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The Relationship between Parental Autonomy Support and Adolescent Academic Burnout: A Variable-Centered and Person-Centered Analysis

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ABSTRACT: Background: While parenting is crucial for adolescents' academic adjustment, few studies have examined how parental autonomy support affects academic burnout or the underlying psychological processes. This study examined the sequential mediating roles of growth mindset and self-esteem in the association between parental autonomy support and academic burnout, using both variable-centered and person-centered approaches. **Methods:** A total of 1032 Chinese junior and senior high school students were recruited through cluster sampling. Using self-report questionnaires, participants were assessed on parental autonomy support, growth mindset, self-esteem, and academic burnout. Data were analyzed using mediation modeling and latent profile analysis. **Results:** The findings revealed a significant inverse association between parental autonomy support and adolescent academic burnout; Both growth mindset and self-esteem showed significant partial mediating associations. Furthermore, they formed a sequential mediating pathway linking parental autonomy support and academic burnout. Four distinct academic burnout profiles were identified: Low-Burnout, Moderate-Exhaustion, High-Exhaustion and Reduced Accomplishment, and Severe Burnout. Higher levels of parental autonomy support, growth mindset, and self-esteem were all significantly associated with a lower likelihood of belonging to higher burnout profiles, particularly the Severe Burnout profile. Among these factors, self-esteem exhibited the most consistent and robust associations across different burnout profile comparisons. Overall, the relationship between parental autonomy support and adolescent academic burnout can be explained through the interconnected psychological processes of growth mindset and self-esteem, with self-esteem serving as a particularly central pathway. **Conclusions:** Parental autonomy support, growth mindset, and self-esteem serve as interrelated protective factors against adolescent academic burnout. This study paves the way for developing differentiated and targeted strategies for adolescent academic burnout.

KEYWORDS: Parental autonomy support; academic burnout; growth mindset; self-esteem; latent profile analysis

1 Introduction

Academic burnout, characterized by chronic mental and physical exhaustion due to unrelenting academic pressure, has become a pervasive concern in contemporary educational contexts with consistently high prevalence across age groups [1,2]. It is fundamentally defined as a process of emotional, cognitive, and behavioral depletion that occurs when students perceive their resources as inadequate to meet learning demands [3,4]. This state is closely associated with diminished motivation, reduced persistence, poorer academic performance, anxiety, and depression [5–7], thereby fueling a cycle of stress and underachievement. Moreover, academic burnout elevates risks such as increased absenteeism and heightened dropout intentions, posing a substantial risk to adolescents' long-term development and career planning [8].

Adolescence is a critical developmental period for understanding academic burnout and its underlying mechanisms [9,10]. This stage is characterized by rapid cognitive, emotional, and social changes, such as identity formation and heightened evaluative sensitivity. When combined with rising academic pressures during educational transitions, these changes significantly increase vulnerability to burnout [9]. Concurrently, adolescence is marked by intensified autonomy striving and heightened needs for competence and self-worth, driven by a growing desire for agency, mastery, and positive self-evaluation [11,12]. It is also a sensitive period for the development of a growth mindset, as beliefs about the malleability of ability become increasingly salient and begin to directly shape how adolescents perceive and cope with academic challenges [13]. Although peer influence grows during adolescence, parents remain key socialization agents, and autonomy-supportive parenting is particularly influential in sustaining adolescents' sense of agency and self-worth, fostering adaptive beliefs about ability and effort, thereby buffering burnout risk in academic contexts [11,14]. Accordingly, adolescence constitutes a sensitive developmental window during which parental autonomy support, growth mindset, and self-esteem may interact in dynamic and complementary ways to jointly influence academic adjustment and vulnerability to burnout [13].

According to Ecological Systems Theory [15], the family constitutes an essential microsystem for individual development; it plays a critical role in shaping adolescents' psychological and academic adjustment. Among numerous familial factors, parenting styles are widely regarded as key predictors of adolescent academic burnout [16]. Research indicates that positive parenting enhances students' self-esteem and diminishes academic burnout, whereas negative parenting practices (e.g., punishment and rejection) conversely heighten risks of emotional exhaustion and disengagement [17,18]. Among various parenting dimensions, parental autonomy support, defined as understanding and respecting children's perspectives while avoiding controlling, pressuring, or guilt-inducing interventions received growing scholarly attention [19]. Self-Determination Theory [20] posits that parental autonomy support effectively alleviates emotional exhaustion and academic disengagement by fulfilling adolescents' fundamental psychological needs, thus enhancing their learning motivation and self-regulation abilities [14]. Adolescents who perceive higher levels of parental autonomy support typically exhibit stronger learning motivation, more positive academic emotions, better academic performance, and fewer learning adjustment problems [21,22].

According to the Conservation of Resources (COR) Theory, positive psychological resources, such as a growth mindset and self-esteem, function as adaptive resources in coping with stress and pursuing goals [23,24]. Growth mindset and self-esteem, as core positive self-beliefs, are fundamental to shaping adolescents' academic adjustment and mental health outcomes [13,25]. Growth mindset, defined as the belief that abilities are malleable [26], is deeply shaped by socialization processes. The family, as the primary setting for individual socialization, plays a foundational role in this process. Children raised in warm, supportive family environments tend to more readily embrace and internalize the values and behavioral norms conveyed by their parents [27]. Supportive parenting behaviors, such as emotional encouragement, respect for autonomy, and responsiveness to needs, foster the development of a growth mindset in adolescents. This, in turn, strengthens adolescents' belief that ability can be developed through sustained effort [28,29]. Individuals with a growth mindset tend to approach learning challenges by seeing them as opportunities for development, which demonstrates greater persistence and adaptive strategies in difficult situations [13,30]. Growth mindset not only enhances psychological resilience in the face of setbacks [31], but also mitigates the negative effects of academic stress by promoting positive emotions and adaptive coping [32,33].

The Looking-Glass Self Theory proposes that individuals construct their self-concept by perceiving the attitudes and feedback of "significant others" [34]. Self-esteem, defined as an overall evaluation

and emotional experience of one's self-worth [35], is profoundly influenced by parental upbringing. Parents act as primary architects in adolescent development, playing an important role in fostering their self-evaluation [36]. Research indicates that parental warmth and understanding are closely associated with higher levels of self-esteem in children, whereas strict, punitive parenting styles tend to undermine it [37–40]. Individuals with high self-esteem typically maintain more positive and stable cognitive schemas about themselves. This enables them to better preserve psychological adaptability and buffer the impact of stress arising from negative evaluations or academic setbacks [25,41]. Research on Chinese student populations further confirms that self-esteem is a key protective factor against academic burnout. Individuals with high self-esteem experience less emotional exhaustion, academic alienation, and reduced feelings of accomplishment in their studies [42,43].

