



The effects of teacher support, parental monitoring, motivation and self-efficacy on academic performance over time

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Abstract

This study aimed to investigate the contribution of teacher support and parental monitoring to academic performance over three years, testing the mediating role of self-determined motivation and academic self-efficacy and establishing whether the role of teachers and parents varies over time. A total of 419 adolescents—201 males (48%) and 218 females (52%), $M_{\text{age}} = 14.34$ years ($SD = .90$)—attending at T1 the ninth grade of schooling participated in the study. The questionnaires were administered three times over three years in February 2016 (T1), February 2017 (T2), and February 2018 (T3). Specifically, at T1, the students answered questionnaires regarding parental monitoring and teacher support. At T2 and T3, the students completed questionnaires about self-determined motivation and academic self-efficacy. At the end of each school year, in June 2017 (T2b) and June 2018 (T3b), the teachers' assessments of the students' academic performance expressed in school marks were collected. A structural equation model was used to test the hypothesised longitudinal relations between the study variables. The results showed that teacher support and parental monitoring directly and positively affected motivation and self-efficacy over time, which, in turn, impacted academic performance positively. The results also indicated that teacher support and parental monitoring indirectly affected academic performance over time through the mediation of motivation and self-efficacy and that the parents' influence was highest on motivation, while the teachers' influence was highest on self-efficacy. These results suggest the importance of implementing interventions aimed at enhancing parental monitoring and teacher support to improve students' academic performance.

Keywords Teacher support · Parental monitoring · Academic self-efficacy · Self-determined motivation · Academic performance · Longitudinal study

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Introduction

School achievement is a core developmental task during adolescence and one of the most influential predictors of positive self-realisation in future life (Choe, 2020; Lerner & Steinberg, 2009). Nevertheless, this goal is far from being reached for many students. On average, across OECD countries, approximately one in four 15-year-old adolescents did not attain the minimum level of proficiency in reading or mathematics (OECD, 2019). For this reason, a primary challenge for researchers is to shed light on the factors that contribute to academic performance, defined as the knowledge acquired, abilities developed at school, and capacity to carry out an assigned task and obtain good results (Nurad & Abdullah, 2016). A great amount of literature has shown that academic performance is multi-determined by school, family, and individual factors, such as teacher support (Filippello et al., 2020; Yu & Singh, 2018), parental monitoring (Chung et al., 2020; Wang & Sheikh-Khalil, 2014), self-determined motivation (Datu & Yang, 2019; Kusrkar et al., 2013), and perceived academic self-efficacy (Komarraju & Nadler, 2013; Olivier et al., 2019).

Although the role of the abovementioned variables in academic performance has been examined in many cross-sectional studies, little research has analysed their direct and indirect effects on academic performance over time. This is the goal and the novelty of the present study. Notably, this study builds on a previous study (Affuso et al., 2017), now including in the research design new measures and a longer period. More specifically, we analysed, over three years, how teacher support and parental monitoring influence academic performance, testing the mediating role of self-determined motivation and academic self-efficacy, to determine whether the role of teachers and parents varies over time.

Teacher support, parental monitoring, and academic performance

Teachers play an essential role in influencing students' academic performance (Chi et al., 2018). This finding was confirmed by the study conducted by Filippello et al. (2020) on a sample of adolescents in the Italian context. According to self-determination theory (SDT), an optimal learning context should guarantee the satisfaction of three basic needs: competence, autonomy, and relatedness (Deci & Ryan, 1985; Ryan & Deci, 2017). Teachers can facilitate this through three procedures: structure, autonomy support, and involvement. Teachers provide structure when they manage activities and give feedback that increases the students' perception of competence. Through autonomy support, teachers motivate and engage their students in academic activities, increasing the students' perception of autonomy. Finally, through involvement, teachers devote time, resources, and affection to their relationships with students, satisfying the latter's need for relatedness (Kurdi et al., 2018).

Although most studies have revealed a positive association between teacher support and academic achievement (Chi et al., 2018; Hiebert & Grouws, 2007; Kurdi et al., 2018; Roorda et al., 2011), teacher support does not guarantee good academic performance because its effect is dependent on a number of other variables. For example, in a short-term longitudinal study, McKellar et al. (2020) demonstrated that teachers' ability to offer constructive feedback to their students predicted the students' engagement over time, while in a longitudinal study on adolescents, Wang and Eccles (2012) highlighted the role played by the quality of the relationship. Teachers who express respect and praise and have confidence in their students may motivate the latter to learn and increase their satisfaction in school.

Similarly, parental involvement has been proven to longitudinally influence the academic performance of adolescents (Chung et al., 2020). This relationship was confirmed by the study conducted by Pastorelli et al. (2019) in the Italian context. According to SDT, parents can facilitate the satisfaction of their children's needs for competence, autonomy, and relatedness. Moreover, parental support increases the levels of school self-efficacy (Rodríguez et al., 2017) and the degree of constancy in studying (Thomas et al., 2019) and improves social integration (Ratelle et al., 2018), generating better results (Santiago et al., 2014; Top et al., 2017). Parental monitoring can be considered a specific dimension of parental involvement that reflects a set of correlated parenting behaviours, including observing and supervising children's activities (Dishion & McMahon, 1998). Parental monitoring is frequently operationalised in terms of parental knowledge about children's school activities and whereabouts (Stattin & Kerr, 2000). Students who tell parents about their school activities achieve better academic results by receiving support and encouragement (Boonk et al., 2020). Moreover, students recognise the importance of studying when they know that school is important to their parents (Amponsah et al., 2018), and students whose parents participate in their school life display higher levels of achievement than those whose parents do not (Yap & Baharudin, 2016).

