

# The Influence of Parental Autonomy Support on Adolescent Academic Achievement: A Moderated Mediation Model

Jichen Wang <sup>1,3, a</sup>, Mingxin Liu <sup>2</sup>, Gen Kou <sup>4</sup>, Jun Li <sup>4</sup>, Xingli Zhang <sup>1,3, b</sup>

<sup>1</sup> Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, China

<sup>2</sup> China Children's Center, Beijing 100035, China

<sup>3</sup> Department of Psychology, University of Chinese Academy of Sciences, Beijing 100049, China

<sup>4</sup> Cangxi Middle School of Sichuan, Sichuan 628404, China.

<sup>a</sup> 13810994597@139.com, <sup>b</sup> zhangxl@psych.ac.cn

**Abstract.** Based on the theories of ecosystem and self-determination, a questionnaire survey was conducted among 1,372 students from four grades (7th to 10th) in three middle schools in Chengdu, Xi'an, and Hangzhou. The study aimed to investigate the relationship between parental autonomy support and adolescents' academic performance, as well as the mediating role of metacognition and the moderating effect of grade level. The results revealed the following: 1. Parental autonomy support significantly and positively predicted adolescents' academic performance; 2. Metacognition played a significant mediating role in the relationship between parental autonomy support and adolescents' academic performance; 3. Grade level moderated the first half of the mediation model, specifically the impact of parental autonomy support on adolescents' metacognition. This study constructed a theoretical model that explores the combined influence of environmental factors (parental autonomy support) and individual factors (metacognition) on academic performance. It provides a theoretical basis and empirical support for gaining a deeper understanding of the underlying mechanisms by which parental autonomy support affects academic performance and offers insights for enhancing adolescents' academic achievement.

**Keywords:** Parental autonomy support; Metacognition; Academic performance; Adolescents; Grade; Moderated mediation effect.

## 1. Introduction

Academic performance is one of the most extensively studied variables in the field of education[1] and a matter of shared concern among students, parents, and teachers. It holds a significant position in the development of adolescents, reflecting not only their learning performance during school years but also exerting a substantial influence on their future educational attainment, career achievements, and income levels[2-4]. In recent years, researchers have examined the relationship between academic performance and various factors from both environmental perspectives, such as economic conditions, social status, and parental involvement[5], as well as individual factors, including learning motivation[6], intelligence[7], self-regulation[8], and self-control[9]. These studies have provided empirical evidence demonstrating the impact of these factors on academic performance. The research on academic performance and its related influencing factors has garnered widespread attention from various sectors of society[10]. Therefore, this study aims to explore the significant factors influencing academic performance in adolescents from both environmental and individual perspectives and provide empirical support for relevant theories.

Based on the Ecological Systems Theory, an individual's development is influenced by their environment and is the result of interactions with the environment[11]. In light of this theory, parental autonomy support is an important environmental factor that significantly impacts academic performance[12-14]. Parental autonomy support refers to parenting behaviors perceived by children (adolescents) as promoting their autonomous development and respecting and acknowledging their perspectives and feelings[15]. However, previous research on adolescence has focused more on the relationship between teacher support, peer support, and academic performance. It suggests that as

adolescents grow older, their dependence on parents decreases[16-18], but parental support remains a significant influencing factor that should not be ignored. A study conducted among college students revealed that perceived parental support had the strongest impact on academic performance (parental support  $r=0.204$ , teacher support  $r=0.198$ , peer support  $r=0.168$ )[19]. Additionally, a meta-analysis supported the direct influence of parental autonomy support on academic performance ( $r=0.11$ )[20]. Especially since the implementation of the "double reduction" policy in China on September 1, 2021, where children spend more time with their families, parent-child communication, activities, and supervision have become increasingly frequent and important[21]. Consequently, this study aims to explore the underlying relationship between parental autonomy support and adolescent academic performance, with the hypothesis that parental autonomy support positively predicts adolescent academic performance (H1).