According to Dweck's Mindset Theory [26], a growth mindset is a positive self-belief system that influences both challenge perception and self-evaluation processes, which in turn fosters a strong connection with self-esteem, the core sense of self-worth [35]. Research indicates that individuals with a growth mindset tend to approach setbacks as surmountable and temporary challenges, adopting more proactive cognitive and behavioral strategies in response [32]. Such adaptive coping mechanisms serve to buffer the impact of negative experiences on self-worth, thereby laying the cognitive foundation for the healthy development of self-esteem. By fostering a more resilient self-perception framework, a growth mindset enables individuals to adopt mastery-oriented goals and to reframe failure as an opportunity for learning and growth [31]. Through this process, individuals demonstrate greater persistence when confronting challenges and foster a sense of self-worth that is progressively consolidated and enhanced through the accumulation of positive experiences [44]. Consequently, a growth mindset serves as sustained motivation for the formation and development of high self-esteem.

While variable-centered approaches effectively identify average associations and general mechanisms, their inherent assumption of population homogeneity can obscure whether these mechanisms operate uniformly across individuals [45]. This limitation is particularly salient in adolescent academic burnout, which comprises distinct configurations of emotional exhaustion, academic disengagement, and reduced accomplishment that may be obscured by mean-level relations [46]. Even when a mediation model is supported at the variable level, it remains unclear whether its components can meaningfully differentiate adolescents who experience different patterns of burnout. Variable-centered analyses cannot address whether parental autonomy support, growth mindset, and self-esteem differ in their utility for classifying individuals into more or less severe burnout profiles. This question, however, is critical for developmentally sensitive identification and intervention. To address this gap, the present study integrates a person-centered perspective, thereby complementing the variable-centered framework with a method capable of capturing heterogeneous patterns. Using latent profile analysis, we identify distinct burnout profiles and examine whether parental autonomy support, growth mindset, and self-esteem, conceptualized as a coherent protective process, differentially predict profile membership. In doing so, this dual-perspective approach links general psychological mechanisms to heterogeneous burnout experiences, clarifying both average relations and their individual-level expression among adolescents.

Although existing research has demonstrated the protective effects of parental autonomy support, growth mindset, and self-esteem, notable gaps remain in the literature. Few studies have directly examined how autonomy-supportive parenting reduces adolescent academic burnout, or, importantly, investigated growth mindset and self-esteem as joint mediators. Moreover, variable-centered approaches, despite their utility, cannot distinguish distinct burnout configurations among adolescents. Integrating variable-centered mediation with person-centered profiling addresses these gaps, linking general psychological mechanisms

to heterogeneous burnout experiences [47,48]. Building on this dual approach, the present study focuses on adolescents to examine the effects of parental autonomy support on academic burnout, as well as the mediating roles of growth mindset and self-esteem. Using latent profile analysis, we aim to identify distinct academic burnout profiles and investigate how these protective factors (parental autonomy support, growth mindset, and self-esteem) predict profile membership. Specifically, we propose the following hypotheses:

Hypothesis 1: *Parental autonomy support is negatively associated with adolescent academic burnout.*

Hypothesis 2: *Growth mindset and self-esteem may independently and sequentially mediate the relationship between parental autonomy support and academic burnout.*

Hypothesis 3: *There are at least three distinct burnout profiles among adolescents (low, moderate, high), with higher levels of parental autonomy support, growth mindset, and self-esteem associated with a lower likelihood of belonging to more severe burnout profiles.*

2 Methods

2.1 Participants and Procedure

A total of 1032 adolescents (41.20% male; aged 12–18 years, Mean = 14.85, SD = 1.70) from junior and senior high schools in Shandong Province, China, were recruited through cluster sampling. The grade distribution was as follows: Grade 7 ($n = 250$, 24.20%), Grade 8 ($n = 244$, 23.60%), Grade 10 ($n = 282$, 27.32%), and Grade 11 ($n = 256$, 24.80%). Students in Grades 9 and 12 were excluded due to local school curriculum arrangements (e.g., Grade 9 students were preparing for high school entrance exams, and Grade 12 students were in college application periods), which could avoid response bias caused by academic pressure-specific situations. Multiple interpolation methods were employed to handle missing data.

Prior to data collection, informed consent was obtained from all participants and their parents. The study was reviewed and approved by the Ethics Committee of the School of Education and Psychology, University of Jinan (No. 202309012). To ensure high-quality data collection, all research assistants received standardized training on administration procedures. Participants completed paper-and-pencil questionnaires during regular class sessions, with each testing session lasting approximately 10–20 min. As a token of appreciation, each participant received a small gift (a 0.5-dollar ballpoint pen) upon survey completion.

2.2 Measures

2.2.1 Parental Autonomy Support

Parental autonomy support was measured using a 12-item Parental Autonomy Support Scale (e.g., “My parents let me plan what I want to do by myself”), originally developed by Robbins [49] and later revised by Wang et al. [50] for use with Chinese adolescents. Items were rated on a 5-point Likert scale (1 = not at all true to 5 = completely true), with higher total scores indicating greater perceived autonomy support. The scale has established reliability and validity among Chinese adolescent groups [50]. In this study, confirmatory factor analysis (CFA) supported good construct validity (CFI = 0.97, TLI = 0.96, $\chi^2/df = 5.4$, RMSEA = 0.07, SRMR = 0.04), and internal consistency was excellent (Cronbach’s $\alpha = 0.94$).

2.2.2 Growth Mindset

Growth Mindset was measured using Dweck’s [26] 6-item scale (e.g., “Intelligence is something about a person that cannot be changed very much”). Items were rated on a 6-point Likert scale from 1 (strongly

disagree) to 6 (strongly agree); relevant items were reverse-scored so that higher scores indicate a stronger growth mindset. The Chinese version of the scale has demonstrated good reliability and validity [51]. In this study, CFA indicated excellent model fit (CFI = 0.99, TLI = 0.99, $\chi^2/df = 3.42$, RMSEA = 0.05, SRMR = 0.03), and internal consistency was high (Cronbach's $\alpha = 0.87$).