Motivation, self-efficacy, and academic performance

Self-determined motivation and academic self-efficacy are among the personal factors that most influence school performance. According to Maslow (1954), motivation refers to the internal thrust directing human action towards the realisation of needs and objectives. Meanwhile, for Bandura et al. (1996), self-efficacy concerns students' belief in mastering specific academic subjects and areas of the curriculum and self-regulating their studying and learning activities.

High self-determined motivation is associated with a reduction in the dropout rate and an increase in students' academic achievement at the secondary level, whereas its absence is linked to a lack of interest in learning (Atta & Jamil, 2012). This finding was confirmed by a study conducted by Alivernini and Lucidi (2011) with adolescents in the Italian context. According to SDT, an autonomous form of motivation promotes self-regulation and engagement in school activities because autonomous students are driven by a personal interest (Thomas et al., 2019). However, although many studies have supported the influence of intrinsic motivation on academic achievement, the few that examined the effect, over time, of academic performance on motivation found conflicting results, reporting in some cases a significant relationship (Rodríguez et al., 2019) and an absence of relationship in others (Affuso et al., 2017).

Likewise, academic self-efficacy positively influences adolescents' academic performance (Pajares & Schunk, 2001). This relationship is also confirmed by the studies of Caprara et al. (2011) and Cattellino et al. (2019) in the Italian context.

Academic self-efficacy increases when students receive frequent and immediate feedback regarding the tasks they perform, as well as when they self-assess their efforts. Awareness of one's level of effectiveness influences the choice of tasks and commitment; the more capable a person feels, the greater their propensity to face difficult challenges (Gebauer et al., 2019). Moreover, a good level of academic self-efficacy allows students to control their anxiety, which promotes a higher involvement in school learning activities and, consequently, the achievement of positive results (Schnell et al., 2015). In sum, longitudinal studies showed a positive relationship between past academic performance and

academic self-efficacy, highlighting a reciprocal influence over time (Hwang et al., 2016; Olivier et al., 2019).

Motivation and self-efficacy as mediators between teacher support, parental monitoring, and academic performance

Teacher support indirectly influences academic performance via the mediation of motivation and self-efficacy (Yu & Singh, 2018). Studies showed that teacher support, understood as warmth, structure, and autonomy support, is a reliable predictor of a rise in motivation, which, in turn, predicts improvements in students' academic performance (Pitzer & Skinner, 2017; Sakiz et al., 2012; Trigueros et al., 2020). Students are more motivated when teachers are emotionally involved in the classroom and give them the opportunity to take action (Pitzer & Skinner, 2017). Similarly, a positive relationship between students and teachers based on feedback, good communication, respect, and equity positively affects self-efficacy, which positively influences students' academic performance (Ma et al., 2018; Yu & Singh, 2018).

Additionally, parental involvement promotes the development of motivation and self-efficacy which, in turn, lead to academic achievement (Affuso et al., 2017; Thomas et al., 2019). More specifically, parental expectations, encouragement, and interest can increase a child's intrinsic motivation, with better academic results (Józsa et al., 2019; Omar et al., 2017). Other studies showed that self-efficacy is a significant mediator between the parent-child relationship and academic performance (Cattellino et al., 2019; Otero et al., 2021). High parental expectations increase academic self-efficacy, which, in turn, affects academic performance (You et al., 2016). Furthermore, students feel more capable when their parents have confidence in their abilities and help them learn from their mistakes, which promotes an increase in academic performance (Rodríguez et al., 2017).

The role of gender, intelligence, and parental education

In analysing the relationships between these constructs, the role played by adolescents' gender is noteworthy. Females generally report higher levels of teacher support (Tennant et al., 2015), parental monitoring (Kokkinos & Vlavianou, 2019), self-determined motivation, academic self-efficacy, and academic achievement (Bugler et al., 2016; Huang, 2013) than males. Lastly, the role of intelligence and parental education should be taken into account. Extensive literature has shown a positive relationship between intelligence and academic performance (Ali & Ara, 2017; Costa & Faria, 2018), as well as a positive relationship between parental education and school-related parental involvement (Hill & Taylor, 2004) and between parental education and children's academic performance (Hamden-Thompson & Galindo, 2017; Munje & Mncube, 2018).

The present study

Previous studies have considered the mediating role of self-determined motivation and perceived academic self-efficacy in the relationship between teacher support, parental monitoring, and school performance. However, to the authors' knowledge, none has examined all these variables concurrently and longitudinally. Furthermore, to date, the variation over time of the role played by teachers and parents has not been investigated. Although these