Based on the Self-Determination Theory, when individuals are provided with opportunities for autonomy in their environment, they gradually develop self-evaluation and self-management abilities. At the core of these abilities is metacognition, which is closely related to academic performance. Metacognition refers to one's awareness and understanding of cognitive processes and outcomes and the active monitoring and regulation of these processes[22,23]. Metacognition is integral to learning strategies, and its impact on adolescent academic performance has received considerable attention. Students with higher levels of metacognition are more likely to achieve better academic performance. The Programmer for International Student Assessment (PISA), the largest international academic achievement test, has conducted surveys on students' metacognitive strategies. After analyzing the reading, mathematics, and science achievements of students from 34 OECD countries, the research found that metacognitive strategies had the greatest impact on students' academic performance[24,25]. The process of using metacognitive strategies by adolescents involves self-evaluation and self-management of cognition[26]. Therefore, from the perspective of self-determination theory, the active use of metacognitive strategies by adolescents is a form of self-determined behavior, and higher levels of metacognition are closely associated with an environment of autonomy support[27]. Previous research supports the influence of parental involvement on adolescent metacognitive strategies, and metacognitive strategies have been found to play an important mediating role between parental involvement and academic performance[1]. Based on the aforementioned research evidence, metacognition may also mediate the relationship between parental autonomy support and academic performance in adolescents. Therefore, this study hypothesizes that parental autonomy support can indirectly influence adolescent academic performance through the mediating role of metacognition (H2).

Ecological Systems Theory emphasizes that both individual and environmental factors undergo changes over time, with individuals developing as they age and their environments changing accordingly[28]. Research has shown that there is a significant cognitive development process in the brain from early to late adolescence[29], and as grade level increases, adolescents' cognitive and metacognitive abilities also tend to increase. However, as adolescents enter puberty, their self-awareness strengthens, and conflicts with parents increase[30], leading to a decrease in perceived parental autonomy support. But as adolescents grow and mature, parents tend to provide more autonomy support, and adolescents are more likely to perceive parental autonomy support. Therefore, the perceived parental autonomy support by adolescents exhibits a trend of initial decline and subsequent increase[31]. It is evident that at different stages of age development, the autonomy support provided by parents to adolescents, as well as the perceived parental autonomy support and their level of metacognition, vary. In this context, the question arises: What impact does grade level, as a time factor, have on the process of parental autonomy support influencing adolescent metacognition? Therefore, this study hypothesizes that grade level acts as a moderator in the first half of the pathway of this mediating model (H3).

In summary, based on the Ecological Systems Theory and Self-Determination Theory, this study aims to further explore the underlying mechanisms of parental autonomy support, metacognition, and adolescent academic performance. Building upon existing research, it seeks to propose a

moderated mediation model to examine the relationship between parental autonomy support and adolescent academic performance, the mediating role of metacognition in this relationship, and the moderating effect of grade level on the relationship between parental autonomy support and metacognition. The findings of this study will contribute to the theoretical foundation and empirical support for understanding how families can promote the academic development of adolescents.

## **2. Objects and Methods**

### **2.1 Research Object**

The research adopted a cluster sampling method to conduct a questionnaire survey on a total of 1,605 students from four different grades (7th to 10th) in one middle school each from Chengdu, Sichuan Province, Xi'an, Shaanxi Province, and Hangzhou, Zhejiang Province. Questionnaires that exhibited strong regularity in responses, missing items, or lacked academic performance data were excluded. The analysis was conducted using 1,372 valid questionnaires, resulting in an effective response rate of 85.5%. Among the participants, there were 644 males (46.9%) and 728 females (53.1%). The distribution across grades was as follows: 484 students in 7th grade (35.3%), 364 students in 8th grade (26.5%), 267 students in 9th grade (19.5%), and 257 students in 10th grade (18.7%). The average age was  $13.88 \pm 1.17$  years. Regarding the educational level of the participants' fathers and mothers, 30.8% had completed college or above, 25.7% had completed high school or vocational school, and 35.4% and 42.2% had completed middle school or below, respectively.

### **2.2 Research Tools**

#### **2.2.1 Parental Autonomy Support Scale**

The Parental Autonomy Support Scale, revised by Wang et al. (2007), was used as the measurement tool[32]. It consists of 12 items. A Likert-type 5-point scoring system was employed (1 = "strongly disagree" to 5 = "strongly agree"). The scale score is calculated as the average score of all items, with higher scores indicating a higher perceived level of parental autonomy support among adolescents. Confirmatory factor analysis was conducted to validate the Parental Autonomy Support Scale, and the fit indices were within an acceptable range:  $\chi^2/df=7.101$ , RMSEA=0.067, GFI=0.954, AGFI =0.933. In this study, Cronbach's  $\alpha$  coefficient for the Parental Autonomy Support Scale was 0.919.