2.2.3 Self-Esteem

Self-esteem was measured using the Rosenberg Self-Esteem Scale [35]. To address the cultural inadaptability for Chinese adolescents, we employed Tian's [52] revised Chinese version, which modifies items such as "I hope I can earn more respect for myself". This 9-item instrument (e.g., "I feel that I have a number of good qualities") was rated on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree). After reverse-coding relevant items, total scores were calculated such that higher scores indicate a higher level of an individual's self-esteem. Previous studies have demonstrated that the scale has high reliability and validity of the Chinese version [52]. In the present study, CFA showed that the scale had good construct validity (CFI = 0.99, TLI = 0.99, $\chi^2/df = 3.04$, RMSEA = 0.04, SRMR = 0.02), and the Cronbach's α was 0.92.

2.2.4 Academic Burnout

Academic burnout was measured using Wu et al.'s [53] 16-item Adolescent Academic Burnout Scale, comprising three dimensions: emotional exhaustion, academic alienation, and low accomplishment (e.g., "At school, I often feel exhausted"). Items were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). After reverse-scoring relevant items, total scores were calculated so that higher scores indicate a higher level of an individual's academic burnout. Previous studies have demonstrated that the scale has high reliability and validity among Chinese adolescent groups [53]. In the present study, CFA showed that the scale had good construct validity (CFI = 0.94, TLI = 0.93, $\chi^2/df = 4.64$, RMSEA = 0.06, SRMR = 0.04). The Cronbach's α coefficients for the three dimensions (exhaustion, alienation, accomplishment) and total scale in the present study were 0.81, 0.87, 0.86, and 0.90, respectively.

2.3 Data Analysis

First, common method bias was examined using Harman's single-factor test. In addition, Pearson correlation analyses were conducted among all study variables to examine the direction and strength of their associations, providing a basis for subsequent model testing.

Second, using Mplus 8.3 (Muthén & Muthén, Los Angeles, CA, USA), a chain mediation model was constructed with parental autonomy support as the independent variable, academic burnout as the dependent variable, and growth mindset and self-esteem as sequential mediators. Age and gender were included as control variables. This analysis examined the indirect effects of parental autonomy support on academic burnout through growth mindset and self-esteem, thereby clarifying the general mechanisms underlying the relationship between parental autonomy support and academic burnout.

Third, latent profile analysis (LPA) was conducted in Mplus 8.3 to identify latent profiles of academic burnout among secondary school students. The three subscale scores, namely emotional exhaustion, academic alienation, and low accomplishment, served as indicator variables. We estimated models specifying one to five latent profiles. Model fit was evaluated using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample-size adjusted BIC (aBIC), entropy, Lo-Mendell-Rubin test (LMRT), and Bootstrap Likelihood Ratio Test (BLRT). Smaller AIC, BIC, and aBIC values indicate better model fit [54,55], entropy values closer to 1 represent more accurate classification, with values above 0.80 indicating over 90% classification accuracy [56]. Significant LMRT and BLRT values indicate that a k-class model fits better

than a (k-1)-class model, and the proportion of each latent profile should not be smaller than 3%. After completing the latent profile analysis, one-way analyses of variance (ANOVAs) were conducted on each dimension of academic burnout, with the identified latent profiles entered as the grouping factor, to examine differences across profiles.

Finally, to examine the differential utility of the core protective factors in predicting burnout profile membership, we performed a multinomial logistic regression using SPSS 22.0 (IBM Corp., Armonk, NY, USA). The latent burnout profiles derived from LPA served as the outcome variable, with parental autonomy support, growth mindset, and self-esteem as predictors, while controlling for age and gender.

3 Results

3.1 Preliminary Analyses

Harman's single-factor test [57] was conducted, indicating no serious common method bias (the first factor explained 32.76% of total variance). Correlation analyses revealed significant negative correlations between protective factors (parental autonomy support, growth mindset, self-esteem) and burnout dimensions (all p s < 0.01).

As shown in Table 1, Pearson correlation analyses indicated that parental autonomy support, growth mindset, and self-esteem were positively intercorrelated. In contrast, these three dimensions of academic burnout and the overall level of burnout were significantly negatively correlated with parental autonomy support, growth mindset, and self-esteem.

Table 1: Pearson correlation and descriptive statistics of key variables.

Variables	Mean ± SD	1	2	3	4	5	6	7	8	9
Gender	0.59 ± 0.49	1								
Age	14.85 ± 1.70	0.19***	1							
Parental autonomy support	3.61 ± 0.86	-0.02	0.08*	1						
Growth mindset	3.31 ± 1.15	-0.06*	-0.12***	0.24***	1					
Self-esteem	2.93 ± 0.52	-0.04	-0.05	0.49***	0.36***	1				
Emotional exhaustion	2.86 ± 1.01	0.15***	0.22***	-0.31***	-0.33***	-0.53***	1			
Academic alienation	1.87 ± 0.84	0.09**	0.20***	-0.36***	-0.31***	-0.64***	0.56***	1		
Low accomplishment	2.78 ± 0.80	0.14***	0.21***	-0.37***	-0.38***	-0.62***	0.42***	0.56***	1	
Total academic burnout	2.52 ± 0.71	0.15***	0.25***	-0.42***	-0.42***	-0.73***	0.77***	0.84***	0.85***	1

Note: Gender (0 = male, 1 = female). * p < 0.05; ** p < 0.01; *** p < 0.001. SD = Standard Deviation.

3.2 Variable-Centered Analysis: Testing the Chain Mediation Effect of Growth Mindset and Self-Esteem

The model results are presented in Fig. 1, which indicates that parental autonomy support was negatively associated with academic burnout ($\beta = -0.09$, $p < 0.001$), and was positively associated with growth mindset ($\beta = 0.24$, $p < 0.001$) and self-esteem ($\beta = 0.44$, $p < 0.001$). Furthermore, a growth mindset was positively associated with self-esteem ($\beta = 0.25$, $p < 0.001$) and negatively associated with academic burnout ($\beta = -0.15$, $p < 0.001$), while self-esteem also showed a significant negative association with academic burnout ($\beta = -0.62$, $p < 0.001$).

