Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

The Influence of Teachers' Emotional Support on College Students' Physical Education Engagement: A Chain Mediation Model

Hongbo Zhao

hongbo1128@163.com

Huabo Feng

Research Article

Keywords: Teachers' Emotional Support, Physical Education Engagement, Academic Self-efficacy, Positive Academic Emotions

Posted Date: February 27th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8700420/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Purpose: This study aimed to explore the relationship between teachers' emotional support and college students' physical education engagement, as well as to verify the mediating roles of academic self-efficacy and positive academic emotions in this association.

Methods: A cross-sectional research design was adopted, and a total of 913 college students (44.9% males and 55.1% females) from several universities located in Liaoning Province, China were recruited via the convenience sampling method to participate in a questionnaire survey. The research instruments included the Teachers' Emotional Support Questionnaire, the Physical Education Engagement Scale, the Academic Self-Efficacy Questionnaire, and a truncated version of the College Students' General Academic Emotions Questionnaire which only incorporated the dimension of positive academic emotions.

Results: (1) Teachers' emotional support could positively predict college students' physical education engagement; (2) Teachers' emotional support exerted a positive predictive effect on academic self-efficacy, which in turn positively predicted both positive academic emotions and college students' physical education engagement; additionally, positive academic emotions were found to be a positive predictor of college students' physical education engagement.

Conclusion: Not only do academic self-efficacy and positive academic emotions mediate individually in the relationship between teachers' emotional support and college students' physical education engagement, but they also exert a serial mediating role therein.

Background

College students' physical education engagement serves as a critical indicator for evaluating the implementation effectiveness of physical education curricula[1]. Sound physical education engagement can not only improve the self-regulatory capacity of college students' motor systems [2], but also foster their capacity to cope with negative emotions such as anxiety and fear arising from academic studies and daily life [3]. Yet, in recent years, the engagement level of Chinese college students in physical education courses has failed to reach an ideal standard [4]. Drawing on Bronfenbrenner's ecological systems theory, college students' physical education engagement can be conceptualized as a developmental process embedded within an intricately interconnected and nested system [5]. As knowledge transmitters, teachers exert an influential effect on students' learning engagement through their professional authority [6]. Empirical studies have corroborated that a close correlation exists between teachers' emotional support and students' learning engagement, which is capable of enhancing students' learning motivation and engagement levels [7, 8]. Nevertheless, the underlying mechanism through which teachers' emotional support impacts college students' physical education engagement remains unclear at present; additionally, in-depth investigations into the interactive effects of relevant factors (e.g., positive academic emotions and academic self-efficacy) on the relationship between teachers' emotional support and college students' physical education engagement are still lacking. Against this backdrop, the present study aimed to explore the chain mediating roles of academic self-efficacy and positive academic emotions in the association between teachers' emotional support and college students' physical education engagement. This attempt is intended to further elaborate on the underlying influence mechanism, thereby providing theoretical guidance for improving the level of physical education engagement among college students.

Theoretical Basis and Hypotheses

The Relationship Between Teachers' Emotional Support and College Students' Physical Education Engagement

Teachers' emotional support refers to the flexible support proactively provided by teachers and perceived by students in dimensions such as understanding and respect [9]. For instance, during interactions with students through verbal or non-verbal communication, teachers can make students feel cared for, respected, and encouraged [10]. Physical education engagement is defined as a process in which students actively endeavor to master relevant knowledge and skills, characterized by preferences for physical activities and voluntary participation in physical education learning [11]. According to Bronfenbrenner's ecological systems theory, college students' physical education engagement is a process of growth and development embedded in an interconnected and structurally sophisticated nested system[5] Teacher-student interaction relationships rich in emotional support can convey acceptance and trust in students' abilities, as well as respect for their autonomous decision-making rights, thereby enhancing learning motivation and promoting the level of physical education engagement [12]. Empirical studies have confirmed that there is a significant positive correlation between teachers' emotional support and students' learning engagement [13]. Within the school context, teacher support is recognized as the most critical agent exerting impacts on students' motivation and behaviors [14]. Social support theory posits that teachers' emotional support serves as a

crucial predictor of the motivation underlying college students' physical education engagement [6], exerting a substantial influence on their engagement in physical education learning [15]. Furthermore, teachers' emotional support can effectively elevate the level of college students' physical education engagement[16]; when students receive adequate emotional support from teachers, they tend to participate in physical exercises more actively and voluntarily, accompanied by a strong sense of satisfaction derived from physical activities [17].

