; GPA, academic achievement; RI, random intercept, between-person component; SUP, autonomy-supportive involvement; w, within-person component; 5, Grade 5; 7, Grade 7; 9, Grade 9. All oberserved variables were controlled for students' gender, school type and socioeconomic status. Academic achievement was controlled additionally for cognitive ability. For sake of simplicity, these control variables and their path coefficients are not depicted but estimated in both models. All autoregressive and cross-lagged paths were estimated, but only significant ones are presented. $*p < .05$; $**p < .01$; $***p < .001$
[Correction added on 17 October 2022, after first online publication: Figure 1 is corrected in PDF.]

to one's expected score) was associated with a higher level of autonomy-supportive involvement (relative to one's expected scores) at the subsequent occasion. A positive cross-lagged coefficient of achievement on autonomy-supportive involvement was observed from Grade 7 to Grade 9. In contrast, controlling involvement was not related to autonomy-supportive involvement or student achievement (Hypothesis 4).

Within the traditional CLPM (Figure 1b, Table 4), there were significant autoregressive effects for all three constructs, and controlling involvement was negatively related to autonomy-supportive involvement at the subsequent occasion. Cross-lagged relations between both forms of involvement were found from Grade 5 to Grade 7. Whereas controlling involvement was linked to lower achievement from Grade 5 to Grade 7, no significant links between autonomy-supportive involvement and achievement were found.

DISCUSSION

This study examined the longitudinal relation between the manner of parental involvement (i.e., autonomy-supportive or controlling) in children's academic problems and children's academic achievement. By comparing the traditional CLPM with a RI-CLPM, this study additionally addressed the ongoing methodological discourse in terms of modelling cross-lagged relations. In this study, the RI-CLPM fitted the data better than the CLPM. Therefore, we interpret the results of the RI-CLPM in more detail in the following sections. Overall, the relation between parental involvement and student achievement should be considered at the between- and within-person levels.

Between-person differences and within-person processes

This study revealed stable, trait-like characteristics of both forms of parental involvement in academic problems and student achievement (between-person differences). Furthermore, after controlling for between-person differences and time-invariant confounders, all three constructs showed varying degrees of intraindividual stability and changes. Whereas autonomy-supportive involvement was relatively stable over time within an individual, the intraindividual stability of controlling involvement was stronger than

TABLE 3 Parameter estimates within the random-intercept cross-lagged panel model

	B (*SE*)	*p*	β		*B* (*SE*)	*p*	β
Autoregressive effects				Effects of time-invariant covariates			
wSUP5 → wSUP7	.25 (.08)	<.01	.24	Gender → wSUP5	.01 (.04)	.89	.00
wSUP7 → wSUP9	.32 (.07)	<.001	.31	ST → wSUP5	.07 (.06)	.28	.05
wCON5 → wCON7	.18 (.06)	<.01	.19	SES → wSUP5	.04 (.02)	.05	.07
wCON7 → wCON9	.10 (.09)	.25	.11	Gender → wSUP7	−.01 (.04)	.87	−.01
wGPA5 →wGPA7	.11 (.15)	.49	.11	ST → wSUP7	.06 (.06)	.32	.04
wGPA7 → wGPA9	.42 (.07)	<.001	.33	SES → wSUP7	.04 (.02)	<.05	.08
Cross-lagged effects				Gender → wSUP9	.03 (.04)	.49	.02
wCON5 → wSUP7	−.08 (.07)	.25	−.06	ST → wSUP9	.05 (.07)	.53	.03
wGPA5 → wSUP7	.22 (.08)	<.01	.18	SES → wSUP9	.06 (.03)	<.05	.11
wSUP5 → wCON7	−.05 (.05)	.36	−.06	Gender → wCON5	.23 (.04)	<.001	.16
wGPA5 → wCON7	−.10 (.06)	.09	−.11	ST → wCON5	−.26 (.05)	<.001	−.18
wSUP5 → wGPA7	.06 (.07)	.34	.08	SES → wCON5	−.07 (.02)	<.001	−.13
wCON5 → wGPA7	−.11 (.06)	.07	−.11	Gender → wCON7	.20 (.04)	<.001	.16
wCON7 → wSUP9	−.08 (.08)	.34	−.06	ST → wCON7	−.10 (.06)	.10	−.07
wGPA7 → wSUP9	.14 (.07)	<.05	.11	SES → wCON7	−.04 (.02)	<.01	−.10
wSUP7 → wCON9	−.04 (.07)	.58	−.05	Gender → wCON9	.24 (.04)	<.001	.19
wGPA7 → wCON9	−.06 (.07)	.38	−.06	ST → wCON9	−.08 (.06)	.18	−.06
wSUP7 → wGPA9	.12 (.06)	<.05	.12	SES → wCON9	−.04 (.02)	.07	−.08
wCON7 → wGPA9	−.08 (.07)	.55	−.04	Gender → wGPA5	−.02 (.04)	.63	−.01
(Residual) covariances				ST → wGPA5	.22 (.08)	<.01	.14
RI-SUP ↔ RI-CON	−.04 (.02)	<.05	−.37	SES → wGPA5	.09 (.02)	<.001	.15
RI-SUP ↔ RI-GPA	−.03 (.02)	.32	−.26	CA → wGPA5	.92 (.13)	<.001	.25
RI-CON ↔ RI-GPA	−.03 (.01)	<.05	−.15	Gender → wGPA7	−.09 (.04)	<.05	−.06
wSUP5 ↔ wCON5	−.03 (.02)	.16	−.09	ST → wGPA7	.15 (.08)	.05	.10
wSUP5 ↔ wGPA5	.03 (.02)	.26	.09	SES → wGPA7	.08 (.03)	<.01	.13
wCON5 ↔ wGPA5	−.04 (.02)	<.01	−.16	CA → wGPA7	1.07 (.12)	<.001	.29
wSUP7 ↔ wCON7	−.08 (.02)	<.001	−.28	Gender → wGPA9	−.21 (.05)	<.001	−.12
wSUP7 ↔ wGPA7	.05 (.02)	<.01	.18	ST → wGPA9	.00 (.10)	.97	.00
wCON7 ↔ wGPA7	−.08 (.02)	<.01	−.18	SES → wGPA9	.10 (.03)	<.001	.14
wSUP9 ↔ wCON9	−.07 (.02)	<.001	−.27	CA → wGPA9	.90 (.14)	<.001	.22
wSUP9 ↔ wGPA9	.03 (.01)	<.05	.10				
wCON9 ↔ wGPA9	−.04 (.02)	<.01	−.16				