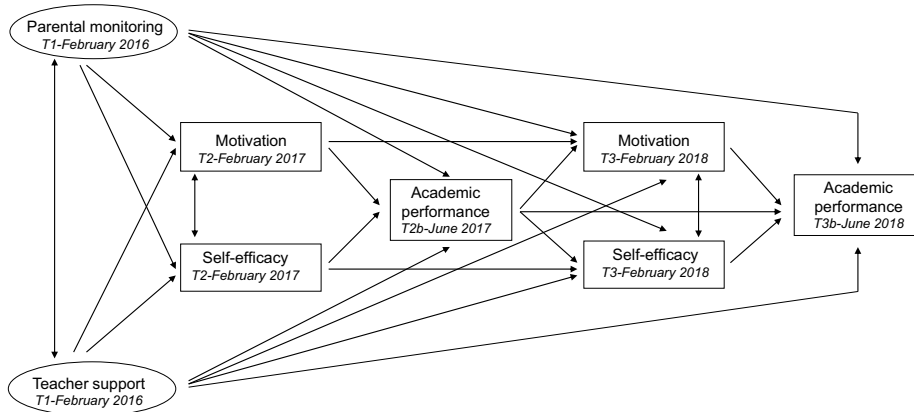


Fig. 1 Conceptual model of the paths of influence

gaps do not guarantee the existence of significant relationships between all the variables considered in this study, the fact that previous studies have revealed significant relationships between a limited number of these variables may justify the hypothesis of potential simultaneous relationships.

Specifically, this study aimed to investigate how teacher support, parental monitoring, self-determined motivation, and academic self-efficacy are related to academic performance over time. We hypothesised that teacher support and parental monitoring have a positive effect on self-determined motivation and academic self-efficacy, which, in turn, have a significant positive association with academic performance. We also investigated whether the contribution of teachers and parents remained constant over time. Finally, we investigated the reciprocal relationships between academic performance, self-determined motivation, and academic self-efficacy over time. Specifically, we tested whether academic performance was positively associated with later academic self-efficacy, anticipating a significant effect. Given the exiguous number of studies that have analysed the relationship between academic performance and self-determined motivation, we do not formulate any specific hypotheses in this regard.

In the hypothesised model, gender was examined as a potential moderator of all expected relationships. In addition, intelligence and parental education were included as covariates influencing all the other variables. The conceptual representation of the hypothesised model is displayed in Figure 1 (for simplicity, the effects of the covariates are not represented).

Method

Participants

The participants were part of the Arzano Longitudinal Study (ALP), a research project investigating the determinants and pathways of typical and atypical development from early to late adolescence. A total of 419 adolescents—201 males (48%) and 218 females (52%), $M_{\text{age}} = 14.34$ years ($SD = .90$)—participated in the study. The questionnaires were administered

thrice over three years in February 2016 (T1), February 2017 (T2), and February 2018 (T3). Specifically, at T1, the students completed questionnaires regarding parental variables (parental education and parental monitoring), school variables (teacher academic support and teacher personal support), and their level of intelligence. At T2 and T3, the students completed questionnaires on self-determined motivation and academic self-efficacy. At the end of each school year, in June 2017 (T2b) and June 2018 (T3b), the teachers' assessments of the students' academic performance expressed in school marks were collected.

The participants were enrolled in the first year (ninth grade) of four different types of secondary schools located in Naples (southern Italy) and Arzano and Casoria, two districts of the Naples metropolitan area. The schools included one high school with three different specialisations (scientific, humanistic, and linguistic) attended on average by students with parents with a medium or high level of education, two technical institutes attended on average by students with parents with a low or medium level of education, and one vocational school attended on average by students with parents with a low level of education. The sample was representative of southern Italy, although it leaned more towards a low or medium education level [Istituto Nazionale di Statistica (ISTAT), 2020]. Specifically, roughly 60% of the fathers and mothers had a low level of education (middle school diploma or less), 30% had a high school diploma, and approximately 10% had a university degree. Moreover, approximately 90% of the children lived with both parents, while 10% lived with only one parent.

Procedure

Data collection was authorised by the managers of the schools involved in the study and took place every year in February. The parents' written consent and the adolescents' assent were obtained before the administration of the questionnaires. All the administrations took place in the classroom, during school time. The compilation of each questionnaire took place in the presence of master and Ph.D. students, who received specific training beforehand.

The study was approved by the Research Ethical Board of the Department of Humanistic Studies, University of Naples "Federico II". The American Psychological Association's ethical standards regarding research with human subjects were followed throughout the research design and implementation.

Measures

Dependent variable

Academic performance During T2b and T3b, the teachers' assessments of the students' performance in all subjects were collected. For each student, a unique academic performance score was calculated based on the arithmetic mean of all school grades obtained in all subjects.

Control variables

Intelligence During T1, intelligence was measured using a shortened version of the Advanced Progressive Matrices (APM; Arthur Jr. & Day, 1994). Participants were presented with 24 matrices in increasing order of difficulty. The first 12 items were taken from

the APM first series and were included to let participants familiarise themselves with the task. To explain how to deal with the problems, the researchers provided the solution for the first two items, which, therefore, were not evaluated. Participants were asked to identify one answer that successfully solved the problem among eight images. The number of correctly solved problems was added up to obtain individual intelligence scores. The Cronbach's α was .89.

Parental education During T1, the students reported their fathers' and mothers' educational levels on a five-point scale from 1 ('did not go to school or finished only primary classes') to 5 ('university degree or higher'). Given the high correlation between the mothers' and fathers' level of education, in the last analyses, we operationalised parental education as a single latent factor constituted by these two indicators.