Based on the above analysis, Hypothesis H1 is proposed in this study: Teachers' emotional support exerts a positive predictive effect on college students' physical education engagement.

The Mediating Role of Academic Self-Efficacy

Academic self-efficacy refers to the cognitive evaluation of one's own ability and confidence to successfully accomplish learning tasks, through which individuals regulate their learning behaviors [18]. According to Self-Efficacy Theory, self-efficacy determines the extent of effort students invest in learning; individuals with high academic self-efficacy firmly believe in their capacity to tackle academic challenges [19]. Empirical studies have confirmed that academic self-efficacy exerts a significant positive predictive effect on learning engagement [20]. Specifically, higher academic self-efficacy correlates with greater learning effort and a higher level of learning engagement [21]. Meanwhile, research has found that the more emotional support students perceive from teachers, the higher their academic self-efficacy [22]. Even in online learning environments where face-to-face teacher-student interaction is unavailable, establishing positive emotional connections can enable students to perceive teachers' emotional support and enhance their academic self-efficacy [23].

Based on the above analysis, Hypothesis H2 is proposed: Academic self-efficacy plays a mediating role in the relationship between teachers' emotional support and college students' physical education engagement.

The Mediating Role of Positive Academic Emotions

Academic emotions refer to various emotional experiences generated by students during the learning process, including those associated with academic success or failure [24]. From the perspective of Control-Value Theory, academic emotions are shaped by individuals' sense of control and value beliefs, and different emotional experiences exert distinct impacts on learners' engagement levels [25]. Studies have indicated that college students can promote their learning engagement through academic emotions [26]. Negative academic emotions may inhibit students' learning engagement [27], whereas positive academic emotions can facilitate it [28]. Thus, academic emotions exert a crucial influence on students' learning engagement [29]. Simultaneously, research has demonstrated that teachers' emotional support, as a crucial component of high-quality teacher-student relationships, affects students' emotional experiences and development [7]. College students who perceive more emotional support from teachers tend to experience more positive emotions and exhibit greater motivation in learning [30]. Evidently, teachers, as key figures in students' learning process, influence students' emotional states in academic contexts [31].

Based on the above analysis, Hypothesis H3 is proposed: Positive academic emotions play a mediating role in the relationship between teachers' emotional support and college students' physical education engagement.

The Chain Mediating Role of Academic Self-Efficacy and Positive Academic Emotions

Academic emotions are the manifestation of emotions in the academic domain, and there is a close interconnection between academic emotions and academic self-efficacy during the learning process [31]. Control-Value Theory of academic emotions posits that control appraisal refers to students' evaluation of their ability to complete learning tasks, with academic self-efficacy being the most prominent factor [32]. When individuals perceive control over the learning process and outcomes, they are more likely to experience positive emotions such as pleasure and pride [32]. Empirical research has confirmed that academic self-efficacy significantly and positively predicts academic emotions [33]. Students with high academic self-efficacy tend to recognize the significance of the knowledge they learn and experience positive academic emotions such as enjoyment [32]. Conversely, such students are prone to feelings of anxiety and exhibit fewer positive academic emotions [34, 35]. Therefore, positive academic emotions are significantly positively correlated with academic self-efficacy, while negative academic emotions are significantly negatively correlated with academic self-efficacy [36].

Based on the above analysis, Hypothesis H4 is proposed: Academic self-efficacy and positive academic emotions play a chain mediating role in the relationship between teachers' emotional support and college students' physical education engagement.

