



From cognition to behavior: Proactive personality pathways and academic performance of college students

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Abstract: The study examined the role of proactive personality in influencing academic performance among Chinese university students, with a focus on the mediating roles of academic self-efficacy and learning engagement. A total of 378 Chinese undergraduate students (females = 49.7%, juniors = 26.5%) participated in the study. Data on proactive personality, academic self-efficacy, and learning engagement were collected using standardized scales, and academic performance was measured via self-reported Grade Point Averages. Structural equation modelling with bootstrap resampling results indicated that proactive personality had a significant direct effect on academic performance, accounting for 63.28% of the total effect. The indirect effects operated through three significant pathways: the independent mediating roles of academic self-efficacy (18.48%) and learning engagement (14.78%), as well as their sequential chain mediation effect (3.23%). Together, these findings provide strong empirical evidence for the proposed pathways linking proactive personality to academic performance. Furthermore, the findings underscore the importance of fostering students' efficacy beliefs and learning engagement synergistically in order to enhance academic achievement in higher education.

Keywords: proactive personality; academic performance; academic self-efficacy; learning engagement; chain mediation

Introduction

How thoughts translate to behaviour may depend on personality. Conceivably, students are not passive recipients of knowledge but active agents who can shape their learning environment and adjust their strategies (Zhang, 2022). This perspective directs attention to the dispositional factors such as proactive personality—defined as a stable tendency to take the initiative in changing one's environment rather than passively adapting to it (Bateman & Crant, 1993).

Nevertheless, significant gaps remain in understanding how proactive disposition may drive academic success for deeper behavioral engagement. This study aims to address this gap in the evidence base.

Proactive personality and academic performance

The transition to university exposes learners to more autonomous environments and complex academic demands—a shift that heightens the importance of personality traits as determinants of success (Poropat, 2009). Within this context, proactive personality emerges as a key predictor of academic performance. This trait reflects a stable tendency to initiate change in one's circumstances and pursue goals—a disposition characterized by spontaneity, initiative, and persistence (Bateman & Crant, 1993). As a core personality dimension, it reflects an individual's propensity to not only overcome environmental constraints but also to actively identify and seize opportunities (Crant, 2000). High levels of proactive personality foster both an endogenous drive—manifested in autonomous goal setting—and a greater capacity for external adaptation through strategic resource acquisition. This combined effect strengthens a student's ability to navigate academic challenges, thereby enhancing overall performance (Parker et al., 2010).

In contrast, negative dispositions such as passivity and procrastination are known antecedents of academic burnout (Demir et al., 2017; Setiyowati et al., 2024). Proactive personality, however, is consistently linked to superior academic outcomes (Chai et al., 2023). Grounded in SRL theory, I argue that highly proactive students exhibit particularly strong self-regulatory capacities, which substantially facilitate their academic development. Specifically, such students actively procure necessary learning resources—for instance, by seeking instructor guidance or forming study groups—while also flexibly deploying metacognitive strategies to meet diverse task demands (Lin et al., 2024). Furthermore, their goal-oriented nature helps sustain motivation, which cultivates resilience when confronting academic difficulties (Parker et al., 2010).

The mediating role of academic self-efficacy

Academic self-efficacy—an individual's belief in their capability to complete learning tasks (Elias & MacDonald, 2007)—has emerged as a robust predictor of academic performance (Lei et al., 2022). More importantly for this framework, it may function as a core psychological mechanism through which proactive personality promotes academic success. Individuals with high proactivity typically set challenging goals and actively seek feedback (Parker et al., 2010). I argue that these behaviors generate mastery experiences, which bolster confidence in one's learning abilities (Pajares, 2002), creating a positive feedback loop between goal striving and efficacy enhancement. Empirical evidence corroborates this link; for instance, a study of 82 sophomores reported a significant positive correlation between academic self-efficacy and performance ($r = 0.45, p < 0.01$) (Meral et al., 2012).



