The Influence of College Students' Perceived Stress on Learning Engagement: The Mediating Role of Academic Mental Resilience

Yixing Ren
Mathematics and Applied Mathematics (Sino-foreign Cooperation), Jiangsu University, Wuxi, Jiangsu, China

Abstract: The purpose of this study is to explore the relationship between perceived stress, academic resilience and learning engagement among college students, and to test whether academic resilience plays a mediating role between perceived stress and learning engagement. Using the questionnaire survey method, 166 college students were selected as the research objects, and one-way analysis of variance, Pearson correlation analysis and Bootstrap mediation test were used for data analytics. The results showed that there was no significant difference in the quantitative total score of different categories, but the mean increased first and then decreased; the correlation between academic resilience, learning engagement and perceived stress was weak; academic resilience did not play a significant mediating role between perceived stress and learning engagement. The research shows that the correlation between the three is weak, and the influence mechanism of learning engagement can be further explored by expanding the sample and introducing regulatory variables in the future.

Keywords: Perceived Stress; Learning Engagement; Academic Psychological Resilience; College Students; Mediating Effect

1. Introduction

In the context of the continuous popularization of higher education and the increasingly fierce social competition, college students are under increasing pressure in terms of academic study, interpersonal communication and future development. Perceived stress is an individual's subjective evaluation and emotional response to the stressful environment, which will directly affect their learning status and mental health. Learning engagement is an important active learning psychological state of college students, which mainly includes three dimensions: vitality, dedication and concentration, and is also the core basis for judging their learning effect and development potential.

According to current studies, perceived stress has a significant negative predictive effect on learning engagement, but the intrinsic mechanism between the two remains to be studied. Academic psychological resilience reflects an individual's ability to quickly recover and maintain good adaptation when encountering academic stress and setbacks, and can effectively buffer the negative effects of stress and maintain stable learning performance. Based on this, this study takes academic psychological resilience as a mediating variable to systematically explore its role in the process of perceived stress affecting learning engagement, and ultimately provides practical reference for improving college students' learning engagement and optimizing stress coping styles.

2. Literature Review

2.1 Perceived Stress

2.1.1 Concept of perceived stress

The concept of stress was first proposed by Selye in 1936. He believed that stress is all the non-specific responses produced by an individual after encountering external stimuli, and the individual's cognitive evaluation of related stimulus events will directly affect the occurrence of such reactions and the intensity of their effects [1]. Stress is also often referred to as stress or tension, which refers to a state of physical and mental tension that an individual presents when he perceives that he is threatened. [2] When academic circles discuss stress, they often start from the individual's subjective experience to measure the degree of stress they feel at the level of thinking and emotion. This process is also known as stress perception [3]. For college students, stress perception refers to their

subjective judgment of the intensity of stress they are under in their studies, life and various social activities. With the continuous advancement of higher education in our country, the scale of college students continues to expand, and gradually becomes an important part of the social talent reserve. Compared with other social groups, the campus environment of college students is relatively simple, and the pressure level they face is usually more relaxed [4].

2.1.2 The study of perceived stress

There have been many studies showing that stress perception has a significant effect on the mental health of adolescents. Compas et al. found through meta-analysis that stressors can not only predict the change trend of psychiatric symptoms such as anxiety and depression in children and adolescents over time, but also reverse the dynamic changes in the frequency of stressors, which also confirms the important position of stressors in the development process of their mental health [5]. The longitudinal study conducted by Li Yuru and others further revealed the dynamic characteristics of this relationship: by tracking negative life events, stress perception and emotional state of college students at multiple time points, the results show that the individual's evaluation of daily negative events will indirectly affect emotional state through the intensity of subjective stress [6]. People who evaluate things more positively are often accompanied by more obvious positive emotions; while those who take negative evaluations are more prone to strong negative mood swings.