Literature Review

Through a systematic review of relevant research findings, existing studies have laid a solid theoretical and empirical foundation for this field. However, obvious deficiencies remain in terms of research objects, variable relationships, and contextual adaptability: (1) Existing studies exhibit a distinct grade bias in research object selection. (2) Although previous studies have confirmed pairwise correlations among core variables, there is a gap in the depth of understanding of the underlying variable relationships. (3) Existing research faces issues of theoretical generalization and ambiguous practical implications. In summary, this study introduces academic self-efficacy and positive academic emotions as chain mediating variables to explore the influencing relationship and internal mechanism between teachers' emotional support and college students' physical education engagement, constructing a chain mediation model for quantitative analysis of the four core variables. Building on previous theories and research, the hypothetical chain mediation model is illustrated in Fig. 1.

Methods

Participants

This study employed the convenience sampling method to conduct a questionnaire survey among 943 college students who met the eligibility criteria (aged 18–25 years old, full-time undergraduate students, capable of participating in physical activities normally, and free of physical diseases or mental illness history) from several universities in Liaoning Province, China. Questionnaires were distributed and collected online via Wenjuanxing (an online questionnaire platform), where college students from different majors across the first to fourth grades were invited to click the Wenjuanxing link to complete the survey and provide data. During the questionnaire collection process, a questionnaire was deemed invalid and excluded if it met any of the following criteria: (1) excessively short response time (less than 120 seconds); (2) monotonous and regular responses; (3) contradictory answers to reverse-scored items. Finally, 913 valid questionnaires were obtained, with an effective response rate of 96.82%. Among the participants, there were 410 males and 503 females. This study has been approved by the Ethics Committee of Liaoning Normal University, and all participants have signed informed consent forms. The basic information of the research subjects selected in this study is shown in Table 1.

Table 1
Basic information on survey respondents (N = 913)

Demographic Characteristics	Category	Frequency	Percentage (%)
Gender	Male	410	44.9%
	Female	503	55.1%
Household Registration Location	Urban	497	54.4%
	Rural	416	45.6%
Grade Level	Freshman	185	20.3%
	Sophomore	299	32.7%
	Junior	181	19.8%
	Senior	248	27.2%
Class Cadre Experience	Yes	511	56.0%
	No	402	44.0%
Father's Educational Level	Junior High School and Below	329	36.0%
	Senior High School/Vocational Secondary School/College	381	41.7%
	Bachelor's Degree	149	16.3%
	Master's Degree and Above	54	5.9%
Mother's Educational Level	Junior High School and Below	341	37.3%
	Senior High School/Vocational Secondary School/College	396	43.4%
	Bachelor's Degree	128	14.0%
	Master's Degree and Above	48	5.3%

Measures

(1)Teachers' Emotional Support Questionnaire

This questionnaire was developed by Jia [9] based on the original Teachers' Emotional Support Questionnaire designed by Babad et al., Yeung, and Leadbeater. It consists of five dimensions: Care (Items 1–6; e.g., "My teacher pays attention to my personal growth"), Respect (Items 7–10; e.g., "My teacher always understands my difficulties"), Trust (Items 11–13; e.g., "My teacher understands the troubles I face during growth"), Understanding (Items 14–18; e.g., "My teacher often encourages me to develop my strengths"), and Encouragement (Items 19–23; e.g., "Even when criticizing, my teacher respects students' psychological feelings"). The questionnaire comprises 23 items and uses a 5-point Likert scale, with responses ranging from "Completely Disagree" (1 point) to "Completely Agree" (5 points). Higher scores indicate a higher level of perceived teachers' emotional support. In the present study, the Cronbach's α coefficient of the scale was 0.973, with subscale reliability coefficients of 0.900, 0.859, 0.833, 0.894, and 0.889 for the five dimensions, respectively.