Moving beyond correlation, scholarly focus has shifted toward elucidating the mediating role of self-efficacy. Supporting this perspective, a study of 388 Chinese university students demonstrated that academic self-efficacy mediated the relationship between proactive personality and academic performance (Wang et al., 2016). This suggests that proactive traits enhance performance primarily by first elevating students' belief in their academic capabilities. The robustness of this mediating pathway is highlighted by its replication across diverse populations. Research on university student-athletes, for example, also found that proactive personality influenced academic performance through self-efficacy (Li et al., 2022), implying that engagement in physical activity may indirectly foster achievement by strengthening students' academic self-efficacy.

The mediating role of learning engagement

Learning engagement may similarly mediate the relationship between proactive personality and academic performance. This construct encompasses students' active participation in learning across cognitive, emotional, and behavioral dimensions, reflecting their sustained concentration, enthusiasm, and effort (Schaufeli et al., 2002a). Academic success depends not only on intellectual capacity but also, critically, on sustained investment in the learning process. Indeed, research substantiates that enhanced learning engagement serves as a potent predictor of improved performance (Pang & Veloo, 2024). An analysis of 1105 students across disciplines, for instance, confirmed that online learning engagement positively predicts academic performance (Rajabalee et al., 2020). While engagement is demonstrably shaped by exogenous factors such as social support (Koob et al., 2021) and the learning environment (Sökmen, 2019), its connection to intrinsic dispositions is equally vital. Proactive personality, as a core intrinsic trait, can significantly increase engagement by stimulating enthusiasm and initiative (Gao et al., 2024; Jiang et al., 2023), thereby creating an indirect pathway to improved performance. Importantly, the mediating role of engagement extends beyond its link with personality, operating robustly within the system of psychological beliefs.

Within the framework of academic self-efficacy, learning engagement may further mediate the connection between efficacy beliefs and performance. Students with strong self-efficacy are more inclined to select challenging goals and persevere in the face of difficulties; these positive beliefs translate directly into deeper, multidimensional engagement, characterized by more sophisticated cognitive strategies, stronger emotional commitment, and persistent behavioral investment (Zimmerman, 2000). A cross-sectional meta-analysis spanning K-12 to university education revealed moderate positive correlations between self-efficacy and all dimensions of engagement—cognitive, emotional, and behavioral ($r = 0.38, p < 0.001$) (Chang & Chien, 2015). Empirical studies further delineate that self-efficacy influences performance both directly and indirectly via engagement (Luo et al., 2023; Meng & Zhang, 2023). Collectively, meta-analytic and causal evidence underscores the robustness of the “academic

self-efficacy → learning engagement → academic performance” pathway, providing a core theoretical model for understanding how psychological beliefs are translated into tangible academic outcomes.

Theoretical basis

This study integrates self-regulated learning (SRL) theory (Zimmerman & Schunk, 2013) and conservation of resources (COR) theory (Hobfoll, 1989) to propose and test a chain mediation model. SRL theory elucidates the cyclical interplay among personal cognition, behavior, and environment, while COR theory portrays individuals as motivated to acquire and protect psychological resources. In this integrated framework, SRL theory describes the pathway from cognition to behavior, while COR theory provides the motivational mechanism—resource investment and gain dynamics—that drives this process. Together, they reveal how proactive personality translates into academic performance through the sequential accumulation of psychological (self-efficacy) and behavioral (engagement) resources.

Within this integrated framework, SRL theory further explains how proactive students regulate their cognition and behavior through cyclical phases of forethought, performance, and self-reflection, positioning academic self-efficacy as a key cognitive component in the forethought phase and learning engagement as a core behavioral manifestation in the performance phase. COR theory complements this by conceptualizing proactive personality as an initial “personal resource” that motivates further resource investment: highly proactive students are predisposed to accumulate psychological resources (e.g., self-efficacy) and convert them into behavioral resources (e.g., engagement), creating a resource gain spiral that culminates in enhanced performance. This integrated perspective suggests that the influence of proactive personality on academic outcomes operates not merely through parallel independent pathways, but potentially through a sequential cascade in which psychological resources are first cultivated and then translated into behavioral engagement—a chain mediation pathway that this study empirically examines.