The mediation analysis revealed that both growth mindset and self-esteem significantly mediated the relationship between parental autonomy support and academic burnout. The total indirect effect was -0.35 , accounting for 79.55% of the total effect, indicating that nearly 80% of the total effect of parental autonomy support on academic burnout was channeled through mediating pathways, and indirect effects played a dominant role in the overall effect. Further decomposition of the indirect effects showed: Indirect path 1 (Parental autonomy support → Growth mindset → Academic burnout) showed an effect size of -0.04 ,

95% CI of $[-0.05, -0.02]$; Indirect path 2 (Parental autonomy support \rightarrow Self-esteem \rightarrow Academic burnout) yielded an effect size of -0.27 , 95% CI $[-0.32, -0.23]$; Indirect path 3 (Parental autonomy support \rightarrow Growth mindset \rightarrow Self-esteem \rightarrow Academic burnout) had an effect size of -0.04 , 95% CI $[-0.05, -0.03]$. Collectively, these three indirect pathways accounted for 9.09%, 61.36%, and 9.09% of the total effect, respectively.

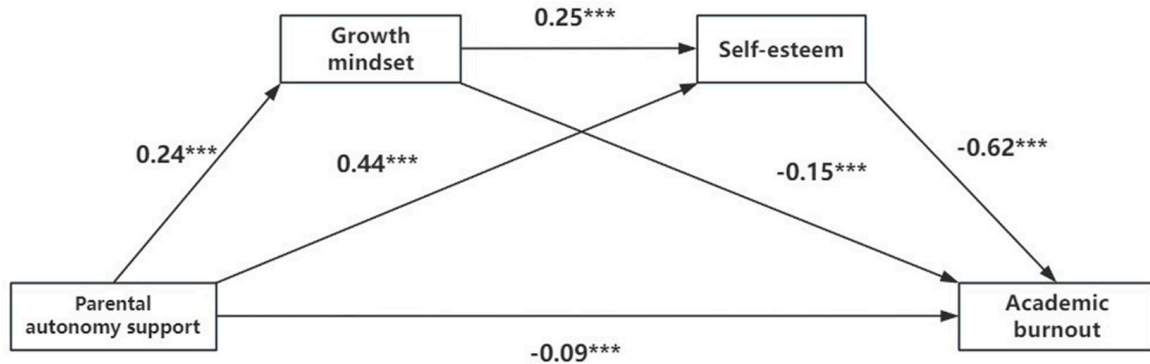


Figure 1: Path diagram of the chain mediating model. Note: *** $p < 0.001$. β represents the standardized regression coefficient for the direct and sequential mediation paths, reflecting the direction and strength of the standardized associations among variables.

3.3 Person-Centered Analysis

3.3.1 Latent Profile Analysis of Academic Burnout

The results revealed that the five-class model was not tenable, as the LMRT was non-significant. Among the variable two-, three-, and four-profile models, both LMRT and BLRT values were significant, and entropy values increased progressively from the two- to four-profile solutions. This suggests that the four-profile model demonstrated the highest classification accuracy. As shown in Table 2, the AIC, BIC, and aBIC values decreased with additional profiles, confirming that the four-class solution provided the best fit. Therefore, adolescent academic burnout was best represented by a four-profile model. The results are shown in Fig. 2. As the number of latent profiles increased from 1 to 5, the entropy values gradually increased, indicating that the classification accuracy of the model improved. Further comparison using the BLRT indices showed that the BLRT test values for all five models were significant ($p < 0.001$), suggesting that models with more latent profiles had better fit. However, in the five-class model, the smallest class accounted for only 1% of the sample, which is below the 3% minimum class size often recommended in previous studies. Based on this, we focused on comparing the three- and four-class models. In terms of information criteria, AIC, BIC, and aBIC were smaller in the four-class model, indicating better model fit than the three-class model. Considering both the statistical indices and theoretical interpretability of the classifications, the four-class model was selected as the optimal solution, suggesting that there may be four latent profiles of academic burnout among adolescents.

In addition, the classification accuracy matrix for the four-profile model is shown in Table 3. The average posterior probabilities of adolescents belonging to their most likely latent profile ranged from 90.30% to 96.30%, indicating high reliability of the four-profile solution.

Table 2: Fit indices of latent profile models for adolescent academic burnout.

Model	AIC	BIC	aBIC	LMRT	BLRT	Entropy	Profile Proportion
1	8002.83	8032.47	8013.41	—	—	—	—
2	7293.04	7342.43	7310.67	<0.001	<0.001	0.78	0.64/0.36
3	7054.68	7123.83	7079.37	0.01	<0.001	0.85	0.55/0.37/0.08
4	6877.76	6966.67	6909.49	0.01	<0.001	0.88	0.30/0.47/0.19/0.04
5	6806.95	6915.61	6845.74	0.21	<0.001	0.91	0.47/0.17/0.29/0.01/0.06

Note: AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, adjusted BIC; LMRT, Lo-Mendell-Rubin Test; BLRT, bootstrap likelihood ratio test.

Table 3: Classification accuracy of the latent profile model (Average posterior probabilities, %).

Profile	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	90.3	5.5	4.2	0
Profile 2	3.7	96.3	0	0
Profile 3	6.6	0	91.6	1.8
Profile 4	0	0	7	93

Fig. 2 illustrates the response patterns for the 16 items of academic burnout across the four identified latent profiles. For Profile 1, the students' scores in the three dimensions of emotional exhaustion, academic alienation, and low accomplishment were higher than those in Profile 2 but lower than those in Profiles 3 and 4. Therefore, this group is named the Moderate-Exhaustion Type, and a total of 307 students (29.75% of the sample) were classified into this group. Profile 2, which comprised 485 students (47.00% of the sample) and was characterized by the lowest scores across all three dimensions, was labeled the "Low-Burnout Type". Students in Profile 3 showed significantly higher scores on emotional exhaustion and low accomplishment than on academic alienation. Accordingly, this profile was labeled the "High-Exhaustion and Reduced Accomplishment Type", comprising 191 students (18.50% of the sample). Finally, the profile, which scored higher than all others across every dimension and was comprised of 49 students (4.75% of the total sample), was named the "Severe Burnout Type".