(2)Physical Education Engagement Scale

This scale was revised by Wang [37] based on the Chinese version of the Utrecht Work Engagement Scale-Student Version (UWES-S) developed by Fang et al. It includes three dimensions of physical education engagement: Vigor (Items 1–6; e.g., "I am eager to exercise as soon as I get up in the morning"), Dedication (Items 7–11; e.g., "I find physical education learning challenging"), and Absorption (Items 12–17; e.g., "When engaged in physical education learning, I forget everything around me"). The scale contains 17 items and employs a 5-point Likert scale, with responses ranging from "Completely Disagree" (1 point) to "Completely Agree" (5 points). Higher scores reflect a higher degree of physical education engagement. In this study, the Cronbach's α coefficient of the scale was 0.960, with subscale reliability coefficients of 0.894, 0.877, and 0.898 for the three dimensions, respectively.

(3)Academic Self-Efficacy Questionnaire

This questionnaire was adapted by Liang and Zhou [38] based on relevant dimensions of the Academic Self-Efficacy Questionnaire developed by Pintrich, DeGroot, et al. It comprises two dimensions: Self-Efficacy for Learning Ability (Items 1–11; e.g., “I believe I have the ability to achieve good academic results”) and Self-Efficacy for Learning Behavior (Items 12–22; e.g., “When studying, I often use self-questioning and self-answering to check whether I have mastered the content”). The questionnaire includes 22 items and uses a 5-point Likert scale, with responses ranging from “Completely Disagree” (1 point) to “Completely Agree” (5 points). Higher scores indicate a higher level of academic self-efficacy. In the present study, the Cronbach’s α coefficient of the scale was 0.908, with subscale reliability coefficients of 0.749 and 0.876 for the two dimensions, respectively.

(4)General Academic Emotions Questionnaire for College Students

This questionnaire was developed by Ma et al. [39] and assesses 10 common emotions experienced by students during learning. It consists of four dimensions: Positive High Arousal (Items 1–26; e.g., “I always feel nervous before exams”), Positive Low Arousal (Items 27–52; e.g., “I feel happy when learning”), Negative High Arousal (Items 53–78; e.g., “I feel relaxed when doing homework”), and Negative Low Arousal (Items 79–88; e.g., “I generally feel relaxed in class”). The full questionnaire contains 88 items; for the present study, only the Positive High Arousal (Items 1–26) and Positive Low Arousal (Items 27–52) dimensions (52 items in total) were used to measure positive academic emotions among college students. Responses were rated on a 5-point Likert scale, from “Completely Disagree” (1 point) to “Completely Agree” (5 points). Higher scores reflect a higher level of experienced positive academic emotions. In this study, the Cronbach’s α coefficient of the selected subscales was 0.982, with reliability coefficients of 0.964 and 0.965 for the two positive emotion dimensions, respectively.

Statistical Analysis

Valid data were imported into SPSS 26.0 for processing and analysis. Independent-samples t-tests and one-way ANOVA were conducted to examine demographic differences. Pearson correlation analysis, regression analysis, and chain mediation analysis were performed to explore variable relationships. The chain mediation effect was tested using the Bootstrap method via the PROCESS macro 4.2.

Results

Common Method Bias Test

Common method bias refers to an artificial covariance phenomenon between predictor variables and criterion variables, which can introduce systematic errors and thereby affect research results and conclusions. This type of bias is prevalent in questionnaire-based studies [40]. Given that the present study adopted a questionnaire survey to explore the relationships among variables, Harman’s single-factor test was conducted to eliminate such systematic errors. As shown in Table 2, the results indicated that there were 5 common factors with eigenvalues greater than 1. Before factor rotation, the maximum variance explained by a single factor was 31.386%, which was lower than the critical value of 40%. These findings demonstrate that common method bias was not a significant issue in this study.