#### **2.2.2 Metacognitive Awareness Inventory (Jr. MAI)**

The Metacognitive Awareness Inventory (Jr. MAI) for adolescents was translated into Chinese. This inventory consists of 18 items and is divided into two dimensions: cognitive knowledge and cognitive regulation. It was developed based on the adult Metacognitive Awareness Inventory (MAI) by Sperling (2002), which was originally created by Schraw and Dennison (1994)[23,33,34]. The Jr. MAI is suitable for general metacognitive assessment of students in grades 3 to 9. A Likert-type 5-point scoring system was used (1 = "completely disagree" to 5 = "completely agree"). Confirmatory factor analysis was conducted to validate the Metacognitive Awareness Inventory for adolescents, and the fit indices were within an acceptable range:  $\chi^2/df=6.630$ , RMSEA=0.064, GFI=0.927, AGFI =0.907. In this study, Cronbach's  $\alpha$  coefficient for the metacognitive inventory was 0.854. The cognitive knowledge dimension and the cognitive regulation dimension had Cronbach's  $\alpha$  coefficients of 0.745 and 0.807, respectively.

#### **2.2.3 Academic Performance**

Academic performance was primarily based on the students' scores in the Chinese, Mathematics, and English exams during the 2022 autumn mid-term or final assessments. Since this study involved three different schools and the content of mid-term and final exams varied across grades, the academic performance scores were standardized and then averaged at the school and grade levels.

## 2.3 Statistical Methods

The data collection was conducted at the class level, using a combination of on-site testing and the use of the Ding Talk questionnaire platform. Statistical analysis was performed using SPSS 22.0, including descriptive statistics, correlation analysis, and the common method bias test. The mediation effects were examined using Model 4 (simple mediation model) from the PROCESS 4.1 component in SPSS. The moderated mediation effects were tested using Model 7 (hypothesized moderated mediation model) consistent with the theoretical model in this study. Bootstrap resampling with 5,000 samples was used to estimate the confidence intervals of the mediation effects and test the significance of regression coefficients. If the 95% bootstrap confidence interval does not include zero, it indicates a significant effect. A significance level of  $P < 0.05$  was considered statistically significant for detecting differences.

## 3. Results

### 3.1 Common Method Bias Test

The Harman single-factor test method[35] was used to examine common method bias. Exploratory factor analysis without rotation was conducted on all measurement items. The results showed that there were four common factors with eigenvalues greater than 1. The first common factor accounted for 26.06% of the total variance, which is below the critical threshold of 40%. Therefore, this study does not exhibit significant common method bias.

### 3.2 Descriptive Statistics

Through one-way analysis of variance (ANOVA), significant differences were found in parental autonomy support levels among different grades. The ANOVA results revealed a significant effect of grade on parental autonomy support,  $F(3, 1368) = 11.295$ ,  $P < 0.001$ ,  $\eta^2 = 0.024$ . Post-hoc tests indicated that the parental autonomy support in the 10th grade (high school) was significantly higher than that in the 7th, 8th, and 9th grades (see Table 1).

### 3.3 Correlation Analysis

The results of the correlation analysis showed significant positive correlations between parental autonomy support and metacognition, as well as between parental autonomy support and academic performance. There was also a significant positive correlation between metacognition and academic performance (see Table 2). In other words, a higher level of parental autonomy support was associated with higher levels of metacognition and better academic performance.

### 3.4 Moderated Mediation Analysis

First, controlling for gender and parental education level, a test was conducted to examine the mediating effect of metacognition in the relationship between parental autonomy support and academic performance. The results indicated that parental autonomy support positively predicted academic performance ( $B = 0.12$ ,  $t = 3.68$ ,  $P < 0.001$ ). After including the mediating variable, parental autonomy support positively predicted metacognition ( $B = 0.22$ ,  $t = 11.73$ ,  $P < 0.001$ ), and metacognition positively predicted academic performance ( $B = 0.30$ ,  $t = 6.74$ ,  $P < 0.001$ ). However, the direct predictive effect of parental autonomy support on academic performance was not significant ( $B = 0.05$ ,  $t = 1.53$ ,  $P = 0.13$ ) (see Table 3).

The analysis of the mediating effect of metacognition in the relationship between parental autonomy support and academic performance in adolescents indicates that the indirect effect of metacognition on academic performance through parental autonomy support is 0.07. The Bootstrap 95% confidence interval does not include 0, indicating that the mediating effect of metacognition in the relationship between parental autonomy support and academic performance is significant (see Table 4).