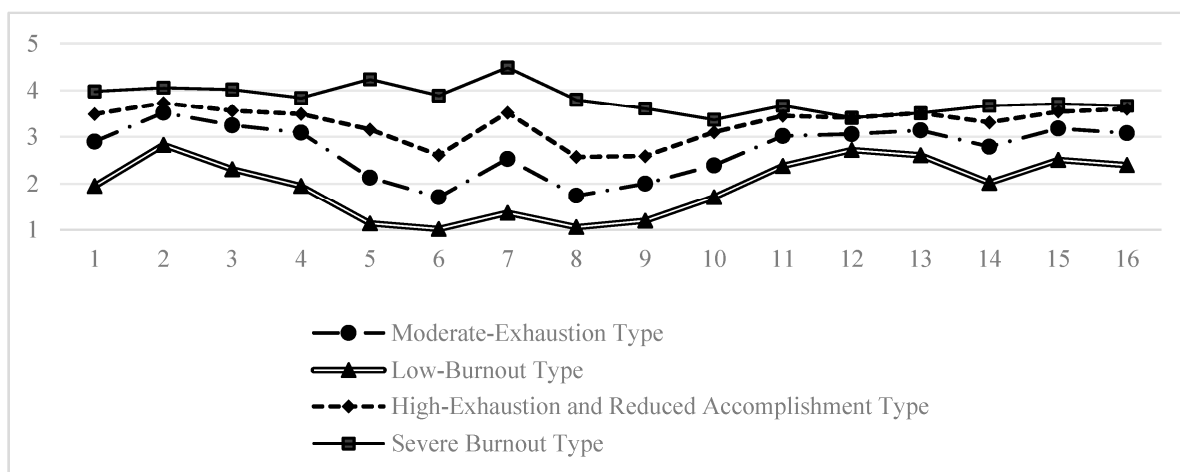


Figure 2: Mean scores across the four latent profiles of adolescent academic burnout. Note: Items 1–4: Emotional exhaustion; Items 5–9: Academic alienation; Items 10–16: Low accomplishment.

An ANOVA was conducted to examine differences in academic burnout among the four profiles, verifying the validity of the LPA results. As shown in Table 4, significant differences were found across all dimensions, confirming the robustness of the four-profile model.

Table 4: Comparison of scores across different academic burnout profiles (Mean \pm SD).

Dimension	Academic Burnout Profiles				F	Post-Hoc
	Profile 1	Profile 2	Profile 3	Profile 4		
Emotional exhaustion	3.19 \pm 0.74	2.26 \pm 0.90	3.57 \pm 0.70	3.97 \pm 0.90	203.91***	3 > 1, 4 > 1, 1 > 2, 3 > 2, 4 > 2, 4 > 3
Academic alienation	2.02 \pm 0.25	1.16 \pm 0.20	2.89 \pm 0.27	4.01 \pm 0.41	189.12***	3 > 1, 4 > 1, 1 > 2, 3 > 2, 4 > 2, 4 > 3
Low accomplishment	2.95 \pm 0.59	2.34 \pm 0.67	3.42 \pm 0.59	3.57 \pm 1.02	196.80***	3 > 1, 4 > 1, 1 > 2, 3 > 2, 4 > 2, 4 > 3

Note: *** $p < 0.001$. 1 = Moderate-Exhaustion Type, 2 = Low-Burnout Type, 3 = High-Exhaustion and Reduced Accomplishment Type, 4 = Severe Burnout Type.

3.3.2 Predictive Effects of Parental Autonomy Support, Growth Mindset, and Self-Esteem on Latent Profiles of Adolescent Academic Burnout

To examine the predictive effects of perceived parental autonomy support, growth mindset, and self-esteem on different categories of adolescent academic burnout, multinomial logistic regression analysis was performed. Gender and age were controlled, and odds ratios (ORs) were calculated to indicate effect sizes. The “Low-Burnout Type,” “Moderate-Exhaustion Type,” and “High-Exhaustion and Reduced Accomplishment Type” were used as reference groups in separate comparisons.

Table 5 presents the differential predictive effects of parental autonomy support, growth mindset, and self-esteem on membership in adolescents’ latent profiles of academic burnout. Self-esteem demonstrated the strongest and most consistent negative predictive effect across all academic burnout profiles. Compared with the Low-Burnout profile, each one unit increase in adolescents’ self-esteem was associated with a substantially lower likelihood of membership in the Moderate-Exhaustion profile (OR = 0.09), the High-Exhaustion and Reduced Accomplishment profile (OR = 0.03), and the Severe Burnout profile (OR = 0.01). In comparisons among higher burnout profiles, self-esteem remained a significant negative predictor. When the Moderate-Exhaustion profile was used as the reference group, the odds ratios for membership in the High-Exhaustion and Reduced Accomplishment profile and the Severe Burnout profile were 0.25 and 0.06, respectively. When the High-Exhaustion and Reduced Accomplishment profile served as the reference group, the odds ratio for membership in the Severe Burnout profile was 0.01.

With the Low-Burnout profile as reference, each one unit increase in parental autonomy support was associated with a 21.5% reduction in the likelihood of membership in the Moderate-Exhaustion profile ($p < 0.05$) and a 31.3% reduction in the likelihood of membership in the High-Exhaustion and Reduced Accomplishment profile ($p < 0.01$). However, its predictive effect on membership in the Severe Burnout profile did not reach statistical significance, and parental autonomy support did not significantly differentiate among higher burnout profiles. Growth mindset showed the strongest predictive effect for the Severe Burnout profile (OR = 0.59), whereas its predictive effects for the Moderate-Exhaustion profile and the High-Exhaustion and Reduced Accomplishment profile were relatively weaker (OR = 0.81 and 0.78, respectively). However, when the Moderate-Exhaustion Type and High-Exhaustion and Reduced Accomplishment Type are used as the reference groups, neither parental autonomy support nor growth mindset shows a significant predictive effect. Chain mediation analyses based on the variable-centered approach indicated that self-esteem accounted for the largest proportion of the total indirect effect in the

full sample (61.36%). Differential prediction analyses based on the person-centered approach further showed that self-esteem significantly predicted membership across all academic burnout profiles, with stronger associations observed for profiles characterized by higher levels of academic burnout.

Table 5: Multinomial logistic regression analysis of adolescent academic burnout.