Table 2
Total Variance Explained

Factor Number	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	35.780	31.386	31.386	35.780	31.386	31.386
2	17.369	15.236	46.622	17.369	15.236	46.622
3	7.621	6.685	53.307	7.621	6.685	53.307
4	5.554	4.872	58.179	5.554	4.872	58.179
5	3.035	2.663	60.842	3.035	2.663	60.842

Descriptive Statistics and Correlation Analysis of Variables

Table 3
Means, Standard Deviations, and Correlation Coefficients of Research Variables (n = 913)

Core Variables	M	SD	1	2	3	4	5	6	7
(1)	1.55	0.50	1						
(2)	1.46	0.50	−0.010	1					
(3)	2.54	1.10	−0.046	0.020	1				
(4)	87.70	21.48	0.032	−0.035	−0.016	1			
(5)	76.80	15.69	−0.022	−0.007	−0.010	0.462**	1		
(6)	195.62	43.86	0.015	0.037	0.015	0.279**	0.269**	1	
(7)	63.87	15.69	−0.047	0.059	−0.007	0.477**	0.515**	0.317**	1

Note: $p < 0.05$, $p < 0.01$, *$p < 0.001$; (1):Gender: 1 = Male, 2 = Female; (2):Household Registration Location: 1 = Urban, 2 = Rural; (3):Grade Level: 1 = Freshman, 2 = Sophomore, 3 = Junior, 4 = Senior.(4):Teachers' Emotional Support;(5):Academic Self-efficacy;(6):Positive Academic Emotions;(7):Physical Education Engagement.

Pearson correlation analysis was conducted using the mean scores of each variable. The results demonstrated that significant correlations existed among college students' teachers' emotional support, academic self-efficacy, positive academic emotions, and physical education engagement (Table 3). The results of this analysis laid a solid foundation for subsequent mediating effect tests, suggesting that academic self-efficacy and positive academic emotions could play mediating roles in the relationship between teachers' emotional support and college students' physical education engagement.

Chain Mediating Effect Analysis of Academic Self-Efficacy and Positive Academic Emotions

Structural Equation Modeling (SEM) was performed using Amos software. A structural equation model was constructed with teachers' emotional support as the independent variable, academic self-efficacy and positive academic emotions as the mediating variables, and physical education engagement as the dependent variable. The results of the model fit indices are presented in Table 4. All fit indices of the model were satisfactory, indicating a high degree of model fit. These findings verify that the chain mediating effect model for the relationship between teachers' emotional support and physical education engagement exhibited good fit.

Table 4
Fit Indices of the Chain Mediating Effect Model

	CMIN/DF	RMSEA	RFI	CFI	TLI
Fit Index	1.300	0.018	0.981	0.997	0.996

This study employed Model 6 of the SPSS macro program Process (developed by Hayes) to conduct 5000 repeated samplings. In this model, teachers' emotional support was designated as the independent variable and physical education engagement as the dependent variable. In contrast, academic self-efficacy and positive academic emotions were identified as serial mediating variables, with the results of path coefficients presented in Fig. 2.

After controlling for gender, household registration location and grade level, first, teachers' emotional support exerted a significant positive predictive effect on physical education engagement ($\beta = 0.476$, $p < 0.001$), which verified Hypothesis H1. Second, it was found that teachers' emotional support could significantly and positively predict academic self-efficacy ($\beta = 0.354$, $p < 0.001$). Third, both teachers' emotional support and academic self-efficacy exerted a significant positive predictive effect on positive academic emotions ($\beta = 0.179$, $p < 0.001$; $\beta = 0.211$, $p < 0.001$). Finally, teachers' emotional support, academic self-efficacy and positive academic emotions all exerted a significant positive predictive effect on physical education engagement ($\beta = 0.278$, $p < 0.001$; $\beta = 0.447$, $p < 0.001$; $\beta = 0.158$, $p < 0.001$), with the detailed results of the multiple regression analysis shown in Table 5.