Independent variables

Teacher support During T1, teacher support was measured with two subscales (Van Ryzin et al., 2009): teacher academic support (four items, e.g. 'My teachers want me to do my best in schoolwork') and teacher personal support (four items, e.g. 'My teachers really care about me'). Students responded to each item using a five-point Likert scale from 'never' to 'always'. We assessed the factor structure of the scale by performing confirmatory factor analysis. The two-factor model, including the correlation between the two factors, showed an acceptable fit (CFI = .99; RMSEA = .07; SRMR = .03). The instrument demonstrated good reliability, with a Cronbach's α of .88 for teacher academic support and .86 for teacher personal support. Given the high correlation between teacher academic support and teacher personal support, in the last analyses, we operationalised teacher support as a single latent factor constituted by these two indicators.

Parental monitoring During T1, parental monitoring was measured with a parental knowledge subscale included in the Parental Monitoring Scale (Kerr et al., 2010), validated for Italy by Miranda et al., (2012). This scale consisted of six items describing maternal and paternal knowledge of the child's whereabouts, activities, and peers (e.g. 'Does your mother/father know what you do during your free time?', 'Does your mother/father usually know what type of homework you have?'). Responses were collected on a five-point Likert scale ranging from 'never' to 'always'. The Cronbach's α was .82 for maternal monitoring and .87 for paternal monitoring. Given the high correlation between maternal and paternal monitoring, in the last analyses, we operationalised parental monitoring as a single latent factor constituted by these two indicators.

Mediation variables

Self-determined motivation During T2 and T3, self-determined motivation was measured using the Academic Motivation Scale (Vallerand et al., 1993) validated for Italy by Alivernini and Lucidi (2008). This scale consists of five subscales¹. Each subscale contains

¹ The five subscales measure Amotivation (T2 Cronbach's α = .88; T3 Cronbach's α = .92), External Regulation (T2 Cronbach's α = .79; T3 Cronbach's α = .79), Introjected Regulation (T2 Cronbach's α = .86; T3 Cronbach's α = .86), Identified Regulation (T2 Cronbach's α = .86; T3 Cronbach's α = .88), and Intrinsic Motivation (T2 Cronbach's α = .89; T3 Cronbach's α = .90). The subscales were weighted as follows: Intrinsic Motivation, +2; Identified Regulation, +1; Introjected Regulation, 0; External Regulation, -1; and Amotivation, -2 (Alivernini & Lucidi, 2011; Vallerand et al., 1997).

four items representing possible responses to the question ‘Why do you go to high school?’. Respondents were asked to indicate the extent to which each answer reflects their reasons by answering on a seven-point Likert scale from 0 (‘does not correspond at all’) to 7 (‘corresponds exactly’). A global measure of student self-determination, with positive scores representing a higher level of self-determined motivation, was obtained by summing the weighted scores on individual subscales.

Academic self-efficacy During T2 and T3, academic self-efficacy was measured using the Academic Perceived Self-Efficacy Scale (Pastorelli et al., 2001). This scale includes 15 items, each referring to the perceived ability to master different curricular areas successfully (e.g. ‘How well do you do in mathematics?’) and the perceived capacity for self-regulation of learning activities, for example, the ability to plan and organise academic activities, structure learning environments, and motivate oneself to carry out one’s school work (e.g. ‘How well can you study when there are other interesting things to do?’). Respondents were asked to rate their perceived abilities on a five-point Likert scale from 1 (‘cannot do at all’) to 5 (‘most certainly can do’). The Cronbach’s α was .90 at T2 and .91 at T3.

Attrition analysis

Attrition analysis showed that 71 adolescents from the original sample ($N = 533$) were not assessed at T2 and T2b (13.3%), and 43 adolescents were not assessed at T3 and T3b (an additional 8.07%). The attrition was mainly due to school dropouts. Although the attrition rate seems very high, it is in line with the latest national statistics on school-dropout rates (ISTAT, 2021), which report that in Campania (the region of southern Italy in which Naples is located), 17.3% of students drop out of school before completing upper secondary education or vocational training. Multivariate analyses of variance (MANOVA) revealed significant differences between those who dropped out of the study and those who were retained through to T3 (Wilks’s $\lambda = .96$, $F(7,525) = 3.42$, $p < .001$). Specifically, participants who dropped out had lower scores for all variables examined except teacher support. The results of the Little test (Little & Rubin, 2002) for data missing completely at random (MCAR) in SPSS version 21 (IBM Corp.; Armonk, NY) were significant ($\chi^2 = 610.949$, $df = 309$; $p < 0.001$), indicating that data were not missing completely at random. Accordingly, full information maximum likelihood (FIML) was used to handle missing data.

Data analysis

MANOVA was used to compare the mean scores of all variables between males and females. Coefficients of correlation (Pearson product-movement correlation) were used to analyse the relationship between pairs of variables. These analyses were performed using the SPSS package, version 21.

Multiple-group structural equation modelling was used to test the hypothesised longitudinal relations between the study variables. All the analyses were run in Mplus 8 using maximum likelihood estimations (Muthén & Muthén, 2017). Indirect effects were estimated using the Sobel test. We used several indexes to determine model fit: the comparative fit index (CFI; Bentler, 1990), the Tucker–Lewis index (TLI; Tucker & Lewis, 1973), and the root mean square error of approximation (RMSEA; Brown & Cudeck, 1993). A

CFI and TLI $\geq .90$ and an RMSEA $\leq .08$ indicate a model's acceptable fit to the data (Hu & Bentler, 1999). The Satorra-Bentler chi-square difference test ($\Delta SB\chi^2$) was used to compare the fit of nested models (Satorra, 2000).