Table 1: ANOVA Tests of Grade on Each Factor								
Test Variable	Grouping	n	M	SD	F	P	$\eta^2$	Post-hoc Comparisons
Parental Autonomy Support	7(1)	484	3.527	0.740	11.295	0.000	0.024	4>1***,2***,3***
	8(2)	364	3.440	0.736				
	9(3)	267	3.491	0.758				
	10(4)	257	3.769	0.644				

Note: \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

Table 2: Correlation Statistics of Variables (N=1372)					
Test Variable	M	SD	1	2	3
1 Parental Autonomy Support	3.542	0.734	1		
2 metacognition	3.504	0.549	0.320**	1	
3 academic performance	0.000	0.877	0.117**	0.237**	1

Table 3: Mediation Model Testing for Metacognition						
Regression equations (N=1372)		goodness-of-fit indices			coefficient significance	
Outcome variable	Predictor variable	R	R <sup>2</sup>	F (df)	B	t
Academic performance		0.24	0.06	20.01***		
	Gender				0.19	4.13***
	Father's Education				0.08	2.84**
	Mother's Education				0.06	1.87
	Parental autonomy support				0.12	3.68***
Metacognition		0.37	0.14	55.25***		
	Gender				0.06	2.02*
	Father's Education				0.05	2.64**
	Mother's Education				0.05	2.78**
	Parental autonomy support				0.22	11.73** *
Academic performance		0.29	0.09	25.61***		
	Gender				0.17	3.82***
	Father's Education				0.07	2.4*
	Mother's Education				0.04	1.39
	Parental autonomy support				0.05	1.53
	Metacognition				0.30	6.74***

Next, using grade 7 as the reference group, we encoded the grade variable into three dummy variables[36]. Controlling for gender and parental education level, we established a moderated mediation model with the moderator variable being a multicategory variable ( $k \geq 3$ ). We examined whether the moderating effect of grade influenced the mediated relationship between parental autonomy support and metacognition. The results indicated that after including grade in the model, the interaction between parental autonomy support and grade significantly predicted metacognition with respective values of ( $B=0.15$ ,  $t=-3.04$ ,  $P < 0.01$ ;  $B=0.11$ ,  $t=-2.15$ ,  $P < 0.05$ ;  $B=0.19$ ,  $t=-3.2$ ,  $P < 0.01$ ). This suggests that the mediating effect of metacognition on the relationship between

parental autonomy support and academic performance is moderated by grade, and it is the first stage of the mediation process that is moderated (see Table 5).

Table 4: Decomposition of Total Effects, Direct Effects, and Mediation Effects						
	Effect	BootSE	BootLLCI	BootULCI	Effect ratio	
Total	0.12	0.03	0.05	0.17		
Direct	0.05	0.03	-0.02	0.12	42.89%	
Indirect	0.07	0.01	0.04	0.09	57.11%	
Table 5: Regression Analysis of Grade as a Moderator						
Regression equations （N=1372）		Fit index			Coefficient significance	
Outcome variable	Predictor variable	R	R2	F（df）	B	t
Metacognition		0.392 2	0.153 8	24.74***		
	Gender				0.06	2.27*
	Father’s Education				0.04	2.56*
	Mother’s Education				0.04	2.18*
	Parental autonomy support				0.32	10.19** *
	Grade W1				-0.06	-1.83
	Grade W2				-0.06	-1.47
	Grade W3				-0.10	-2.39*
	Parental autonomy support * Grade W1				-0.15	-3.04**
	Parental autonomy support * Grade W2				-0.11	-2.15*
	Parental autonomy support * Grade W3				-0.19	-3.2**
Academic performance		0.292 7	0.085 7	25.61***		
	Gender				0.17	3.82***
	Father’s Education				0.07	2.4*
	Mother’s Education				0.04	1.39
	Parental autonomy support				0.05	1.53
	Metacognition				0.30	6.74***

Specifically, the size of the mediated effect at grade 7 was 0.32, 95% CI [0.26, 0.38]. At grade 8, the size of the mediated effect was 0.18, 95% CI [0.10, 0.25]. At grade 9, the size of the mediated effect was 0.21, 95% CI [0.13, 0.29]. Finally, at grade 10, the size of the mediated effect was 0.13, 95% CI [0.04, 0.23] (see Table 6).

Table 6: Mediation Effects of Metacognition across Different Grades					
	Grade	Effect	BootSE	BootLLCI	BootULCI
Mediation Effects	Grade7 (W1=0, W2=0, W3=0)	0.32	0.03	0.26	0.38
	Grade8 (W1=1, W2=0, W3=0)	0.18	0.04	0.10	0.25
	Grade9(W1=0, W2=1, W3=0)	0.21	0.04	0.13	0.29
	Grade10(W1=0, W2=0, W3=1)	0.13	0.05	0.04	0.23