Table 5
Serial Mediation Model Regression Analysis Results Table

Predictor	(7)			(5)			(6)			(7)		
Variable	β	SE	t	β	SE	t	β	SE	t	β	SE	t
(1)	−0.115	0.054	−2.138*	−0.053	0.042	−1.249	0.024	0.053	0.444	−0.094	0.049	−1.899
(2)	0.140	0.054	2.598*	0.013	0.042	0.297	0.077	0.053	1.444	0.122	0.049	2.470
(3)	−0.003	0.024	−0.112	−0.003	0.019	−0.133	0.015	0.024	0.612	−0.004	0.022	−0.173
(4)	0.476	0.029	16.597***	0.354	0.023	15.757***	0.179	0.032	5.572***	0.278	0.030	9.227***
(5)							0.211	0.042	5.029***	0.447	0.039	11.400***
(6)										0.158	0.031	5.146***
R	0.487			0.464			0.324			0.603		
R^2	0.237			0.215			0.105			0.364		
F	70.589			62.262			21.337			86.432		

Note: p < 0.05, p < 0.01, *p < 0.001; (1):Gender: 1 = Male, 2 = Female; (2):Household Registration Location: 1 = Urban, 2 = Rural; (3):Grade Level: 1 = Freshman, 2 = Sophomore, 3 = Junior, 4 = Senior.(4):Teachers' Emotional Support;(5):Academic Self-efficacy;(6):Positive Academic Emotions;(7):Physical Education Engagement.

After testing the mediating effects using the Bootstrap resampling method, the total effect of teachers' emotional support on physical education engagement was 0.476. Further analysis revealed three significant mediating effects (Table 6), which verified Hypotheses H2, H3, and H4. First, the indirect effect through the path of Teachers' Emotional Support→Academic Self-Efficacy→Physical Education Engagement was 0.159, accounting for 33.40% of the total effect, with the Bootstrap confidence interval excluding zero. This indicates that academic self-efficacy plays a crucial role in the relationship between teachers' emotional support and physical education engagement, demonstrating a significant mediating effect of academic self-efficacy in this association. Second, the indirect effect via the path of Teachers' Emotional Support→Positive Academic Emotions→Physical Education Engagement was 0.028, accounting for 5.88% of the total effect, and the Bootstrap confidence interval also excluded zero. This suggests that positive academic emotions exert a significant mediating effect on the relationship between teachers' emotional support and physical education engagement. Similarly, academic self-efficacy and positive academic emotions together exert a significant serial mediating effect on the relationship between teachers' emotional support and physical education engagement, indicating a substantial chain-mediated association between the two variables. In summary, the above results demonstrate that teachers' emotional support exerts a significant impact on college students' physical education engagement through the two mediating variables of academic self-efficacy and positive academic emotions.

Table 6
Bootstrap mediation effects and confidence intervals

Effect	Effect Size	BootSE	95%CI		Effect Ratio
			LLCI	ULCI	
Total Effect	0.476	0.029	0.420	0.532	100%
Direct Effect(X→Y)	0.278	0.030	0.219	0.337	58.40%
Indirect Effect(Ind1 + Ind2+Ind3)	0.198	0.022	0.158	0.245	41.60%
Ind1: X→M1→Y	0.159	0.021	0.121	0.202	33.40%
Ind2: X→M2→Y	0.028	0.009	0.013	0.047	5.88%
Ind3: X→M1→M2→Y	0.012	0.004	0.005	0.020	2.52%

Note: X: Teachers' Emotional Support;Y：Physical Education Engagement；M1:Academic Self-efficacy；M2：Positive Academic Emotions.

Discussion

The Relationship Between Teachers' Emotional Support and College Students' Physical Education Engagement