Results

Descriptive statistics

The means and standard deviations of study variables are reported in Table 1. Gender effects were tested with MANOVA. We considered gender to be an independent variable in the analysis, and all other variables (school variables, parental variables, and personal variables) were treated as dependent variables. The results indicated a significant effect of gender (Wilks's $\lambda = .77$, $F(13,405) = 9.21$, $p < .0001$). An exploration of the univariate effects showed that females had higher scores for parental monitoring, self-determined motivation at T2 and T3, and academic performance at T2b and T3b.

Pearson correlations among study variables are reported separately for males and females in Table 2. Correlation analysis revealed significant relationships. Specifically, self-determined motivation, academic self-efficacy, and academic performance at T2 and T2b were significantly and positively correlated with all measures detected at T1, except intelligence with self-determined motivation in males and parental education with self-determined motivation, academic self-efficacy, and academic performance in females. Furthermore, in females, academic performance at T2b was not significantly associated with paternal monitoring and teacher personal support. Finally, in both males and females, all measures detected at T3 and T3b were significantly and positively correlated with all measures at T2 and T2b.

Table 1 Mean and standard deviations for measures of intelligence, parental education, parental monitoring, teacher support, self-determined motivation, academic self-efficacy, and academic performance by gender.

	Males		Females		<i>F</i> (1, 419) ^a
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	
Intelligence - T1	9.24	3.08	9.06	2.87	.42
Maternal level of education - T1	3.28	.86	3.27	.86	.01
Paternal level of education - T1	3.26	.83	3.33	.78	.95
Maternal monitoring - T1	3.90	.86	4.21	.74	15.13***
Paternal monitoring - T1	3.56	1.06	3.34	1.14	3.97*
Teacher academic support - T1	3.96	.78	4.04	.92	.96
Teacher personal support - T1	3.12	.92	3.07	1.05	.23
Self-determined motivation - T2	6.49	4.31	8.20	4.14	17.05***
Academic self-efficacy - T2	3.60	.66	3.68	.69	1.48
Academic performance - T2b	6.39	.65	6.65	.77	14.46***
Self-determined motivation - T3	5.77	4.80	7.98	4.61	23.15***
Academic self-efficacy - T3	3.57	.69	3.66	.65	2.07
Academic performance - T3b	6.29	1.09	6.93	1.00	38.81***

Note: ^aUnivariate post hoc analysis. * $p < .05$; ** $p < .01$; *** $p < .001$. The *F* test was from a MANOVA. T1 February 2016, T2 February 2017, T2b June 2017, T3 February 2018, T3b June 2018

Table 2 Correlations among the variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Intelligence - T1	-	.15*	.21**	.02	.11	.17*	.03	.23***	.26***	.28***	.29***	.25***	.29***
2. Maternal level of education - T1	.28***	-	.44***	.00	.03	.00	.06	.00	.07	.05	.00	.12	.08
3. Paternal level of education - T1	.33***	.51***	-	-.02	.08	-.03	-.05	.01	.06	.06	.03	.04	.01
4. Maternal monitoring - T1	.09	.18**	.14*	-	.53***	.31***	.32***	.30***	.36***	.14*	.30***	.35***	.17*
5. Paternal monitoring - T1	.00	.11	.10	.72***	-	.20**	.23***	.28***	.38***	.11	.31***	.41***	.12
6. Teacher academic support - T1	-.08	.05	-.05	.25***	.20**	-	.65***	.39***	.35***	.15*	.39***	.34***	.18**
7. Teacher personal support - T1	-.11	.07	.03	.33***	.34***	.58***	-	.44***	.32***	.11	.36***	.36***	.11
8 Self-determined motivation - T2	.12	.14*	.17*	.38***	.36***	.47***	.41***	-	.63***	.40***	.57***	.48***	.33***
9 Academic self-efficacy - T2	.18*	.19**	.20**	.36***	.38***	.28***	.28***	.64***	-	.48***	.55***	.73***	.47***
10 Academic performance - T2b	.29***	.28***	.19**	.17*	.14*	.20**	.15*	.38***	.53***	-	.29***	.39***	.74***
11 Self-determined motivation - T3	.13	.10	.18*	.28***	.26***	.31***	.28***	.61***	.47***	.35***	-	.61***	.32***
12 Academic self-efficacy - T3	.07	.16*	.14	.28***	.36***	.34***	.31***	.60***	.71***	.44***	.53***	-	.48***
13 Academic performance - T3b	.28***	.22**	.20**	.14	.12	.10	.17*	.36***	.47***	.67***	.39***	.39***	-

Note: Correlations for males are below the diagonal; correlations for females are above the diagonal. * $p < .05$; ** $p < .01$; *** $p < .001$. T1 February 2016, T2 February 2017, T2b June 2017, T3 February 2018, T3b June 2018

Structural equation modelling

Conceptual model

Multiple-group structural equation modelling was used to test the hypothesis, with gender as the grouping variable. The model included two latent variables—teacher support at T1 (measured as teacher academic support and teacher personal support) and parental monitoring at T1 (measured as maternal monitoring and paternal monitoring)—and six observed variables: self-determined motivation at T2 and T3, academic self-efficacy at T2 and T3, and academic performance at T2b and T3b. Intelligence and parental education were included in the model as covariates influencing all variables. We measured parental education in terms of both the maternal and paternal educational levels. To test the equivalence of the structural parameters across groups (males vs. females), in a first step, parameters were freely estimated. In a second step, structural paths and correlations were constrained to be equal across groups. Finally, to test whether the role played by teachers and parents differs over time, the same effects repeated during the time were constrained to be equal across time (teacher support on self-determined motivation, teacher support on academic self-efficacy, and teacher support on academic performance; parental monitoring on self-determined motivation, parental monitoring on academic self-efficacy, and parental monitoring on academic performance; self-determined motivation on academic performance; academic self-efficacy on academic performance).