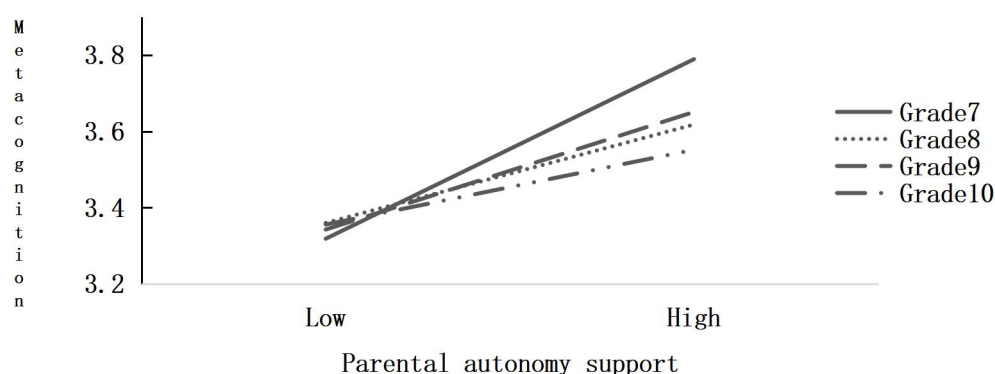


Figure 1: Moderating Role of Grade in the Relationship between Parental Autonomy Support and Metacognition

To further analyze the moderating effect trend of the multicategory moderator variable (grade), we plotted a simple effects analysis graph (Figure 1) by taking metacognition values at one standard deviation above and below the mean of parental autonomy support. The results of the simple slope test indicate that as grade increases, the promoting effect of parental autonomy support on metacognition tends to weaken[37].

## 4. Summary

Based on previous research, ecological systems theory, and self-determination theory, this study constructed a moderated mediation model with metacognition as the mediating variable and grade (a multicategory variable) as the moderating variable. This model not only clarifies how parental autonomy support affects adolescents' academic performance through metacognition but also responds to the question of under what conditions (moderating effect of grade) parental autonomy support has a more significant impact on adolescents' academic performance[38]. The findings of this study have theoretical and practical implications for deepening the understanding of the relationship between parental autonomy support, adolescents' metacognition, and academic performance, as well as guiding parents to actively provide a positive external environment and enhance adolescents' ability to master and apply learning strategies.

### 4.1 The Mediating Role of Metacognition in the Relationship between Parental Autonomy Support and Academic Performance

Metacognition is an essential component of learning strategies. Exploring the mediating role of metacognition in the relationship between parental autonomy support and adolescents' academic performance not only helps to elucidate the factors through which parental autonomy support influences adolescents' academic performance from a self-determination theory perspective but also sheds light on the factors influencing academic performance. Firstly, the study found that the impact of parental autonomy support on academic performance was smaller compared to its impact on metacognition, which aligns with the viewpoint of self-determination theory[39]. This indicates that parental autonomy support is a distal influencing factor for academic performance, and the relationship between the two is mediated by proximal factors such as metacognition. Secondly, the study found that parental autonomy support predicted adolescents' academic performance through the mediating role of metacognition. This result supports previous research, suggesting that metacognition is a major component of learning strategies, influencing adolescents' levels of strategy use, and serving as a proximal factor through which other factors influence academic performance [20,40-42]. There is a strong positive correlation between metacognitive strategies and adolescents' academic performance[43]. When parental autonomy support enhances adolescents' metacognitive abilities, it further increases the likelihood of achieving good academic performance.

Finally, compared to the direct impact of parental autonomy support on adolescents' academic performance, the path through metacognition is a more favorable pathway, aligning with the positive psychological assertion of self-determination theory[44]. This is because metacognition's two key features, self-evaluation, and self-regulation of cognition, are autonomous behaviors of adolescents and represent their inherent academic potential. They do not require parental supervision, and there is no concern for negative effects such as academic burnout or procrastination.

In conclusion, higher perceived parental autonomy support is beneficial for meeting students' competence development and the application of learning strategies, thereby enhancing their academic performance[45].

#### **4.2 The Moderating Role of Grade in the Relationship between Parental Autonomy Support and Metacognition**

Based on ecological systems theory and self-determination theory, a moderated mediation model was constructed to explore the moderating role of grade in the relationship between parental autonomy support, metacognition, and adolescents' academic performance[38]. The results revealed that grade played a moderating role in the first half of the mediation chain from parental autonomy support to metacognition. The study analysis found that firstly, one-way ANOVA revealed a significant difference in parental autonomy support across grades. Secondly, post-hoc tests indicated that parental autonomy support in grade 10 was significantly higher than in middle school grades. Finally, the study found that the promoting effect of parental autonomy support on metacognition weakened as grade increased. This result is consistent with previous research, indicating that as students mature, the influence of parental autonomy support gradually diminishes, and the decisive role of metacognitive abilities in academic success becomes more prominent[37]. In summary, during lower grades (grade 7), although parental autonomy support may be lower, it has a greater impact on metacognition. This suggests that it is an opportune time to cultivate adolescents' metacognitive abilities through parental autonomy support. In higher grades (grade 10), although parents provide more autonomy support, its promoting effect on metacognition weakens. This indicates that as adolescents develop and mature, the influence of environmental factors gradually diminishes, and individual factors take on a more dominant role.