This study found that teachers' emotional support was positively correlated with college students' physical education engagement, indicating that teachers' emotional support is an effective approach to enhancing college students' physical education engagement levels [17]. This finding verifies Hypothesis H1 and is consistent with previous research results [13]. Individuals' learning engagement is primarily influenced by internal factors (e.g., self-efficacy and psychological resilience) and external factors (e.g., school climate and teacher-student relationships) [40]. Within the school context, teachers are the most critical agents shaping students' motivation and behavior, and serve as an important, positive predictor of students' learning engagement motivation [14]. Existing studies have confirmed that teachers' emotional support can positively predict students' learning engagement [13, 41]. When students perceive teachers' care, affection, and support, it enhances their academic self-efficacy, thereby promoting active participation in learning activities and persistent pursuit of learning goals[42, 43]. Meanwhile, students not only exhibit more positive learning attitudes and values [44], but also participate more actively in physical exercise and experience a strong sense of satisfaction with physical activity [44]. Therefore, colleges and universities should prioritize teachers' emotional support as a core priority, and collaborate with multiple educational stakeholders to build an ecological system of emotional care for college students. By stimulating students' motivation for physical education learning, improving their psychological state, and increasing their participation in physical education classes, we can comprehensively promote college students' physical education engagement and the coordinated development of their physical and mental well-being.

The Mediating Role of Academic Self-Efficacy

This study found that academic self-efficacy plays a mediating role in the relationship between teachers' emotional support and college students' physical education engagement. Teachers' emotional support can positively predict the level of college students' academic self-efficacy—specifically, the higher the level of teachers' emotional support, the stronger students' academic self-efficacy, which in turn leads to higher levels of physical education engagement. This finding verifies Hypothesis H2 and is consistent with the results of other scholars [45, 46]. Teachers' emotional support permeates students' campus life, and the emotional support students receive motivates them to complete challenging tasks [6]. Meanwhile, to achieve excellent academic performance, students transform academic pressure into motivation, and relatively high academic self-efficacy makes them more willing to engage in learning [47]. Existing research has confirmed that teachers' emotional support can positively predict an individual's academic self-efficacy [48]. By establishing positive emotional bonds, teachers enable students to perceive their emotional support and enhance their academic self-efficacy [49]. Therefore, colleges and universities should advocate that teachers strengthen their emotional support. Through sustained encouraging feedback, personalized care, and trust-based interactions with college students, we can effectively enhance their academic self-efficacy and help them establish a positive developmental pathway of "competence recognition→active engagement→growth breakthrough".

The Mediating Role of Academic Emotions

This study found that academic emotions play a mediating role in the relationship between teachers' emotional support and college students' physical education engagement. That is, the higher the level of teachers' emotional support, the higher the level of students' positive academic emotions, which in turn leads to greater engagement in physical education. This finding verifies Hypothesis H3 and is consistent with the results of other scholars [7, 30]. The teacher-student relationships shaped by teachers' emotional support are a key aspect of students' learning environment [50], influencing their corresponding emotional experiences and development [7]. The emotional care students perceive can either facilitate their engagement in learning behaviors or lead to disengagement [51]; the more emotional support students receive from teachers, the more positive emotions they experience, and the more motivated they are to learn [30]. Existing research has confirmed that academic emotions are an important mechanism through which teachers' emotional support influences students' learning engagement. By fostering students' positive academic emotional experiences [7], teachers' emotional support enables students to increase their learning engagement, overcome learning difficulties, and achieve academic success [29]. Therefore, colleges and universities must prioritize the educational value of teachers' emotional support. By establishing positive feedback mechanisms, providing personalized emotional care, and creating a harmonious learning atmosphere, institutions can effectively alleviate students' negative academic emotions, cultivate a positive, optimistic, and resilient academic emotional state, and lay a solid psychological foundation for their physical education engagement and academic development.

The Serial Mediating Role of Academic Self-Efficacy and Academic Emotions

This study found that academic self-efficacy and academic emotions exert a serial mediating role in the relationship between teachers' emotional support and college students' physical education engagement. High levels of academic self-efficacy are significantly positively correlated with positive academic emotions, and academic self-efficacy can positively predict the level of academic emotions [33]. This finding verifies Research Hypothesis H4 and is consistent with the results of other scholars. Students with low academic self-efficacy

tend to experience emotions such as tension and anxiety when facing academic difficulties [52, 53]. In contrast, those with high academic self-efficacy experience more positive academic emotions, which in turn promotes their engagement in learning [54]. Existing research has confirmed that college students' academic self-efficacy can positively predict their academic emotion levels [55]; positive academic emotions are significantly positively correlated with academic self-efficacy, while negative academic emotions are significantly negatively correlated with academic self-efficacy [36]. Therefore, colleges and universities should focus on enhancing college students' academic self-efficacy. By strengthening competence recognition, optimizing goal setting, and building support systems, institutions can help students cope with physical education learning challenges with more positive academic emotions, and form a virtuous developmental cycle.