Equivalence across gender and time

Initially, we freely estimated the relationships between the variables simultaneously for males and females, and the fit for this model was $\chi^2(62) = 86.38, p = .02$, RMSEA = .04 (.02; .06), TLI = .97, and CFI = .99. Subsequently, we constrained structural paths and correlations to be equal across groups, and the fit for this model was $\chi^2(103) = 129.19, p = .04$, RMSEA = .03 (.01; .05), TLI = .98, and CFI = .99. The delta chi-square statistics revealed that the fit of the constrained model across gender was significantly better than that of the unconstrained model ($\Delta\chi^2(41) = 42.81, p > .05$). Finally, we constrained the same effects repeated during the time to be equal across time, and the fit for this model was $\chi^2(111) = 171.98, p < .001$, RMSEA = .05 (.04; .07), TLI = .96, and CFI = .97. The delta chi-square statistics showed that the fit of the constrained model across time was significantly worse than that of the constrained model across gender ($\Delta\chi^2(8) = 42.79, p < .001$). The examination of the modification indices suggested that we could improve the fit of this model by estimating teacher support on self-determined motivation and parental monitoring on academic self-efficacy freely across time. After this refinement, the model fitted the data well ($\chi^2(109) = 139.940, p = .02$, RMSEA = .04 (.01; .05), TLI = .98, and CFI = .99). Therefore, we chose this last model with total invariance across gender and partial invariance across time because it showed better fit and a non-significant delta chi-square statistic ($\Delta\chi^2(6) = 10.75, p > .05$).

Associations and effects

The results (Figure 2) revealed that teacher support was significantly correlated with parental monitoring, self-determined motivation and academic self-efficacy were positively correlated at T2 and T3, and all autoregressive paths (the path predicting a variable based on its prior level) were significant.

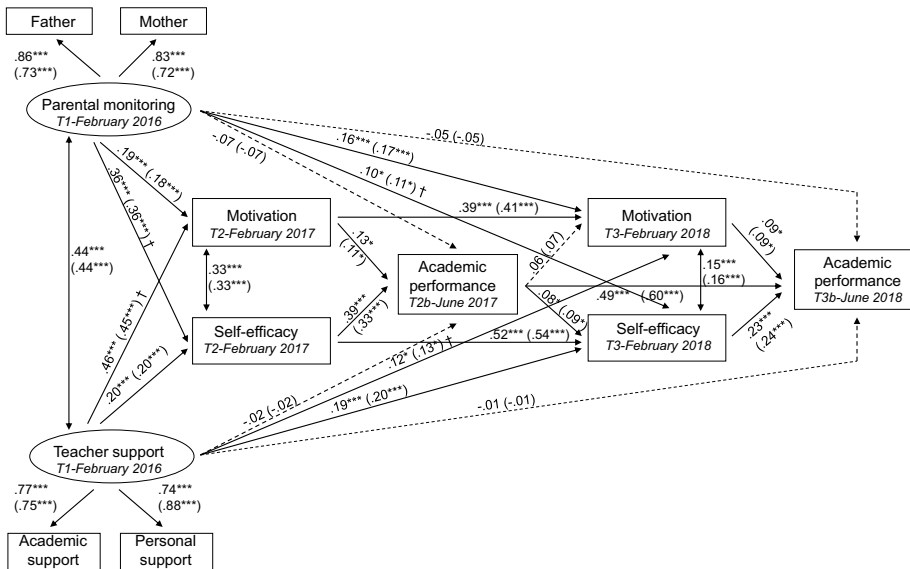


Fig. 2 Relations between teacher support, parental monitoring, self-determined motivation, academic self-efficacy, and academic performance across time. Standardised path coefficients. Parameters for males are shown without brackets; parameters for females are shown in brackets. * $p < .05$; ** $p < .01$; *** $p < .001$. To simplify, the paths from intelligence and parental education to all other variables were omitted and reported in Table 3. † indicates a significant difference of same effects across time.

Moreover, the results indicated that teacher support at T1 had a positive effect on self-determined motivation at T2 and T3, although the relationship between teacher support at T1 and self-determined motivation at T3 was less strong ($p < .05$) and significantly different from that between teacher support at T1 and self-determined motivation at T2 ($p < .001$). Teacher support at T1 also had a positive effect on academic self-efficacy at T2 and T3 but not on academic performance at T2b and T3b.

The results also showed that parental monitoring at T1 had a positive effect on self-determined motivation at T2 and T3 and on academic self-efficacy at T2 and T3, although the relationship between parental monitoring at T1 and academic self-efficacy at T3 was less strong ($p < .05$) and significantly different from the relationship between parental monitoring at T1 and academic self-efficacy at T2 ($p < .001$). However, parental monitoring at T1 did not have a positive impact on academic performance at T2b and T3b.