According to Selye's stress response theory, stressful situations trigger negative emotions like anxiety and depression, driving individuals to cope via the Internet or mobile phones [7]. Empirical research supports this, showing stress and negative emotions positively predict excessive Internet use and problematic smartphone behavior [8-10]. Adolescents with higher perceived stress tend to escape reality through mobile phones, increasing dependence.

2.1.3 Measurement of perceived stress

In terms of measurement tools, Cohen et al. developed the Perceived Stress Scale (PSS) in 1983 based on the core connotation of "individuals judge their own needs as exceeding their coping ability" [11]. The scale is divided into two dimensions: tension and loss of control, with a total of 14 items. It can effectively measure the individual's daily stress level. It has been widely used in various related studies [11]. The scale can be used not only to predict early health problems, but also to explore chronic stress caused by unhealthy lifestyles, especially in adolescent groups. [12] After the scale was introduced in China, Yang Tingzhong and others made localization revisions to form a Chinese version of the Perceived Stress Scale with excellent reliability and validity indicators [13]. Based on the mature measurement performance of this tool, this study chose this scale to evaluate the stress perception level of adolescents.

2.2 Learning Engagement

2.2.1 Concept of learning engagement

The concept of learning engagement evolved from research on work engagement. As studies on work engagement deepened, scholars in education began exploring this construct. Early research focused on time investment: Taylor (1930s) found that students' time spent on learning correlated with outcomes. In the 1970s, Pace introduced the idea of "quality of effort," emphasizing that learning depends not only on time but also on the quality of engagement.

Until 1984, Astin formally proposed the theory of "learning engagement" based on the perspective of behaviorism, defining it as the sum of time and energy that students devote to school learning activities and learning experiences. He believed that the higher the degree of investment in the learning process, the more it can promote their own learning and development [14]. Astin's research further improved the core concept of "quality of effort" and provided a theoretical basis for subsequent research. Since then, Kuh and Hughes have proposed relevant learning investment theories based on the theoretical results of Pace and Astin, further expanding the connotation of the concept, integrating the core elements of time investment and effort investment, and defining learning investment as the degree of concentration, time span and effort level that students invest in the learning process [15-16].

In addition, Newmann et al. proposed that learning engagement is not merely time and effort, but an integration of students' cognitive and emotional involvement [17]. Marks described it as a complex psychological process combining attention, interest, and effort [18]. Schaufeli et al. (2002) further defined learning as a persistent positive state with three dimensions: vitality, dedication, and concentration [19].

2.2.2 Measurement of Learning Engagement

In terms of measurement tools, researchers have developed a variety of mature learning engagement measurement scales for different research objects and research questions. The Learning Engagement Scale (UWES-S) developed by Schaufeli et al. defines learning engagement from three dimensions of vitality, dedication and concentration, laying the foundation for quantitative research in this field [19]. Most domestic scholars have introduced and revised this scale as a standard. Among them, Fang Laitan and other psychological researchers have completed the revision of the Chinese version of the scale and systematically tested its reliability and validity [20]. The reliability data show that the revised scale has good internal consistency as a whole and in each dimension: the alpha coefficient of the total table is 0.951, and the alpha coefficients of the dimensions of vitality, dedication, and focus are 0.858, 0.913, and 0.905, respectively. It can provide reliable measurement support for related research [20].

2.2.3 Dimension of learning engagement

Domestic research on the dimensions of learning engagement has shown a trend of extending from three-dimensional to four-dimensional as a whole. In 2009, Sun Weiwen pointed out that learning engagement mainly covers three core levels: behavioral participation, emotional experience, and the use of cognitive strategies [21]. This definition essentially covers three input dimensions: behavioral, emotional, and cognitive, reflecting students' rational psychological commitment to learning activities. With the rapid development of online learning models, the role of social interaction in learning has become increasingly prominent, which has also promoted some scholars to include social engagement in the research category of learning engagement [21]. In 2017, based on the existing research results, from an ecological perspective, combining the interaction between students, learning groups and learning environments, Yin Rui built a theoretical model of four-dimensional online learning investment, and explored the internal connection between each dimension [22]. In 2020, Li Yanyan found through research that the quality of interaction among student groups in the process of interactive learning will have an important impact on the effect of collaborative learning. Therefore, the dimension of social investment is incorporated into the original research framework of behavioral, emotional and cognitive investment, and the dimensional system of learning investment is further improved [23].