The Chinese higher education context

As Chinese higher education has expanded rapidly, the determinants of university students' academic performance reflect distinct local characteristics. With continuous enrollment expansion and a growing student population, academic performance, as a core measure of educational quality, has drawn increasing societal attention. The current academic environment for Chinese students is complex: intensifying job market competition has made performance a signal of human capital value (reflected in employers' emphasis on GPA), while educational digitalization has made blended teaching the norm, placing greater demands on self-directed learning abilities. Driven by both employment pressure and educational transformation, academic performance carries particular weight in the Chinese context, providing a strong rationale for examining the impact of individual traits like proactive personality.

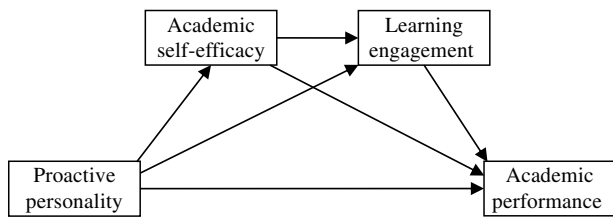


Figure 1. The conceptual model

Goals of the study

This study aims to examine how personality dispositions explain academic success and provide a foundation for developing learner-centered adaptive education systems.

Based on the preceding review, the following hypotheses are proposed for testing (see Figure 1 for conceptual model):

H1: Proactive personality is positively associated with university students' academic performance.

H2: Academic self-efficacy mediates the positive relationship between proactive personality and academic performance.

H3: Learning engagement mediates the positive relationship between proactive personality and academic performance.

H4: Academic self-efficacy and learning engagement play a chain mediation role between proactive personality and academic performance, such that proactive personality enhances academic self-efficacy, which in turn promotes learning engagement, ultimately leading to improved academic performance.

Method

Participants and setting

A total of 378 undergraduate students were participants (49.7% female, $n = 188$; 50.3% male, $n = 190$). Year-level distribution was: freshmen 25.1% ($n = 95$), sophomores 27.2% ($n = 103$), juniors 26.5% ($n = 100$), and seniors 21.2% ($n = 80$). Disciplinary backgrounds included: social sciences 37.3% ($n = 141$), natural sciences 28.3% ($n = 107$), and interdisciplinary/other 34.4% ($n = 130$). All questionnaires were administered anonymously, with written informed consent obtained from all participants prior to data collection.

Measures

Participants completed these standardized scales: (1) the Proactive Personality Scale (PPS; Shang & Gan, 2009); (2) the Academic Self-Efficacy Scale (ASES; Lee, et al., 2010); and (3) the Learning Engagement Scale (LES; Schaufeli et al., 2002b). All scales used a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) (see also Table 1).

Proactive personality

Proactive personality was measured using the 11-item Proactive Personality Scale (PPS) by Shang and Gan (2009). Sample items are: "I like to challenge the status quo," "Nothing is more exciting than seeing my ideas turn into reality," and "I am always looking for new ways to

Table 1. The result of reliability test

Variable	N	Number of items	Cronbach α
Proactive personality	378	11	0.919
Academic self-efficacy	378	7	0.894
Learning engagement	378	17	0.946
Academic performance	378	1	—

Note. PP = Proactive personality; ASE = Academic self-efficacy; LE = Learning engagement; AP = Academic performance.

improve my life." In this study, the scale's Cronbach's α was 0.919, indicating good reliability.

Academic self-efficacy

Academic self-efficacy was assessed with the 7-item Academic Self-Efficacy Scale (ASES) by Lee et al. (2010). Sample items are: "Compared to other students, I expect to do well," "I am confident that I can understand the content taught in class," and "I believe I can excel in class assignments and homework." The scale's Cronbach's α was 0.894 in this study.