Finally, the results indicated that self-determined motivation and academic self-efficacy at T2 had a positive effect on academic performance at T2b, self-determined motivation and academic self-efficacy at T3 had a positive effect on academic performance at T3b, and the students' performance at T2b had a positive effect on academic self-efficacy at T3 but not on self-determined motivation at T3. The significant indirect effects are reported in Table 3.

Covariates and variance explained

The effects of covariates, intelligence, and parental education on all the examined variables of the posited model are presented in Table 4. Intelligence was positively related to

Table 3 Standardised indirect effects.

Independent variables	Mediation variables	Dependent variable
		<u>Academic performance T3b</u>
Teacher support T1	Via motivation at T2 and T3	.02**; .02**
	Via motivation at T2 and academic performance at T2b	.03**; .03**
	Via self-efficacy at T3	.04***; .05***
	Via self-efficacy at T2 and T3	.02**; .02**
	Via self-efficacy at T2 and academic performance at T2b	.03**; .03**
Parental monitoring T1	Via motivation at T3	.01*; .01*
	Via motivation at T2 and T3	.01*; .01*
	Via motivation at T2 and academic performance at T2b	.01*; .01*
	Via self-efficacy at T3	.02*; .03*
	Via self-efficacy at T2 and T3	.04***; .05***
	Via self-efficacy at T2 and academic performance at T2b	.07***; .07***
Motivation T2	Via academic performance at T2b	.06**; .07**
	Via motivation at T3	.03*; .04*
Self-efficacy T2	Via academic performance at T2b	.19***; .20***
	Via academic performance at T2b and self-efficacy at T3	.01*; .01*
	Via self-efficacy at T3	.12***; .13***
Academic performance T2b	Via self-efficacy at T3	.02*; .02*

Note: The standardised coefficients are reported for males and females, respectively. * $p < .05$; ** $p < .01$; *** $p < .001$. T1 February 2016, T2 February 2017, T2b June 2017, T3 February 2018, T3b June 2018

self-determined motivation at T1 and T2, academic self-efficacy at T1, and academic performance at T1b, and parental education was positively related to parental monitoring.

Overall, the model explains a reasonable percentage of the variance for academic performance at T1b (30% for males and 22% for females) and T2b (44% for males and 59% for females).

Discussion

The aim of this study was to investigate the associations between teacher support and parental monitoring on academic performance over three years, hypothesising that self-determined motivation and academic self-efficacy would mediate the relationship. A further goal was to analyse whether the contribution of teachers and parents remained constant over time.

Academic achievement is considered an important goal during a teenager's school career, and students who experience good academic performance will have positive beliefs about their abilities (Arens et al., 2020), which will help them increase their future success (Olivier et al., 2019).

Table 4 Standardised effects of intelligence and parental education on parental monitoring, teacher support, self-determined motivation, academic self-efficacy, and academic performance.

	Teacher support	Parental monitoring	Motivation	Self-efficacy	Academic performance	Motivation	Self-efficacy	Academic performance
	T1	T1	T2	T2	T2b	T3	T3	T3b
Intelligence T1	-.02; -.02	.03; .03	.16***; .15***	.17***; .17***	.19***; .15***	.11*; .11*	.01; .01	.07; .07
Parental education T1	.03; .03	.13*; .13*	.03; .03	.07; .07	.07; .07	-.01; .01	.03; .03	-.01; -.01

Note: The standardised coefficients are reported for males and females, respectively. * $p < .05$; ** $p < .01$; *** $p < .001$. T1 February 2016, T2 February 2017, T2b June 2017, T3 February 2018, T3b June 2018

Our study involved 419 adolescents over three years, and the results fully confirmed the hypotheses. Teacher support (T1) and parental monitoring (T1) did not affect academic performance directly but influenced self-determined motivation and academic self-efficacy positively both after one year (T2) and after two years (T3). In turn, self-determined motivation and academic self-efficacy affected academic performance after five months, both in the 10th (T2b) and 11th (T3b) grades. Teacher support and parental monitoring affected academic performance indirectly, both after 17 months (T2b) and after 29 months (T3b), through the mediation of self-determined motivation and academic self-efficacy measured after one year (T2) and two years (T3). These results were equal across gender. In addition, the study revealed interesting results regarding the possible different roles played by parents and teachers over time. In particular, although the effect of parental monitoring on academic self-efficacy at T3 remained significant, its magnitude was significantly lesser than the effect on academic self-efficacy at T2. Conversely, although the effect of teacher support on self-determined motivation at T3 remained significant, its magnitude was significantly lesser than the effect on self-determined motivation at T2. These relationships were significant even after controlling for the confounding effects of intelligence and parental education, as well as the temporal stability of self-determined motivation, academic self-efficacy, and academic performance.

These results are consistent with the literature. The positive and significant association between teacher support and academic performance through self-determined motivation and academic self-efficacy shows that teachers are regarded by students as an important reference point within the school context. Establishing a relationship based on mutual respect, feedback, and support for learning and commitment makes students more motivated to study and more aware of their abilities, thus promoting a good academic performance aimed at success (Jelas et al., 2016; Liu et al., 2021). The positive and significant association between parental monitoring and academic performance through self-determined motivation and academic self-efficacy shows that parents can improve their children's school careers. Good relationship quality between parents and children promotes the increase of motivation (Wehrspann et al., 2016) and academic self-efficacy (Yuan et al., 2016), which are fundamental to good academic performance (Choe, 2020). Parents who know what their children are doing, follow them closely, and build relationships based on support and advice positively affect their children's academic performance (Costa & Faria, 2017; Dotterer & Wehrspann, 2016).