2.3 Academic Mental Resilience

2.3.1 Concept of Academic Mental Resilience

The academic definition of mental resilience is mainly divided into three categories: one is the process view, which regards mental resilience as a dynamic development process, which can be embodied in an individual's positive cognitive orientation, self-regulation ability, and active seeking for assistance. Fonagy and other scholars pointed out that mental resilience is a dynamic process in which an individual can still grow normally in the face of difficulties [24]. In 2005, the American Psychological Association (APA) further defined mental resilience as: the development process in which an individual continues to maintain a good adaptive state when encountering adversity, negative emotions, and various stressful events. The second is the outcome view, which defines mental toughness as a manifestation phenomenon after an individual experiences setbacks. The core feature is that an individual can still produce positive development results after facing stress and negative events. Masten et al. pointed out that the essence of mental toughness is a psychological phenomenon, which is manifested in the individual's ability to successfully cope with threats and present a good state [25]. The third is the ability view, which emphasizes that mental toughness is an individual's own personality trait or core ability, specifically refers to the individual's ability to adapt, adapt, and recover in the face of stressful events. Germezy et al. define it as the individual's ability to recover and maintain adaptive behavior when facing difficulties [26]; Connor and Davidson define mental toughness as the individual's internal characteristics and core psychological ability to cope with negative events such as stress, frustration, and trauma [27]. Academic resilience, a domain-specific form of psychological resilience, refers to individuals' ability to sustain positive cognition, regulate emotions, seek support, and persist in learning when facing academic stress and setbacks.

2.3.2 Factors Affecting Academic Mental Resilience

2.3.2.1 Internal factors affecting mental resilience

Individual self-assessment in different aspects

can affect the evaluation criteria and results of mental resilience at a subjective level. First, self-awareness can affect mental resilience, which will give us encouragement or negative effects. Second, emotional well-being can also affect, for example, a positive attitude towards things can improve mental resilience; on the contrary, a negative attitude towards things can reduce mental resilience. At the same time, an individual's personality and ability also have a great impact on mental resilience. Prominent personality traits or excellent ability can improve mental resilience. Being pessimistic about one's own ability and feeling that one cannot solve it in the face of special circumstances can reduce mental resilience. Overall, an individual's assessment of their own level of various aspects will affect the judgment of mental resilience.

2.3.2.2 External factors affecting mental resilience

Ji Yanhong's research shows that social support has a significant positive role in promoting the psychological resilience of female college students [28]. After receiving social support, female college students can gain emotional comfort, enhance self-confidence, establish a solid social support, and then effectively improve their own psychological resilience [28]. Zhao Jianping conducted relevant research on college students from divorced families to explore the correlation between same-sex attachment of parents and psychological resilience. The results of the study showed that college students' good communication with their mothers and peers was significantly positively correlated with their psychological resilience; while parent-child alienation and peer alienation were negatively correlated with psychological resilience [29]. To sum up, family structure is an important factor affecting the psychological resilience of college students, which has a profound impact on their development.

2.3.3 Measurement of Academic Mental Resilience

This study selected the "Adolescent Mental Resilience Scale" as the core measurement tool. The scale was compiled by Hu Yueqin and others in combination with the psychological resilience development characteristics of the adolescent population, with a total of 27 test questions, and was evaluated by five-point scoring method [30]. The scale as a whole is divided into two core dimensions: personal strength and support. The personal strength dimension includes three sub-dimensions of goal focus, emotional control, and positive cognition, and the support dimension covers two sub-dimensions of interpersonal assistance and family support. After a large number of empirical studies, the scale has good reliability and validity, and the measurement results are stable and reliable, which can provide strong and scientific support for the data investigation and empirical analysis of this study [30].