Note: Gender: 1 = *boy*, 0 = *girl*. ST = school type: 1 = *Gymnasium*, 0 = *Hauptschule*.

Abbreviations: 5, Grade 5; 7, Grade 7; 9, Grade 9; β, standardized estimate; *B*, unstandardized estimate; CA, cognitive ability; CON, controlling involvement; GPA, academic achievement; *p*, *p*-value; RI, random intercept, between-person component; SE, standard error; SES, socioeconomic status; SUP, autonomy-supportive involvement; w, within-person component.

the intraindividual change from Grade 7 to Grade 9, and the intraindividual stability of achievement was weaker than the intraindividual change from Grade 5 to Grade 7. Regarding parental involvement, previous studies applying person-oriented approaches show that autonomy-supportive parental involvement is relatively stable and that its stability increases over the course of secondary education, whereas controlling involvement is more likely to change (Teuber et al., 2022). The within-person dynamics in terms of academic achievement are in line with our assumption. In this study, T1 took place in the second term of

TABLE 4 Parameter estimates within the traditional cross-lagged panel model

	B (*SE*)	*p*	β		*B* (*SE*)	*p*	β
Autoregressive effects				Effects of time-invariant covariates			
SUP5 → SUP7	.37 (.04)	<.001	.36	Gender → SUP5	.01 (.04)	.89	.00
SUP7 → SUP9	.43 (.04)	<.001	.42	ST → SUP5	.07 (.06)	.28	.05
CON5 → CON7	.46 (.03)	<.001	.48	SES → SUP5	.04 (.02)	.05	.07
CON7 → CON9	.46 (.04)	<.001	.47	Gender → SUP7	−.01 (.04)	.88	−.01
GPA5 → GPA7	.53 (.03)	<.001	.53	ST → SUP7	.06 (.06)	.33	.04
GPA7 → GPA9	.70 (.04)	<.001	.61	SES → SUP7	.04 (.02)	<.05	.08
Cross-lagged effects				Gender → SUP9	.03 (.04)	.55	.02
CON5 → SUP7	−.11 (.04)	<.01	−.11	ST → SUP9	.04 (.07)	.54	.03
GPA5 → SUP7	.06 (.03)	.06	.06	SES → SUP9	.06 (.03)	<.05	.11
SUP5 → CON7	−.07 (.03)	<.05	−.07	Gender → CON5	.22 (.04)	<.001	.16
GPA5 → CON7	−.06 (.03)	.06	−.07	ST → CON5	−.26 (.05)	<.001	−.18
SUP5 → GPA7	−.01 (.03)	.78	−.01	SES → CON5	−.07 (.02)	<.001	−.13
CON5 → GPA7	−.07 (.03)	<.05	−.06	Gender → CON7	.20 (.04)	<.001	.16
CON7 → SUP9	−.10 (.04)	<.05	−.10	ST → CON7	−.10 (.06)	.10	−.07
GPA7 → SUP9	.01 (.03)	.86	.01	SES → CON7	−.05 (.02)	<.01	−.10
SUP7 → CON9	−.01 (.04)	.75	−.01	Gender → CON9	.24 (.04)	<.001	.19
GPA7 → CON9	−.02 (.03)	.49	−.03	ST → CON9	−.09 (.06)	.16	−.07
SUP7 → GPA9	.04 (.04)	.32	.03	SES → CON9	−.04 (.02)	.10	−.08
CON7 → GPA9	−.06 (.04)	.17	−.05	Gender → GPA5	−.02 (.04)	.63	−.01
(Residual) covariances				ST → GPA5	.22 (.08)	<.01	.14
SUP5 ↔ CON5	−.06 (.02)	<.001	−.15	SES → GPA5	.09 (.02)	<.001	.15
SUP5 ↔ GPA5	.00 (.01)	.78	−.01	CA → GPA5	.91 (.13)	<.001	.25
CON5 ↔ GPA5	−.07 (.01)	<.001	−.15	Gender → GPA7	−.09 (.04)	<.05	−.06
SUP7 ↔ CON7	−.08 (.01)	<.001	−.26	ST → GPA7	.15 (.08)	.05	.10
SUP7 ↔ GPA7	.02 (.01)	.10	.05	SES → GPA7	.08 (.03)	<.01	.12