The analysis of the different roles played by parents and teachers over time suggests that teacher support continues to have a significant impact on academic self-efficacy and self-determined motivation at T3, but this last relationship is significantly less strong than that between teacher support and self-determined motivation at T2. Conversely, parental monitoring continues to have a significant impact on self-determined motivation at T3 and academic self-efficacy at T3, although this last relationship is significantly less strong than that between parental monitoring and academic self-efficacy at T2. In other terms, both parents and teachers contribute to increasing self-determined motivation and academic self-efficacy, but over time, the parents' influence is greater on motivation, whereas the teachers' influence is greater on self-efficacy. These results seem to point to a differential effect over time. Although these findings should be interpreted with caution and require further investigation, one possible explanation is that over time, teachers help students to better understand what they are most capable of by supporting them concretely in the tasks and assigning marks. Teachers' support guides students in refining the choice of their goals and achieving satisfactory results more easily. Coincidentally, by transmitting values to their children, parents help them to internalise the importance of studying (Boonk et al., 2020).

Consequently, the children will engage in studying based on a personal internal drive of self-realisation.

Moreover, the results are consistent with those of other studies reporting a significant association between self-determined motivation, academic self-efficacy, and academic performance. Students who are intrinsically motivated and study for the pleasure of learning have more opportunities to achieve academic success (Kusurkar et al., 2013; Xu et al., 2020). Similarly, self-efficacy emerges as an internal resource that facilitates self-disciplined conduct and allows students to remain focused on their work (Komarraju & Nadler, 2013; Li et al., 2020).

Furthermore, it is interesting to note that despite the high stability of self-determined motivation, academic self-efficacy, and academic performance over time, the relationship between self-efficacy and academic performance is reciprocal over time. As a consequence, good academic performance improves academic self-efficacy, which, in turn, enhances academic performance (Hwang et al., 2016). Conversely, academic performance does not improve self-determined motivation after one year. This result confirms the individuals' capacity to draw lessons from experience (Bandura, 1997) and indicates that self-determined motivation derives more from the value that the subject internally attributes to a task than from external rewards such as teachers' evaluations (Affuso et al., 2017).

It is noteworthy that the strength of the relationships is maintained after checking the effects of intelligence and parental education, which are proven to be strong predictors of academic performance (Di Giunta et al., 2013; Zuffianò et al., 2013). The results revealed a positive association between parental education and parental monitoring, thus confirming that higher levels of parental education generate greater interest, involvement, and expectations regarding the children's educational paths (Boonk et al., 2020; Munje & Mncube, 2018). Moreover, the results pointed to a positive association of intelligence with self-determined motivation, academic self-efficacy, and academic performance, confirming that intelligence allows one to orient oneself towards more difficult tasks (Ali & Ara, 2017).

Finally, there are no differences across gender in the relationships between all the variables examined, although preliminary analyses suggested that females reported higher levels of parental monitoring, self-determined motivation, and academic performance. These results confirm that females give more importance to school, are committed to overcoming difficulties, and tend to discuss their progress with their mother and father. Males, on the other hand, are more likely to seek alternative experiences, for instance with the peer group (King, 2016).

In this regard, a potential limitation of this study is that we did not consider the role of other school variables, such as peer relationships, and personal variables, such as temperamental traits and resilience, which might play a part in increasing academic performance. Another limitation is related to the nature of the sample. The attrition analysis showed that participants who remained in the study at T3 had higher scores for all variables examined except teacher support than participants who dropped out. Future studies using different samples should replicate these findings and verify that this limitation did not impact the generalisability of the results. Moreover, to detect teacher support and parental monitoring, we used only student self-reports. Future research should personally involve parents in the measurement of monitoring and teachers in the measurement of support. Another important point concerns the length of the longitudinal study. Further studies are needed to reinforce the solidity of the findings, for example, by considering longer periods to shed further light on the different long-term effects of teacher support and parental monitoring on self-determined motivation and academic self-efficacy.

Nevertheless, the main strength and novelty of this study consist in having examined, concurrently and over time, the contribution of school, parental and personal variables such as teacher support, parental monitoring, self-determined motivation, and academic self-efficacy to academic performance, keeping under control other relevant variables such as intelligence and parental education.

In conclusion, our study found that, over time, the joint action of teachers and parents improves academic performance by increasing self-determined motivation and academic self-efficacy and confirms that teachers and parents are important not only for the transmission of knowledge but also for both support and trust. The results of this study emphasise that implementing intervention projects aimed at enhancing parental monitoring and teacher support can indirectly contribute to increasing students' academic performance and reducing the risk of academic failure.

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Author contribution All authors contributed to the study conception and design. Material preparation and data collection were performed by Anna Zannone and Maddalena Pannone, and data analysis was performed by Gaetana Affuso. The first draft of the manuscript was written by Gaetana Affuso, Anna Zannone, Concetta Esposito, and Dario Bacchini, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Conflict of interest The authors declare no competing interests.

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Bacchini, D., Affuso, G., & Trotta, T. (2008). Temperament, adhd and peer relations among school children: The mediating role of school bullying. *Aggressive Behavior*, 34, 447–459. <https://doi.org/10.1002/ab.20271>.

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