2.4 Research on the Relationship between Perceived Stress, Learning Engagement and Academic Psychological Resilience

2.4.1 The relationship between perceived stress and learning engagement

Existing studies generally confirm a significant negative correlation between perceived stress and learning engagement, with distinct dimensional differences. Perceived stress most strongly impairs emotional engagement, such as learning interest and subjective identification with learning [31]. In contrast, its negative effect on behavioral engagement (e.g., attending classes and finishing basic tasks) is milder. Notably, moderate stress—from challenging tasks or clear academic goals-can boost cognitive engagement by stimulating motivation and deep thinking [32].

From the perspective of the mechanism of action of the relationship between the two, early related studies mostly focused on the direct relationship between perceived stress and learning investment; with the deepening of theoretical research, scholars have gradually made it clear that perceived stress is not simply directly related to learning investment, but indirectly affects learning investment through the consumption of individual psychological conditions-including attention allocation ability, emotional regulation level, self-efficacy, etc. This function logic is also strongly supported by the theory of resource preservation, which holds that the essence of stress is the process of individual psychological resources depletion, and the maintenance of learning investment cannot be separated from sufficient psychological resources as support [33].

At the group and contextual level, research indicates that external factors such as teacher support and social resources can effectively mitigate the negative effects of perceived stress on learning engagement [34]. Additionally, there are notable differences in stress adaptation

across student groups; rural students tend to maintain higher learning engagement under high-stress conditions compared to urban students [35]. Furthermore, perceived stress can indirectly reduce engagement by weakening psychological adaptability, with a substantial mediating effect observed in prior studies [36]. Domestic empirical research also confirms a significant negative relationship between stress and learning engagement among Chinese college students, providing local empirical support [35, 37].

2.4.2 Relationship between Academic Mental Resilience and Learning Engagement

As an important positive psychological trait of individuals, mental resilience has a profound impact on their daily learning life and long-term physical and mental development. Existing studies have shown that mental resilience can have a significant impact on an individual's learning engagement level through multiple action paths. Numerous studies have shown that students with higher levels of mental resilience have higher learning engagement-related scores than students with lower mental resilience at different educational stages. The research results of scholars Wang Lihua and others also confirm this conclusion [38]. Students with stronger mental resilience perform more prominently in the dimension of optimism, have a more positive and open-minded attitude towards life, can extract positive meaning from unfavorable situations, and are good at using positive emotion management strategies to regulate their own negative emotions, and then continue to engage in learning activities in a stable and good learning state. Scholar Wang Yong found through research that rich positive emotions are one of the core characteristics of students with high mental resilience; such students can experience more positive emotions, and the improvement of positive emotions can help students perceive more positive emotions, optimize their academic emotional performance, and then promote the improvement of learning engagement level [39]. In addition, academic research on the theme of student gratitude further found that mental resilience can play a mediating role and positively improve students' learning engagement level. In a study of left-behind children, it was shown that by implementing gratitude education for left-behind children, improving their gratitude level can enhance their psychological resilience, thereby promoting their learning engagement [40]. Another study on college students shows that mental resilience has a moderating effect, which can alleviate the negative impact of adverse factors on learning engagement; under the same academic burden, students with higher levels of mental resilience can actively adjust their psychological state and optimize learning behavior strategies to maintain a high level of learning engagement [41].