CON7 ↔ GPA7	−.04 (.01)	<.001	−.11	CA → GPA7	1.07 (.12)	<.001	.29
SUP9 ↔ CON9	−.08 (.02)	<.001	−.25	Gender → GPA9	−.20 (.04)	<.001	−.12
SUP9 ↔ GPA9	.02 (.01)	.22	.04	ST → GPA9	.01(.10)	.93	.01
CON9 ↔ GPA9	−.04 (.02)	<.01	−.13	SES → GPA9	.10 (.03)	<.01	.14
				CA → GPA9	.87 (.15)	<.001	.22

Note: Gender: 1 = *boy*, 0 = *girl*. ST, school type: 1 = *Gymnasium*, 0 = *Hauptschule*.

Abbreviations: 5, Grade 5; 7, Grade 7; 9, Grade 9; β, standardized estimate; *B*, unstandardized estimate; CA, cognitive ability; CON, controlling involvement; GPA, academic achievement; *p*, *p*-value; *SE*, standard error; SES, socioeconomic status; SUP, autonomy-supportive involvement.

fifth grade, when students were still new in secondary schools. The changed learning environment and academic demands may affect one's academic performance (Eccles & Roeser, 2009).

Concerning the longitudinal associations between autonomy-supportive parental involvement and student achievement, the relation between these constructs was not significant at the between-person level. However, we found positive cross-lagged effects of student achievement on autonomy-supportive involvement at the within-person level and vice versa. That is, students with higher academic achievement (compared to one's own mean) are likely to experience greater parental autonomy-supportive involvement at a subsequent occasion (compared to one's own mean). When students experience more autonomy-supportive involvement (compared to one's own mean), they are more likely to show higher

academic achievement at the next occasion. Dumont et al. (2014) found a positive reciprocal relation between parental involvement through providing structure in homework settings and student achievement. Our study could extend this result to the dimension of autonomy support and provides evidence that the positive reciprocal relation between need-supportive involvement and student achievement may not be limited to homework-like settings. Parents' constructive communication about academic problems, stimulation of solutions and perspective-taking may provide access to motivational and psychological resources that foster school engagement (Pomerantz et al., 2007) and thus contribute to children's academic development. As suggested by Grolnick (2003), students' characteristics (e.g., good performance) may increase parents' self-efficacy in supporting their children and thus facilitate their adaptive involvement when academic problems arise. It is noteworthy that there was no association between autonomy-supportive involvement and achievement at the between-person level. These results indicate that the relation between the two may be mainly accounted for by the underlying intraindividual processes rather than stable between-person differences.