Overall, this study highlights the importance of seizing key periods and utilizing parental autonomy support to help adolescents develop autonomy, thereby mastering learning strategies and enhancing their learning abilities.

#### **4.3 Significance and Limitations**

The moderated mediation model employed in this study not only elucidates the internal mechanism (mediating role of metacognition) through which parental autonomy support influences academic performance but also reveals the developmental differences of this mechanism (moderating role of grade). This moderated mediation model addresses both how parental autonomy support affects adolescent academic performance and under what conditions its effects are more significant. It contributes to a deeper understanding of the factors influencing academic performance. The results of this study indicate that parental autonomy support is an external (environmental) factor influencing academic performance, while metacognition is an internal (individual) factor influencing academic performance. The influence of external factors on internal factors is moderated by grade, which is in line with ecological systems theory and self-determination theory.

Furthermore, the findings of this moderated mediation model provide insights for guiding parents to provide appropriate autonomy support and fostering students' learning abilities. Firstly, the "double reduction" policy reduces external pressures, providing an opportunity to create a supportive environment for adolescents and cultivate their autonomy. Secondly, although the "double reduction" policy reduces external pressures, it may not necessarily alleviate internal



pressures. Therefore, it is important to seize critical periods of adolescent development and promote a collaborative effort between families and schools. Leveraging the positive influence of parental autonomy support as an external factor, adolescents' internal capabilities can be nurtured, such as the ability to master and apply effective learning strategies, laying a solid foundation for future development. In summary, school and family education should be integrated, with a focus on providing support for learning and stimulating students' potential to the fullest extent in a supportive environment.

However, this study has a few limitations: (1) The use of cross-sectional design in this study precludes establishing causal relationships. Future research should employ longitudinal designs or experimental studies to explore the causal relationships among parental autonomy support, metacognition, and academic performance using methods such as cross-lagged designs or manipulation of independent and mediating variables[38]. (2) The measurement of parental autonomy support in this study relied on self-reports from adolescents. It is worth exploring whether there are discrepancies between adolescents' perceptions and the actual support provided by parents in future research[31].

Conclusion: (1) Parental autonomy support significantly predicts adolescents' academic performance in a positive direction. (2) Metacognition plays a significant mediating role in the relationship between parental autonomy support and adolescents' academic performance. (3) Grade level moderates the first half of the mediation model, specifically the impact of parental autonomy support on adolescents' metacognition.

## Fund Project

"Practical Research on High School Students' Autonomous and Supportive Development from the Perspective of Home-School Collaboration in the New Era" (Project Number: CYZD2021-015) is a key research project of the Beijing Education Research Society for the 14th Five-Year Plan in Education, conducted in 2021.

National Science and Technology Support Program: Psychological Development Characteristics of Children and Adolescents during Social Transformation and Techniques for Psychological Problem Intervention and Counseling (2012BAI36B02)

Chinese Academy of Sciences "Leading Action" Program Special Research Institute Project (TSS-2015-06)

## References

- [1]VEAS A, CASTEJÓN J L, MIÑANO P, et al. Relationship between parent involvement and academic achievement through metacognitive strategies: A multiple multilevel mediation analysis[J]. British journal of educational psychology, 2019, 89(2): 393-411.
- [2]ZONG X, ZHANG L, YAO M. Parental involvement and Chinese elementary students' achievement goals: the moderating role of parenting style[J]. Educational studies, 2018, 44(3): 341-56.
- [3]SIJTSEMA J J, VERBOOM C E, PENNINX B, et al. Psychopathology and Academic Performance, Social Well-Being, and Social Preference at School: The TRAILS Study[J]. Child psychiatry and human development, 2014, 45(3): 273-84.
- [4]XIE Y T, SHI Z F, YIN L, et al. A Meta-analysis of the Relationship between Chinese Parenting Styles and Children's Academic Achievement[J]. Psychological Development and Education, 2022, 38(03): 366-79.
- [5]OKPALA C O, OKPALA A O, SMITH F E. Parental Involvement, Instructional Expenditures, Family Socioeconomic Attributes, and Student Achievement[J]. The Journal of educational research, 2001, 95(2): 110-5.