2.4.3 Mediating effect of academic psychological resilience

Numerous empirical studies have confirmed that academic resilience plays an important mediating role in the relationship between perceived stress and learning engagement. Academic resilience, as the main psychological resource of individuals facing adversity, can reduce the energy consumption caused by stress by improving cognition, managing emotions, and focusing on planning, so as to maintain the same or more learning engagement [42]. Scientific studies have clearly pointed out that individuals with high resilience are better at imagining stress situations as some situational tasks, and reduce stress levels through characteristics such as cognitive reconstruction and strategy implementation, while individuals with low resilience are prone to feel negative effects in stress, and their learning engagement levels will decrease [43]. In terms of the action path, on the one hand, perceived stress will indirectly reduce learning investment by reducing the individual's mental resilience ability, and some studies have confirmed that the proportion of related mediating effects is 33.68% -41.80%, and the "personal strength" dimension (such as strong, cheerful, optimistic) is the key to the mediating path [34]; on the other hand, some studies continue to study the mediating path, introducing academic emotions to create a chain mediating model, finding that stress first weakens psychological resilience by suppressing positive emotions, and then affects learning engagement. This multi-path mediating model can more efficiently explain the role of stress in learning engagement [35]. At the same time, the theory of resource preservation provides an important theoretical support for this intermediary relationship. The theory holds that academic mental resilience is a key core psychological resource for individuals, which can reduce the loss caused by stress and provide corresponding protection for learning engagement [33].

3. Research Design

3.1 Purpose of the Study

At present, college students are facing multiple pressures such as academic, interpersonal, and employment, and perceived stress significantly affects their learning engagement and physical and mental health. Existing studies pay more attention to the direct relationship between the two, and there is insufficient verification of the mediating effect of academic mental resilience. Based on this, this study focuses on the pure mediating path of "perceived stress → academic mental resilience → learning engagement", and uses a questionnaire to study the relationship between the three, providing reference for the education work in colleges and universities.

3.2 Research Significance

3.2.1 Theoretical significance

Learning engagement, as a positive psychological and behavioral state, plays an indispensable and important role in the physical and mental health development, academic performance improvement and long-term life development of college students. This is undoubtedly an important issue that needs to be explored and paid attention to jointly by families, schools and society. In our daily life and learning process, we always encounter various types of perceived stress, and this kind of pressure will inevitably affect individuals, especially college students, who are in a critical stage of physical and psychological maturity. Improving the level of learning engagement has extraordinary significance for their growth. Therefore, it is particularly necessary to conduct research on the relationship between perceived stress and learning engagement, but looking at the relevant literature in the past, the existing research still lacks a certain generality.

In addition, academic mental resilience, as a precious positive psychological trait of individuals, plays an indispensable and important role in students' learning and daily life. Based on this, this study, based on sorting out and drawing on previous research results, deeply explores the impact of perceived stress on learning engagement, and systematically analyzes the mechanism of academic mental resilience between the two, so as to further enrich and improve the research system in this field.

3.2.2 Practical significance

This study analyzes the relationship between perceived stress and learning engagement, which can help parents and teachers understand the phenomenon of college students' learning engagement more macroscopically and thoroughly, so as to scientifically and efficiently help college students with poor learning engagement under the influence of perceived stress, and achieve twice the result with half the effort.

At the same time, this study uses academic psychological resilience as a mediating variable, explores the relationship between perceived stress and learning investment, and applies the research results to practical education practice. Parents and teachers can use this research conclusion as a reference to carry out the cultivation of college students' academic psychological resilience, effectively improve students' psychological resilience and adaptability, and ultimately achieve the goal of improving and improving college students' learning investment level. This will also provide new ideas and references for future school education and family parenting practice.

3.3 Research Ideas

(1) This study first conceptually explains the core variables, clarifying the core connotations and boundaries of perceived stress, academic psychological resilience, and learning engagement; then, it conducts literature traceability, systematically combs the previous relevant research results, and clarifies the relationship between the variables.

(2) This study uses the Chinese version of the Perceptual Stress Scale (CPSS), the Learning Engagement Scale, and the Adolescent Mental Resilience Scale as research tools, combined with professional data analytics software, to systematically investigate the overall status of college students' perceived stress, learning engagement and academic psychological resilience, and analyze the differences in demographics variables such as gender, grade, student origin, and whether they are only children. On this basis, explore the correlation between college students' perceived stress, academic psychological resilience and learning engagement, and further test the mediating role of academic psychological resilience between perceived stress and learning engagement.

(3) On this basis, this study will analyze the current situation and causes based on the results

of the survey, and put forward targeted optimization suggestions to provide reference for alleviating the negative impact of perceived stress and cultivating the positive psychological state of college students, thereby helping college students to improve their learning engagement level.