Predictor	Low-Burnout Type vs. Moderate-Exhaustion Type			Low-Burnout Type vs. High-Exhaustion and Reduced Accomplishment Type			Low-Burnout Type vs. Severe Burnout Type		
	B	OR	95%CI	B	OR	95%CI	B	OR	95%CI
Parental autonomy support	-0.24*	0.79	[0.62, 0.99]	-0.38**	0.69	[0.52, 0.92]	-0.31	0.74	[0.48, 1.13]
Growth mindset	-0.22**	0.81	[0.68, 0.95]	-0.24*	0.78	[0.63, 0.97]	-0.52**	0.59	[0.41, 0.85]
Self-esteem	-2.38***	0.09	[0.06, 0.14]	-3.59***	0.03	[0.02, 0.05]	-4.83***	0.01	[0.00, 0.02]
Predictor	Moderate-Exhaustion Type vs. High-Exhaustion and Reduced Accomplishment Type			Moderate-Exhaustion Type vs. Severe Burnout Type			High-Exhaustion and Reduced Accomplishment Type vs. Severe Burnout Type		
	B	OR	95%CI	B	OR	95%CI	B	OR	95%CI
Parental autonomy support	-0.13	0.88	[0.68, 1.12]	-0.07	0.94	[0.63, 1.40]	0.07	1.07	[0.72, 1.59]
Growth mindset	-0.03	0.97	[0.80, 1.19]	-0.31	0.74	[0.52, 1.04]	-0.28	0.76	[0.53, 1.07]
Self-esteem	-1.21***	0.30	[0.19, 0.46]	-2.45***	0.09	[0.04, 0.17]	-1.24***	0.29	[0.15, 0.56]

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. OR = Odds Ratio; 95%CI = 95% Confidence Interval for the OR (statistically significant if the interval does not include 1). The group preceding “vs.” serves as the reference group.

4 Discussion

This study examined how family and individual factors are associated with academic burnout, an issue that has become increasingly prevalent among adolescents. Drawing on Ecological Systems Theory [15], Self Determination Theory [20], and Conservation of Resources Theory [23], we integrated variable-centered and person-centered analytical approaches within a unified framework. This approach enabled us to first identify general association patterns and then test heterogeneity within these processes. Within this framework, the study examined the relationship between parental autonomy support and adolescent academic burnout. The findings indicated that parental autonomy support was associated with lower levels of academic burnout, through both independent and sequential mediating roles of growth mindset and self-esteem. From a person-centered perspective, four distinct profiles of academic burnout were identified: Low-Burnout, Moderate-Exhaustion, High-Exhaustion and Reduced Accomplishment, and Severe Burnout. Building on these results, a hierarchical pattern of associations emerged. Parental autonomy support and growth mindset were primarily associated with lower burnout at less severe levels, whereas self-esteem, a core internal resource, exhibited consistent associations across all burnout profiles, particularly in those characterized by more severe burnout. Overall, these findings highlight the value of integrating variable-centered and person-centered approaches, deepen the theoretical understanding of the academic burnout development, and provide an empirical basis for differentiated and targeted intervention strategies for addressing academic burnout.

4.1 The Chain Mediating Effect of Growth Mindset and Self-Esteem between Parental Autonomy Support and Academic Burnout

This study systematically examined the relationship between parental autonomy support and adolescent academic burnout through a chain mediation model. Results indicated that parental autonomy support was not only directly and negatively associated with adolescents’ academic burnout, but also indirectly associated with lower-level burnout through both independent and sequential association patterns of growth mindset

and self-esteem. These findings thereby enrich the theoretical mechanism of parent-adolescent academic burnout and provide practical references for alleviating adolescents' academic burnout.

First, the findings indicated that parental autonomy support was negatively associated with academic burnout among adolescents, providing support for Hypothesis 1. According to Self-Determination Theory, autonomy support provided by parents fulfills adolescents' fundamental psychological needs, particularly the need for autonomy, thereby enhancing their intrinsic motivation and psychological vitality. This, in turn, mitigates emotional exhaustion and academic alienation triggered by internal and external pressure [58]. In autonomy-supportive family environments, adolescents are more likely to perceive learning as a self-directed exploration process rather than a passive burden, leading to more engaged and less burned-out academic involvement. Furthermore, the findings revealed that parental autonomy support also alleviated academic burnout by fostering adolescents' growth mindset, a pathway that further supports and expands the perspectives of Self-Determination Theory. Specifically, parental autonomy support creates an environment that encourages exploration and accepts mistakes by fulfilling adolescents' need for autonomy [12]. Within this supportive environment, adolescents are more likely to perceive academic challenges as opportunities for developing their abilities rather than threats to their fixed intelligence. This facilitates the formation of a growth mindset [13] and promotes the adoption of proactive coping strategies when facing academic difficulties [59] rather than succumbing to helplessness and avoidance. This helps reduce physical and mental exhaustion and academic alienation caused by prolonged stress [60], thereby alleviating academic burnout.

Second, self-esteem significantly mediated the relationship between parental autonomy support and academic burnout, which was consistent with Hypothesis 2. Furthermore, its effect size was the largest among all mediating pathways. According to Conservation of Resources Theory, self-esteem, as a core psychological resource, helps individuals cope with stress and maintain psychological stability [25]. This study indicates that adolescents who perceive parental respect, understanding, and support are more likely to internalize this positive treatment, forming a stable sense of self-worth [37]. Adolescents with higher self-esteem exhibit greater confidence in their ability to meet academic demands. Their sense of self-worth remains resilient against temporary setbacks, enabling them to better withstand the emotional exhaustion and diminished sense of accomplishment stemming from academic pressure. This aligns with prior research indicating that high self-esteem effectively buffers the adverse effects of stress on mental health [61] and serves as a crucial protective factor against depression and psychological distress [62]. Thus, self-esteem represents a vital pathway through which parental autonomy support exerts its protective effects.

This study revealed a significant chain mediating effect between parental autonomy support and academic burnout: parental autonomy support was associated with higher growth mindset, which in turn was linked to higher self-esteem, and all three variables were negatively associated with academic burnout. This result was in line with Hypothesis 2. This pathway holds significant theoretical implications, demonstrating that a growth mindset, as a positive cognitive belief system, serves as a crucial cognitive prerequisite for fostering healthy self-esteem [30]. When adolescents believe their abilities can be improved through effort (i.e., possess a growth mindset), they attribute academic setbacks to temporary, modifiable factors (such as effort level or strategy) rather than inherent, unchangeable deficiencies [63]. This adaptive attribution effectively mitigates the impact of failure experiences on self-worth. According to Dweck's [60] Motivational Theory, the core of a growth mindset lies in attributing setbacks to controllable factors like effort and strategy, rather than innate ability. This prevents the formation of a negative self-concept where "failure proves my incompetence". Burnette et al. [30] further demonstrated that adolescents with a growth mindset exhibited fewer negative emotions and better academic adjustment when facing academic challenges. This process contributes to the maintenance and enhancement of self-esteem.