Learning engagement

Learning engagement was measured using the 17-item Learning Engagement Scale (LES) by Schaufeli et al. (2002b), comprising three dimensions: Vigor (6 items), Dedication (5 items), and Absorption (6 items). Sample items are: "When I'm studying, I feel full of energy (Vigor)," "I find my studies full of meaning and purpose (Dedication)," and "I become immersed in my studies (Absorption)." The total scale's Cronbach's α was 0.946.

Academic performance

Academic performance was measured using GPA, which students reported after accessing their official academic records. Participants were instructed to log into the university's grading system using their personal credentials and report their cumulative GPA for the 2024 academic year as displayed in the system. The participating institutions used a standard calculation: 100–90 points (Excellent, 4 grade points), 89–80 (Good, 3 points), 79–70 (Average, 2 points), 69–60 (Pass, 1 point), below 60 (Fail, 0 points). GPA was computed as $\Sigma (\text{Course Credit} \times \text{Course Grade Points}) / \Sigma \text{Course Credits}$. To ensure accuracy, students were reminded to report the exact GPA as displayed in the system, and responses with obvious inconsistencies (e.g., GPA values outside the possible range) were excluded from analysis.

Procedure

This study was approved by the Ethics Review Committee of the researcher's affiliated institution (Approval No.: 20250523). All participants provided signed informed consent before completing the questionnaire via the "Wenjuanxing" online platform, which uses data encryption and privacy protocols to ensure information security.

Data analysis

Data analysis was performed using the SPSSAU online platform. Scale reliability (Cronbach's α) and validity (factor loadings, composite reliability, average variance extracted) were first assessed. Model fit was then examined using χ^2/df , IFI, TLI, CFI, and RMSEA. Finally, the structural equation model was validated using the bootstrap method with 5000 iterations to construct 95% confidence intervals.

Common method bias test

Since most data were collected via self-report questionnaires (proactive personality, academic self-efficacy, learning engagement), common method bias was a potential concern. Academic performance, however, was based on students' reports of their official GPA obtained from the university's grading system, which reduces concerns about method effects for this variable. Harman's single-factor test yielded three factors with eigenvalues greater than 1; the first factor explained 34.97% of the variance, below the 40% threshold, indicating acceptable levels of common method bias.

To further examine the potential influence of common method bias, the unmeasured latent method factor (ULMF) technique was employed (Podsakoff et al., 2003). By adding a common method factor specified as orthogonal to the trait factors, with all items loading on both their respective trait factors and the method factor, the results showed that the ULMF model ($\chi^2/\text{df} = 1.009$, CFI = 0.999, RMSEA = 0.005) did not yield a substantial improvement in model fit compared to the baseline model ($\chi^2/\text{df} = 0.810$, CFI = 1.002, RMSEA = 0.000), with $\Delta\text{CFI} = -0.002$ and $\Delta\text{RMSEA} = 0.005$. Moreover, the average variance explained by the method factor was only 0.05%. These findings suggest that common method bias was unlikely to confound the interpretations of the present study.

Confirmatory factor analysis and model fit

Table 2 presents the confirmatory factor analysis results. The average variance extracted (AVE) values for proactive personality (0.509), academic self-efficacy (0.547), and learning engagement (0.506) all exceeded the 0.5 benchmark. Composite reliability (CR) values (PP = 0.919, ASE = 0.894, LE = 0.946) all surpassed 0.7, confirming good convergent validity. Furthermore, the square roots of the AVEs for all variables were greater than their correlations with other variables, demonstrating good discriminant validity.