4. Research Methods

4.1 Research Subjects

This study uses stratified sampling method to select college students from 3-5 comprehensive, science and engineering, liberal arts and other different types of colleges and universities across the country as the research objects. The samples cover all grades from freshman to senior. This research plan distributes 200 questionnaires.

4.2 Differences Across Categorized Total-score Groups

166 valid questionnaires were collected, and univariance analysis was used to test the differences in perceived stress, academic resilience, and learning engagement in different demographic variables (such as gender, grade, and major) to control the impact of demographic factors on subsequent analysis and ensure the objectivity and accuracy of the research results. The results are shown in Figure 1.

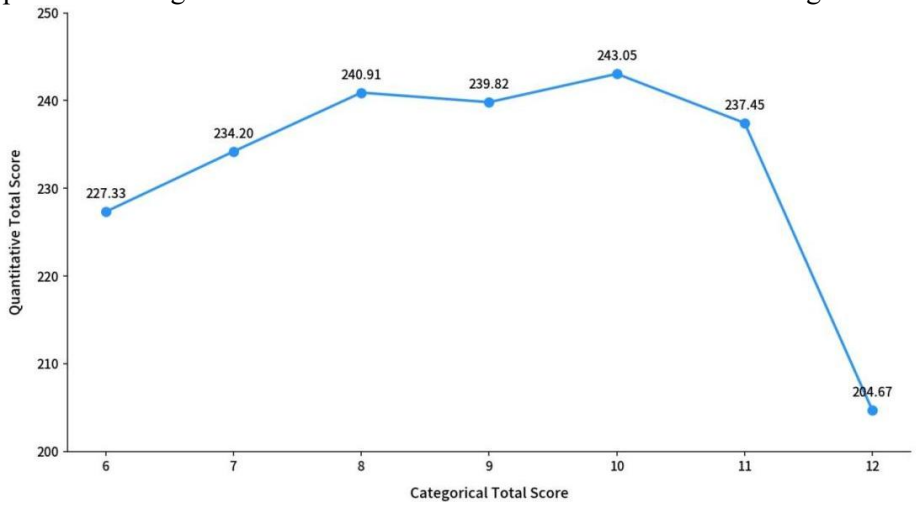


Figure 1. Comparison of Variance Analysis between Classified Total Score and Quantitative Total Score

The results showed that the mean of the quantitative total score of each group showed a nonlinear trend of rising first, then plateauing, and then plummeting as the total score of the category increased. Specifically, the mean of the 6 groups was the lowest (M = 227.33), and then gradually increased to reach the peak of the 10 groups (M = 243.05), the 11 groups slightly declined (M = 237.45), and the 12 groups showed a cliff-like decline (M = 204.67). Although there were obvious changes in the mean, the results of variance analysis showed that the difference between the groups did not reach a statistically significant level ($p > 0.05$), indicating that the difference in the quantitative total score of the different categories of the total score group was not statistically significant in this study sample.

4.3 Exploration of Variable Relationships

Pearson correlation analysis was used to test the correlation degree and direction between the independent variable perceived stress, the mediator variable academic mental resilience and the dependent variable learning engagement, and to clarify the correlation characteristics between each variable, providing a basis for the subsequent mediation model analysis. The correlation heat map is shown in Figure 2.

This study shows that there is no significant difference between the categorized total score and the quantitative total score, and there is no significant correlation between academic resilience, learning engagement and perceived stress, and the mediating effect of academic resilience is not established. The research suggests that students' learning engagement is affected by multiple factors, and the single variable path is difficult to explain its mechanism. In the future, the sample can be expanded to include more variables for further discussion.