Regarding the longitudinal associations between controlling involvement and student achievement, we found a negative relation between these constructs at the between-person level, suggesting that students who perceive greater controlling parental involvement are more likely to show lower academic achievement (compared to the other students). This is consistent with previous findings that controlling parental involvement frustrates children's needs for autonomy, relates to less self-determined learning motivation and is, therefore, negatively linked to student academic outcomes (Domina, 2005; Dumont et al., 2014; Lorenz & Wild, 2007). Yet, at the within-person level, we did not find any significant cross-lagged relations between controlling involvement and student achievement, suggesting that intraindividual changes in achievement are unlikely to result in prospective intraindividual changes in perceived controlling involvement or vice versa. In other words, the relation between controlling involvement and student achievement may be explained primarily by stable differences between individuals rather than by underlying intraindividual processes.

Empirical and practical implications

Comparing the results of the RI-CLPM with those of the traditional CLPM, the estimated relations between parental involvement and academic achievement differed substantially (Figure 1). After accounting for stable between-person differences, a reciprocal relation between autonomy-supportive involvement and achievement on the within-person level was revealed in the RI-CLPM. Within the traditional CLPM, which conflates between- and within-person processes (Hamaker et al., 2015; Mulder & Hamaker, 2020), no reciprocal relations between parental involvement and student achievement were found. The current findings suggest that future studies may need to distinguish between the between-person and within-person levels to gain a deeper understanding of the interplay between parental involvement and student achievement.

Several practical implications can be drawn from the current findings. The between-person negative relation between controlling involvement and achievement suggests that it may be helpful to inform parents about the detrimental effects of such dysfunctional involvement practices (e.g., through parent counselling/training or teacher-parent conferences). The within-person fluctuations in all constructs imply that parental involvement and student achievement can change and that it is possible for parents to adopt more adaptive involvement strategies, which may positively impact children's academic development. The within-person positive reciprocal relations between autonomy-supportive involvement and achievement encourage parents to initiate constructive conversations with their children so that children know they can trust and talk to their parents and that they will be supported by their parents when they have academic problems. By knowing children's thoughts and needs better, parents may be involved in a more adaptive manner. Dealing with academic problems can be challenging for both students and their parents. Need-fulfilling parental involvement can serve as a resource, energize students and parents and foster parent–child relationship (e.g., Neubauer et al., 2021).

Limitations and future research

Several limitations of this study should be noted. Firstly, the results relied on self-reported data. Common method variance may partly explain some of the results. It could be an advantage to obtain parental involvement from the parent's perspective. Regarding the self-reported academic achievement, the participants may have intentionally over-inflated their grades, and the retrospective report may have led to inaccuracy. It may be beneficial to include some more proximal outcomes that lead to academic achievement (e.g., academic self-concept), learning motivation and school engagement (e.g., Lerner et al., 2022; Lorenz & Wild, 2007). Secondly, to reduce the complexity of the model, we used the basic RI-CLPM with time-invariant covariates without taking measurement errors into account. Future studies are encouraged to extend the basic RI-CLPM to RI-CLPM with multiple indicators (Mulder & Hamaker, 2020). Thirdly, girls, students from *Gymnasium* and students from higher-SES families were overrepresented in our sample. Although these covariates were controlled for, we could not rule out possible biases in our results. Finally, parental involvement can be affected by both relatively stable and dynamic factors, such as parents' skills, construction of parental role, parental well-being, and invitation and demands for involvement from children and schools (Hoover-Dempsey & Sandler, 1997). Investigating such potential predictors can provide policymakers and practitioners with valuable information on promoting adaptive parental involvement.

CONCLUSION

The present study advanced our knowledge of the longitudinal relation between parental involvement in children's academic problems and children's academic achievement by incorporating the SDT framework and comparing the traditional CLPM with the RI-CLPM. The results indicate that parental involvement practices and academic achievement have trait-like characteristics and show intraindividual dynamics. The current findings further highlight that controlling parental involvement is generally associated with lower student achievement and that intraindividual changes in autonomy-supportive parental involvement and intraindividual changes in student achievement influence each other. Hence, the manner of parental involvement in children's academic problems and children's academic outcomes are associated with each other at both between-person and within-person levels. However, we still know far from enough about the underlying mechanism. Further longitudinal studies are necessary for a deeper understanding.

AUTHOR CONTRIBUTIONS

Ziwen Teuber: Conceptualization; methodology; writing – original draft. **Lena Sielemann:** Writing – review and editing. **Elke Wild:** Funding acquisition; resources; writing – review and editing.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available for scientific research purposes at the Research Data Center at the Institute for Educational Quality Improvement at http://doi.org/10.5159/IQB_FUnDuS_v1.

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