Table 3 presents the overall model fit indices. The chi-square/degrees of freedom ratio (χ^2/df) was 1.346, below the standard of 3; RMSEA was 0.03, below the 0.08 critical value; and IFI, TLI, and CFI values were 0.973, 0.971, and 0.973, respectively, all exceeding the 0.9 benchmark, indicating good model fit. Structural equation modeling was used to test the chain mediation effects (see Table 4 below).

Results

Descriptive statistics and correlation analysis

Table 2 presents the descriptive statistics and correlations for the study variables. Mean scores were 3.465 (SD = 0.954) for proactive personality, 3.373 (SD = 1.025) for academic self-efficacy, 3.461 (SD = 0.940) for learning engagement, and 2.829 (SD = 0.864) for academic performance. All variables were significantly positively correlated ($p < 0.01$). The correlation between proactive personality and academic performance was highest ($r = 0.478$), followed by learning engagement with academic performance ($r = 0.418$) and academic self-efficacy with academic performance ($r = 0.426$). These results provide necessary support for subsequent model testing.

Mediation effect test

Proactive personality had a significant direct effect on academic performance ($\beta = 0.302$, $p < 0.01$), supporting H1. Mediation tests showed that proactive personality influenced academic performance indirectly through two independent paths: academic self-efficacy ($\beta = 0.358 \rightarrow 0.248$, $p < 0.01$) and learning engagement ($\beta = 0.362 \rightarrow 0.196$, $p < 0.01$), confirming H2 and H3. Importantly, the analysis identified a significant sequential mediation path from academic self-efficacy to learning engagement (all path coefficients $p < 0.01$), supporting H4.

Bootstrap resampling tests with 5000 iterations quantified the effect sizes (Table 5). The total effect of proactive personality on academic performance was 0.433 (95% CI [0.352, 0.514]). The direct effect accounted for 63.28% (0.274, 95% CI [0.188, 0.361]). Decomposition of indirect effects showed that the independent mediation of academic self-efficacy accounted for 18.48% (0.080, 95% CI [0.043, 0.125]), the independent mediation of learning engagement accounted for 14.78% (0.064, 95% CI [0.030, 0.106]), and the chain mediation effect accounted for 3.23% (0.014, 95% CI [0.005, 0.028]). Confidence intervals for all paths excluded zero, indicating statistical significance. These results demonstrate that proactive personality affects academic performance directly, through parallel enhancements of self-efficacy and engagement, and sequentially via "academic self-efficacy $\rightarrow$ learning engagement." Together, the three mediating paths explain 36.72% of the total effect variance.

Discussion

Results show that proactive personality not only directly and positively predicts academic performance but also exerts a significant indirect effect through "academic self-efficacy and learning engagement". This finding reveals a progressive pathway: highly proactive students develop greater academic self-efficacy, which in turn enhances their learning engagement, ultimately improving academic performance. This finding aligns with Richardson et al.'s (2012) large-scale meta-analysis of Western students, indicating that both paths are equally important in explaining the proactive personality–academic performance link.

Proactive personality was associated with higher academic performance (see also Parker et al., 2010). The

Table 2. Mean, standard deviations, and correlations among study variables

Variable	M	SD	AVE	CR	Correlations			
					1	2	3	4
1 PP	3.465	0.954	0.509	0.919	(0.713)			
2 ASE	3.373	1.025	0.547	0.894	0.358**	(0.740)		
3 LE	3.461	0.940	0.506	0.946	0.442**	0.355**	(0.711)	
4 AP	2.829	0.864	—	—	0.478**	0.426**	0.418**	—

Note. N = 378, ** $p < 0.01$ (two-tailed), Numbers in parentheses are AVE square roots. PP = Proactive personality; ASE = Academic self-efficacy; LE = Learning engagement; AP = Academic performance; M = Mean value; SD = Standard deviation; AVE = Average variance extracted; CR = Composite reliability.

Table 3. Model fit test

Model fitting indicators	χ^2/df	RMSEA	IFI	TLI	CFI
Value	1.346	0.03	0.973	0.971	0.973
Judgment criteria	<3.0	<0.08	>0.9	>0.9	>0.9

Note. RMSEA = Root mean square error of approximation; CFI = Comparative fit index; TLI = Tucker-Lewis index; IFI = Incremental fit index.