- [6]GREEN J, LIEM G A D, MARTIN A J, et al. Academic motivation, self-concept, engagement, and performance in high school: Key processes from a longitudinal perspective[J]. *Journal of adolescence*, 2012, 35(5): 1111-22.
- [7]LU L, WEBER H S, SPINATH F M, et al. Predicting school achievement from cognitive and non-cognitive variables in a Chinese sample of elementary school children[J]. *Intelligence*, 2011, 39(2): 130-40.
- [8]MATTHEWS J S, PONITZ C C, MORRISON F J. Early Gender Differences in Self-Regulation and Academic Achievement[J]. *Journal of educational psychology*, 2009, 101(3): 689-704.
- [9]STADLER M, AUST M, BECKER N, et al. Choosing between what you want now and what you want most: Self-control explains academic achievement beyond cognitive ability[J]. *Personality and individual differences*, 2016, 94: 168-72.
- [10]POROPAT A E. A Meta-Analysis of the Five-Factor Model of Personality and Academic Performance[J]. *Psychological bulletin*, 2009, 135(2): 322-38.
- [11]BRONFENBRENNER U, EVANS G W. Developmental science in the 21st century: Emerging questions, theoretical models, research designs and empirical findings[J]. *Social Development*, 2002, 9(1): 115-25.
- [12]SONG J, BONG M, LEE K, et al. Longitudinal Investigation Into the Role of Perceived Social Support in Adolescents' Academic Motivation and Achievement[J]. *Journal of educational psychology*, 2015, 107(3): 821-41.
- [13]FROILAND J M, WORRELL F C. Parental autonomy support, community feeling and student expectations as contributors to later achievement among adolescents[J]. *Educational Psychology*, 2016, 37(3): 261-71.
- [14]LERNER R E, GROLNICK W S, CARUSO A J, et al. Parental involvement and children's academics: The roles of autonomy support and parents' motivation for involvement[J]. *Contemporary educational psychology*, 2022, 68: 102039.
- [15]DECI E L, RYAN R M. Self-determination theory in health care and its relations to motivational interviewing: a few comments[J]. *The international journal of behavioral nutrition and physical activity*, 2012, 9(1): 24.
- [16]ZHANG J J, LI H X, ZHANG M L, et al. Relationship Among Perceived Teacher Support, Math Self-efficacy and Mathematics Achievement for Primary School Students: A Moderated Mediation Model[J]. *Studies of Psychology and Behavior*, 2019, 17(05): 644-51.
- [17]ROSENFELD L B, RICHMAN J M, BOWEN G L. Social support networks and school outcomes: The centrality of the teacher[J]. *Child & adolescent social work journal*, 2000, 17(3): 205-26.
- [18]CHEN Y L, GUO S Y. Effect of Perception of Teachers' Supporting Behavior on Academic Achievement in Middle School Youths: A Mediated Moderation Effect[J]. *Chinese Journal of Clinical Psychology*, 2016, 24(02): 332-7.
- [19]TAYFUR C, ULUPINAR S. The Effect of Perceived Social Support on the Academic Achievement of Health College Students[J]. *Journal of Psychiatric Nursing*, 2016, 7(1): 1-6.
- [20]VASQUEZ A C, PATALL E A, FONG C J, et al. Parent Autonomy Support, Academic Achievement, and Psychosocial Functioning: a Meta-analysis of Research[J]. *Educational Psychology Review*, 2016, 28(3): 605-44.
- [21]HU Y Q, ZENG Z H, PENG L Y, et al. The Effects of Parent-Child Relationship and Parental Educational Involvement on Adolescent Depression, Self-Injury, and Suicidal Ideation: The Role of Defeat and Meaning in Life[J]. *Acta Psychologica Sinica*, 2023, 55(01): 129-41.
- [22]FLAVELL J H. Metacognitive aspects of problem solving[M]. Hillsdale, NJ: Erlbaum, 1976: 231-6.
- [23]XIE Y T. The Development Characteristics of Junior High School Students' Metacognition and its Relationship with Academic Achievement in Mathematics[D]. Changsha: Hunan Normal University, 2021.