4.2 Potential Categories of Adolescent Academic Burnout

This study, focusing on adolescents and adopting a person-centered perspective, employed latent profile analysis to explore latent profiles of academic burnout. Results indicated four distinct types of academic burnout: a Low-Burnout Type (47.00%), a Moderate-Exhaustion Type (29.75%), a High-Exhaustion and Reduced Accomplishment Type (18.50%), and a Severe Burnout Type (4.75%), which provided partial support for Hypothesis 3.

Scores across the four categories demonstrated distinct patterns in all dimensions of academic burnout, with the most pronounced disparity observed in academic alienation. The Severe Burnout Type scored markedly higher than the other categories. According to Maslach et al.'s [64] Burnout Theory, academic alienation reflects an individual's apathy and detachment toward academic pursuits. The exceptionally high academic alienation observed in the Severe Burnout Type adolescents may indicate profound skepticism regarding the value of academic endeavors. It may also stem from negative attitudes triggered by academic demands far exceeding individual resources [4]. In contrast, adolescents in the "Low-Burnout Type" exhibited low academic alienation, reflecting their high involvement and identification with studies. Regarding emotional exhaustion, Maslach et al. [64] and Freudenberger [65] proposed that physical and emotional exhaustion represent an excessive depletion of emotional and physical energy resulting from prolonged stress. Except for the "Low-Burnout Type", the remaining three categories scored high on the physical and mental exhaustion dimension. This indicates that most adolescents may be enduring prolonged high-pressure academic environments, where sustained academic demands and competitive pressures lead to excessive emotional and physical depletion. This aligns with the description of "resource depletion caused by chronic stress". As for the dimension of reduced accomplishment, Self-Determination Theory [66] posits that individuals are likely to experience a diminished sense of accomplishment when their needs for competence, autonomy, and relatedness remain unmet. Students in the High-Exhaustion and Reduced Accomplishment Type and Severe Burnout Type exhibit higher levels of low accomplishment. This may stem from difficulties in obtaining competence feedback during academic competition and task completion, with accumulated experiences of frustration eroding their self-efficacy.

4.3 Predictive Effects of Parental Autonomy Support, Growth Mindset, and Self-Esteem on Latent Profiles of Adolescent Academic Burnout

This study employed multinomial logistic regression analysis to examine the predictive effects of parental autonomy support, growth mindset, and self-esteem across different types of adolescent academic burnout. Results revealed significant differences in the predictive effects of these three factors across various burnout categories, which were consistent with Hypothesis 3.

Self-esteem demonstrated an exceptionally significant and stable protective effect across nearly all burnout subtypes, indicating that it functions as a core internal resource and shows the strongest association with lower levels of academic burnout. Particularly when comparing to the Low-Burnout Type, where self-esteem's odds ratio (OR) was substantially lower than those of other variables. This indicates that adolescents with high self-esteem exhibit a significantly reduced risk of belonging to any burnout subtype, especially the High-Exhaustion and Reduced Accomplishment Type and Severe Burnout Type. This finding strongly aligns with Conservation of Resources Theory [67], which posits that high self-esteem, as a core individual resource, helps individuals effectively cope with stress and prevent excessive depletion of psychological resources. Numerous longitudinal studies and meta-analyses also indicate that low self-esteem is a significant risk factor predicting future depression, anxiety, and academic difficulties [25]. Individuals with higher self-esteem maintain better psychological well-being and adopt more positive attitudes toward

academic challenges, thereby reducing academic burnout [42,43]. This study further refines the role of self-esteem to different subtypes of burnout, confirming the important role of self-worth as a key internal defense line in preventing academic burnout [10].

The protective roles of parental autonomy support and growth mindset exhibited a certain “threshold effect”. Specifically, both primarily function in distinguishing between “healthy states” (low burnout groups) and “at-risk states” (various burnout groups), while their differentiating effect between different risk groups is not significant. This suggests that parental autonomy support is primarily associated with lower levels of academic burnout, consistent with a “primary prevention” pattern. At the early stages of academic burnout, sufficient parental autonomy support can effectively prevent adolescents from transitioning from low to moderate or high burnout states. However, once individuals enter a burnout state, their psychological resources become caught in a “depletion spiral” [68], characterized by severe depletion of psychological resources and frustration of autonomy, competence, and relatedness [69]. Under these conditions, adolescents are less able to perceive or utilize external support, and the protective effect of parental autonomy support is superseded by more core individual factors, such as self-esteem.

Similarly, a growth mindset [26] functions as a positive belief system that provides protection during early academic stages and when facing general setbacks by framing challenges as learning opportunities and attributing failure to effort rather than fixed ability. However, when students endure prolonged high levels of exhaustion, a single belief may prove insufficient to counteract persistent negative feedback, rendering its effects insignificant [43,59,60]. A key finding is that, when using the Low-Burnout Type as a reference, growth mindset exhibits its strongest predictive effect on the Severe Burnout type (OR = 0.59) relative to other profiles. This suggests that this belief in “capability plasticity” may become particularly valuable when confronting the most severe forms of burnout. Growth mindset helps individuals maintain resilience and the flexibility to seek strategies when facing major setbacks and persistent adversity [13]. Therefore, for adolescents on the verge of exhaustion, cultivating a growth mindset may provide the critical psychological leverage needed to break the vicious cycle of helplessness and low achievement.

Overall, the findings support a hierarchical protective model: parental autonomy support and growth mindset form the initial external and cognitively-mediated buffers against the onset of academic burnout. In contrast, self-esteem serves as a more central internal psychological resource, offering protection not only in the initial stages of burnout but also providing a stabilizing effect throughout the entire burnout spectrum, particularly in mitigating progression toward more severe burnout. This study established an integrated analytic framework that combines variable-centered analyses, which identify general mechanisms, with person-centered analyses to examine differential effects, thereby demonstrating the complementary value of both approaches and addressing a key limitation of prior research. Variable-centered analyses revealed that general parental autonomy support influences academic burnout through a sequential mediation pathway involving growth mindset and self-esteem. Person-centered analyses further tested micro-level heterogeneity by first identifying four distinct burnout profiles through latent profile analysis, and then confirming the differential predictive effects of core protective factors using multinomial logistic regression. The two approaches are mutually reinforcing. Person-centered analyses provide a more nuanced explanation for the average effects observed in variable-centered analyses. For example, the robust mediating effect of self-esteem reflects its protective role across all burnout profiles. Conversely, variable-centered analyses guide the selection of predictors in person-centered analyses. This linkage provides theoretical justification and reduces the exploratory limitations of latent profile analysis, and thereby enhances the precision and interpretability of the person-centered results. For instance, growth mindset exhibited the strongest negative predictive effect for students in the High-Exhaustion and Reduced Accomplishment Type, suggesting that