Table 4. Hierarchical regression results for the mediation model

Model	ASE			LE			AP		
	b	SE	β	b	SE	β	b	SE	β
Constant	2.041**	0.186	—	1.529**	0.183	—	0.550**	0.172	—
PP	0.385**	0.052	0.358	0.357**	0.048	0.362	0.274**	0.044	0.302
ASE				0.206**	0.044	0.225	0.209**	0.039	0.248
LE							0.180**	0.045	0.196
R ²	0.128			0.24			0.332		
Adjusted R ²	0.126			0.236			0.327		
F	55.191***			59.174***			61.957***		
df	(1, 376)			(2, 375)			(3, 374)		

Note. N = 378, Bootstrap times = 5000; ** $p < 0.01$, *** $p < 0.001$. PP = Proactive personality; ASE = Academic self-efficacy; LE = Learning engagement; AP = Academic performance.

Table 5. Bootstrap results

Effect	Path	Estimate	S.E.	95% CI	%
Total effect	PP→AP	0.433***	0.041	[0.352, 0.514]	100.00
Direct effect	PP→AP	0.274***	0.044	[0.188, 0.361]	63.28
Indirect effect	PP→ASE→AP	0.080	0.021	[0.043, 0.125]	18.48
	PP→LE→AP	0.064	0.020	[0.030, 0.106]	14.78
	PP→ASE→LE→AP	0.014	0.006	[0.005, 0.028]	3.23

Note. *** $p < 0.001$; Bootstrap times = 5000. PP = Proactive personality; ASE = Academic self-efficacy; LE = Learning engagement; AP = Academic performance.

trait itself is associated with autonomous learning (Zhang, 2022), or the ability to proactively overcome environmental constraints and optimize learning strategies (Liu et al., 2025). This finding suggests that educational practice should move beyond traditional cognitive ability training and incorporate proactive personality development into intervention programs, providing a theoretical foundation for a learner-centered educational ecosystem.

This study also found that academic self-efficacy and learning engagement partially mediate the proactive

personality–performance relationship to be stronger. This path indicates that highly proactive students strengthen their self-efficacy beliefs (Cook & Artino, 2016) through goal setting and success experiences, indirectly enhancing performance—consistent with Wang et al.'s (2016) findings with Chinese students. Proactive personality supports sustained cognitive, emotional, and behavioral participation, directly promotes performance (Wang et al., 2025). Although independent, these two mediating paths jointly reveal the underlying process: self-efficacy provides

psychological empowerment, compensating for motivational gaps when external support is lacking, while engagement represents behavioral transformation (Bandura, 1997; Ouwenel et al., 2013).

Moreover, academic self-efficacy and learning engagement together form a chain mediation between proactive personality and higher academic achievement. This finding corroborates the integrated framework of SRL and COR theories: from the COR perspective, by which highly proactive students accumulate psychological resources (e.g., efficacy beliefs) to buffer against academic stress, subsequently converting them into sustained behavioral engagement (Kong et al., 2021). For instance, when students accumulate success through active exploration, their “I am competent” belief enhances resilience (Joshi & Khan, 2022), propelling them toward more challenging tasks (e.g., deep reading, collaborative discussion). Moreover, sustained engagement, in turn, consolidates efficacy beliefs, forming a “cognition-behavior” synergistic gain cycle (Storksdiack & Staus, 2023).

Theoretical and practical implications

Findings empirically confirm the resource gain spiral that COR theory posits within SRL's process framework. Specifically, psychological resources (self-efficacy) transform into behavioral resources (engagement) and ultimately accumulate as academic capital (performance)—a core tenet of COR theory (Vîrgă et al., 2022). Moreover, the results advance SRL theory by clarifying the micro-level mechanism through which proactive personality, as an individual difference variable, enhances cognitive components (self-efficacy) to drive key learning behaviors (engagement).