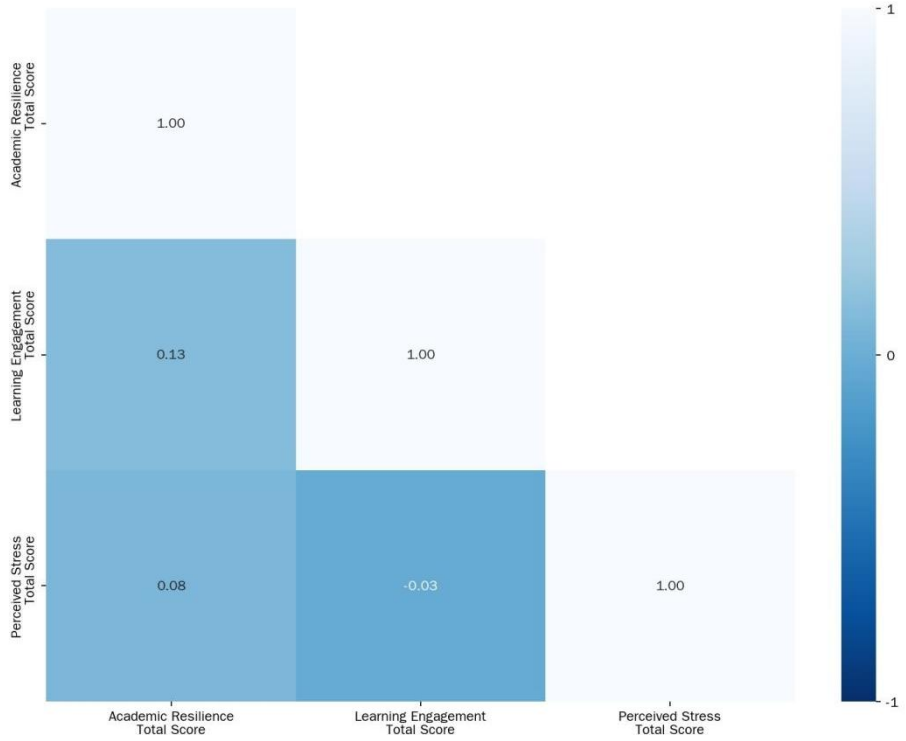


Figure 2. Pearson Heat Map

Table 1. Mediation Effect Test Results

Path	Coefficient	95% CI	p value	Conclusion
Total effect c	-0.084	[-0.530, 0.362]	0.711	insignificant
Indirect effect a × b	0.030	[-0.021, 0.193]	0.503	insignificant
Direct effect c ‘	-0.114	[-0.559, 0.331]	0.613	insignificant

4.4 Mediation Effect Test

The results of the mediating effect test are shown in Table 1.

In this study, the Bootstrap mediation effect test was conducted with perceived stress as an independent variable, academic resilience as a mediating variable, and learning engagement as a dependent variable. The empirical results showed that the total effect of perceived stress on college students’ learning engagement did not reach a significant level ($c = -0.084$, $p = 0.711$); at the same time, the positive predictive effect of perceived stress on academic resilience was also not significant ($a = 0.234$, $p = 0.314$). Further analysis found that academic resilience only showed a marginal significant positive influence on learning engagement ($b = 0.130$, $p = 0.091$). The mediating effect value of this test was 0.030, and its 95% Bootstrap confidence interval included 0, indicating that the mediating effect of academic resilience between perceived stress and learning engagement was not established.

5. Conclusion

The results of one-way ANOVA in this study showed that there was no significant difference in the quantitative total score between different categories of total groups ($F = 1.573$, $p > 0.05$), but the mean of each group showed a nonlinear trend of first rising and then falling. Pearson correlation analysis showed that academic resilience, learning engagement and perceived stress were not significantly correlated ($r = 0.079$-0.130, $p > 0.05$). The results of the mediation effect test further showed that academic resilience did not play a significant mediating role between perceived stress and college students’ learning engagement ($a \times b = 0.030$, 95% CI $[-0.021, 0.193]$, $p > 0.05$). In summary, this model is not statistically supported in the current sample, and the correlation between variables is weak. In the future, the sample can be expanded, the measurement tools can be optimized, and more regulatory variables can be included for further discussion.

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