during severe burnout, the concept of plasticity may serve as a critical cognitive resource to prevent further psychological depletion [59]. In contrast, self-esteem demonstrated stable predictive effects across all burnout types, with a particularly pronounced effect in the high-burnout group, consistent with its conceptualization as a core psychological resource within Conservation of Resources [68]. A key insight emerging from this methodological integration is that future intervention practices should not only promote adolescents' growth mindset and self-esteem development at the macro level of parental autonomy support, but also adopt differentiated strategies for distinct burnout categories. For instance, adolescents in the "High-Exhaustion and Reduced Accomplishment" Type may benefit from attributional retraining to strengthen their growth mindset. Conversely, adolescents in the Severe Burnout Type require interventions that integrate both individual and environmental resources to bolster self-esteem and interrupt the psychological "spiral of loss" [10,70]. This integrated perspective thus offers a more comprehensive and precise theoretical foundation and a more practical pathway for understanding and addressing adolescent academic burnout.

4.4 Strengths, Limitations, and Future Directions

The present study systematically examined the relationship between parental autonomy support and adolescent academic burnout by integrating variable-centered and person-centered analytical approaches. It further clarified the chain mediating roles of growth mindset and self-esteem, and identified the heterogeneity in academic burnout through latent profile analysis. First, it simultaneously examined both the independent and sequential mediating roles of growth mindset and self-esteem in the relationship between parental autonomy support and adolescent academic burnout. This addresses a gap in prior research, which was predominantly focused on single mediators. Second, the study integrated variable-centered and person-centered approaches by combining chain mediation analysis with latent profile analysis, representing a methodological innovation. This integrated approach not only clarified general mediating processes but also identified heterogeneous burnout profiles and the differential protective effects of core variables across these profiles, an aspect rarely explored in previous studies. Third, by drawing on multiple theoretical frameworks, including Ecological Systems Theory, Self-Determination Theory, Conservation of Resources Theory, and Mindset Theory study establishes a robust theoretical foundation. This comprehensive perspective allows for a nuanced understanding of how external factors, such as parental autonomy support, interact with internal psychological resources, growth mindset, and self-esteem relation to academic burnout. While prior research has established positive links between parental support and individuals' emotional competencies, the present study advances understanding by elucidating the specific psychological pathway from growth mindset to self-esteem and identifying differences across distinct burnout subgroups. Together, these contributions deepen the theoretical understanding of the mechanisms underlying adolescent academic burnout and enhance the practical relevance of the findings.

Nevertheless, several limitations should be acknowledged. First, the cross-sectional research design limits the ability to capture the dynamic causal relationships and developmental trajectories among parental autonomy support, growth mindset, self-esteem, and academic burnout. For example, the reciprocal relationship between academic burnout and self-esteem varies across developmental stages, and the protective effects of parental autonomy support and growth mindset may change over time. Future research should adopt longitudinal designs with repeated measurements across multiple time points to examine the long-term developmental patterns of latent burnout profiles and to test potential bidirectional causal relationships among key variables. Such designs would enhance the temporal validity of the findings. Second, this study relied solely on adolescent self-reports, which may introduce subjective

bias despite no serious common method variance being detected. Self-report data remain susceptible to social desirability, recall bias, or the motivation of adolescents to present themselves favorably. For instance, some adolescents may overreport parental autonomy support or underreport their academic burnout symptoms. Future research could strengthen the robustness and ecological validity of findings by incorporating multi-informant reports, such as parent or teacher ratings, as well as behavioral indicators to further strengthen the robustness and ecological validity of the conclusions. Third, although latent profile analysis provides valuable person-centered insights, the extracted profiles may vary across samples, contexts, or measurement indicators. The profile structure identified in this study needs to be replicated in diverse populations and settings to establish its stability and generalizability. Fourth, the generalizability of the findings is limited by the sampling scope. Participants were exclusively middle and high school students from Shandong Province, China. Differences in educational systems, parenting norms, and sociocultural values across regions and countries may influence the relationships among parental autonomy support, growth mindset, self-esteem, and academic burnout. Caution is thus needed when extending these findings to other sociocultural contexts. Future research should include adolescents from multiple regions and diverse cultural and socioeconomic backgrounds to enhance external validity and to explore potential cross-cultural or regional differences in academic burnout mechanisms.

5 Conclusions

This study investigated the relationship between parental autonomy support and adolescent academic burnout through an integrated variable-centered and person-centered approach. Variable-centered analyses explored whether growth mindset and self-esteem mediated this relationship, while person-centered analyses identified latent profiles of academic burnout and examined the differential associations of core variables across these profiles. The findings indicate that: (1) Parental autonomy support was significantly associated with lower levels of adolescent academic burnout, and this relationship was mediated sequentially by growth mindset and self-esteem; (2) Adolescent academic burnout was characterized by four distinct profiles: Low-Burnout, Moderate-Exhaustion, High-Exhaustion and Reduced Accomplishment, and Severe Burnout; (3) Parental autonomy support, growth mindset, and self-esteem showed differential associations across burnout profiles. Specifically, self-esteem exhibited the strongest and most consistent associations across all profiles; parental autonomy support was more strongly associated with lower burnout levels, whereas growth mindset displayed relatively stronger associations with the Severe Burnout profile.

This study established an integrated analytic framework that combines variable-centered analyses to identify general explanatory patterns with person-centered analyses for examining heterogeneity across subgroups. The framework not only elucidated the general psychological pathway between parental autonomy support and academic burnout, but also clarified how these relationships vary across distinct burnout subgroups. This study provides a comprehensive empirical basis for developing stratified and targeted intervention strategies to address adolescent academic burnout. Although causal inferences cannot be drawn, the identified associative patterns suggest that multilevel interventions focusing on family contexts and individual psychological resources may be effective in addressing academic burnout. These may include enhancing parental autonomy support through family education programs, fostering a growth mindset through cognitive-behavioral interventions, and promoting self-esteem through competency-building and value-affirmation activities.

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