Based on the revealed chain mediation mechanism, higher education practice can be optimized in several ways. First, given proactive personality's strong direct predictive power, universities should incorporate its development into core educational practices—for example, by embedding goal-setting and management training in general education courses or adding an “Active Innovation Index” to comprehensive evaluation systems. Second, targeted interventions should address each mediating pathway. The empowerment stage, growth mindset training (Dweck, 2006) could boost self-efficacy. In the activation stage, goal setting and behavioral contracts (Locke & Latham, 2002) could translate self-efficacy into sustained engagement.

Limitations and future research directions

This study validated the chain mediation mechanism through which proactive personality influences academic performance via self-efficacy and engagement, but several limitations should be acknowledged.

First, the cross-sectional design limits causal inference, as single-time-point data cannot capture dynamic variable interactions (e.g., the temporal causal direction between self-efficacy and engagement). Although the proposed model is theoretically grounded, reverse or reciprocal relationships cannot be ruled out.

Second, while multiple approaches were used to assess common method bias—and both Harman's test and the nature of the GPA measure (based on official records)

suggested that bias was not a serious concern—the reliance on self-report questionnaires for the three core constructs (proactive personality, self-efficacy, engagement) means that method effects cannot be completely eliminated.

Third, the sample was drawn from a single provincial public university in Henan Province, which may limit the generalizability of the findings to other institutional types (e.g., elite research universities, specialized institutions) or regions with different educational resources and cultural contexts. Although the sample included students from diverse disciplinary backgrounds and year levels, it lacked national stratification. Additionally, socioeconomic background data were not collected—a factor that could potentially moderate the relationships examined.

Fourth, although academic performance was based on students' reports of their GPA as accessed through the university's grading system—which enhances accuracy compared to unaided recall—it cannot be guaranteed that all students reported their GPA accurately. Social desirability or recall errors may still have occurred.

Addressing these limitations, future research should: (a) adopt longitudinal or experimental designs to establish causal direction; (b) incorporate objective performance data (e.g., official transcripts) and multi-method assessments (e.g., teacher ratings, behavioral logs) to cross-validate self-reports; (c) employ multi-site sampling strategies encompassing different tiers and types of institutions across various regions, and collect socioeconomic background data to examine potential moderating effects; and (d) explore chain mediation heterogeneity across regions, disciplines, and institutional types.

Conclusion

Grounded in SRL and COR theories, this study constructed and validated a chain mediation model. The results confirm that proactive personality not only directly and positively predicts university students' academic performance (direct effect accounting for 63.28% of the total) but also operates through three indirect pathways: the independent mediating effects of academic self-efficacy (18.48%) and learning engagement (14.78%), and the chain mediation path of “academic self-efficacy → learning engagement” (3.23%). These findings illuminate the dynamic pathway from proactive personality to academic performance through academic self-efficacy and learning engagement. It provides a clear theoretical framework for understanding how individual trait differences lead to academic differentiation and empirically supports the “cognitive empowerment → behavioral transformation” educational intervention logic. This offers a solid theoretical basis and practical direction for enhancing academic performance in higher education by jointly fostering students' self-efficacy beliefs and learning engagement.

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Availability of Data and Materials: The data that support the findings of this study are available from the corresponding author, Yunsheng Ruan, upon reasonable request.

Ethics Approval: This study involving human subjects was reviewed and approved by the Ethics Committee of the School of Economics and Management, Zhoukou Normal University, under approval number 20250523. All procedures performed in this study were in accordance with the ethical standards of the Institutional Review Board and in compliance with the ethical standards of the 1964 Declaration of Helsinki and its subsequent amendments. Informed consent was obtained from all participants. All data were anonymized to protect privacy.

Conflicts of Interest: The author declares no conflicts of interest.

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