- [24]TANG Y P, WANG C, HU Y M. How to Improve Students' Academic Performance: A Perspective of Learning and Teaching Strategies[J]. Journal of East China Normal University (Educational Sciences), 2020, 38(03): 93-105.
- [25]CHIU M M, CHOW B W Y, MCBRIDE-CHANG C. Universals and specifics in learning strategies: Explaining adolescent mathematics, science, and reading achievement across 34 countries[J]. Learning and Individual Differences, 2007, 17(4): 344-65.
- [26]PARIS S G, WINOGRAD P. How metacognition can promote academic learning and instruction[M]. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc., 1990: 15-51.
- [27]XU D J, YU C F, DOU K, et al. Parental Autonomy Support and Adolescents' Future Planning: The Mediating Role of Basic Psychological Needs and Personal Growth Initiative[J]. Psychological Development and Education, 2019, 35(01): 23-31.
- [28]BRONFENBRENNER U. The Ecology of Human Development: Experiments by Nature and Design[M]. Cambridge, MA: Harvard University Press, 1979: 1-330.
- [29]BLAKEMORE S J, CHOUDHURY S. Development of the adolescent brain: implications for executive function and social cognition[J]. Journal of Child Psychology and Psychiatry, 2006, 47(3-4): 296-312.
- [30]DE GOEDE I H A, BRANJE S J T, MEEUS W H J. Developmental Changes in Adolescents' Perceptions of Relationships with Their Parents[J]. Journal of youth and adolescence, 2009, 38(1): 75-88.
- [31]SUN H R, LIU M X, ZHANG X L, et al. The Relationship Between Job Stress and Job Burnout in Primary and Middle School Teachers: A Chain Mediating Effect of Emotional Labor and Job Satisfaction[J]. Studies of Psychology and Behavior, 2022, 20(03): 375-81+418
- [32]WANG Q, POMERANTZ E M, CHEN H C. The role of parents' control in early adolescents' psychological functioning: A longitudinal investigation in the united states and china[J]. Child Dev, 2007, 78(5): 1592-610.
- [33]SPERLING R A, HOWARD B C, MILLER L A, et al. Measures of children's knowledge and regulation of cognition[J]. Contemporary Educational Psychology, 2002, 27(1): 51-79.
- [34]SCHRAW G, DENNISON R S. Assessing metacognitive awareness[J]. Contemporary educational psychology, 1994, 19(4): 460-75.
- [35]PODSAKOFF P M, MACKENZIE S B, PODSAKOFF N P. Sources of method bias in social science research and recommendations on how to control it[J]. Annual review of psychology, 2012, 63(1): 539-69.
- [36]FANG J, WEN Z L, HE Z J. Moderated Mediation Analyses of a Frequently-Used Types of Categorical Variable[J]. Chinese Journal of Applied Psychology, 1-12.
- [37]LI H X, ZHANG J J, ZHAO X, et al. Relationships among Epistemological Beliefs, Self-regulated Learning and Academic Procrastination in College Students: A Moderated Mediation Model[J]. Psychological Development and Education, 2019, 35(05): 557-65.
- [38]LIAN S L, LIU Q Q, SUN X J, et al. Mobile Phone Addiction and College Students' Procrastination: Analysis of a Moderated Mediation Model[J]. Psychological Development and Education, 2018, 34(05): 595-604.
- [39]RYAN R M, DECI E L. Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness[M]. New York: Guilford Press, 2017: 1-756.
- [40]LI M, SHANG X H, FANG X Y, et al. From Parental Educational Involvement to Students' Achievement: A Serial Mediation Model of Parental Autonomy Support and Self-regulation Learning Potential[J]. Psychological Development and Education, 2022, 38(06): 839-47.
- [41]ZHANG Z. The Influence of Parents and Teachers' Self-support on the Academic Performance of Junior High School Students: the Role of Chain Control in Self-control and Academic Delay[D]. Beijing: China University of Geosciences, 2019.
- [42]THOMAS V, FREE DE B, PEETERS J, et al. Parental involvement and adolescent school achievement: the mediational role of self-regulated learning[J]. Learning Environments Research, 2019, 22(3): 345-63.

- [43]LIU Z Y, WANG Y, YANG M X. Research on the Influence of Metacognitive Strategies on Primary and Middle School Students' Academic Performance from the Perspective of Technical Support-Based on the Meta-analysis of 54 Foreign Researches[J]. Modern Educational Technology, 2021, 31(08): 60-6
- [44]RYAN R M, DECI E L, GROLNICK W S, et al. The Significance of Autonomy and Autonomy Support in Psychological Development and Psychopathology[J]. Developmental Psychopathology, 2015, 1795-849.
- [45]RYAN R M, DECI E L. Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being[J]. The American psychologist, 2000, 55(1): 68-78.