Conclusions

(1) Teachers' emotional support, academic self-efficacy, positive academic emotions, and college students' physical education engagement are pairwise correlated.

(2) Teachers' emotional support can positively predict college students' physical education engagement.

(3) Academic self-efficacy plays a partial mediating role in the relationship between teachers' emotional support and college students' physical education engagement.

(4) Positive academic emotions play a partial mediating role in the relationship between teachers' emotional support and college students' physical education engagement.

(5) Academic self-efficacy and positive academic emotions exert a serial mediating role in the relationship between teachers' emotional support and college students' physical education engagement.

Limitations and Prospects

This study explores the relationship between teachers' emotional support and college students' physical education engagement, as well as the internal mechanism of academic self-efficacy and positive academic emotions in the impact of teachers' emotional support on college students' physical education engagement. It aims to positively affect college students' physical education engagement, promote the improvement of teachers' teaching methods, and advance the high-quality development of modern education. However, this study has limitations that need to be addressed and improved.

First, this study adopts a questionnaire survey among college students to collect data, which is a cross-sectional study, making it difficult to reveal the causal relationships between variables. Future research can adopt longitudinal study or experimental research designs to further verify the causal relationships among teachers' emotional support, physical education engagement, academic self-efficacy, and positive academic emotions.

Second, this study only focuses on the serial mediating role of academic self-efficacy and positive academic emotions between teachers' emotional support and college students' physical education engagement. There may also be other relevant mediating variables such as learning motivation, classroom environment, and academic burnout that affect this relationship. Future research can incorporate other related variables, conduct in-depth studies from multi-dimensional and multi-perspective angles, and improve the research on the relationship between teachers' emotional support and college students' physical education engagement.

Finally, the research objects of this study are undergraduate students from freshman to senior year in colleges and universities, and the sample source of the research objects is relatively single, which has limitations. Future research can expand the sample scope of research objects, such as different universities and different majors, to enhance the authenticity of the relationship between teachers' emotional support and college students' physical education engagement.

Therefore, this study should adjust and optimize research methods, variable selection, and data sources, further improve the research on the relationship between teachers' emotional support and college students' physical education engagement, and provide more reliable theoretical guidance for positively influencing college students' physical education engagement.

Declarations

Acknowledgements

The authors would like to thank 913 college students, for agreeing to participate in the study.

Compliance statement

During the implementation of this study,it strictly adheres to the International Ethical Guidelines for Health—related Research Involving Human Subjects issued by the Council for International Organizations of Medical Sciences (CIOMS) and relevant Chinese scientific research ethics management measures and regulations. All aspects, such as the design of research methods and the collection and use of data, prioritize the protection of the rights, safety, and well—being of participants, ensuring that the research is carried out within a legal and compliant framework.

Authors' contributions

H-B Z is responsible for questionnaire distribution, data analysis and methods. H-B F is responsible for data analysis and writing the original manuscript. H-B Z is responsible for conceiving, writing, reviewing, editing the first draft and obtaining funds. H-B F is responsible for conceiving, writing, reviewing and editing the first draft. All the authors read and approved the final manuscript.

Funding

Not applicable.

Data availability

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding authors.

Ethics approval and consent to participate

The design of this study followed the guidelines and regulations of the Declaration of Helsinki and approved by Ethics Committee of Liaoning Normal University (LL2025097), and all participants signed an informed consent form and were paid for their participation.

Consent for publication

Not applicable.

Competing interests

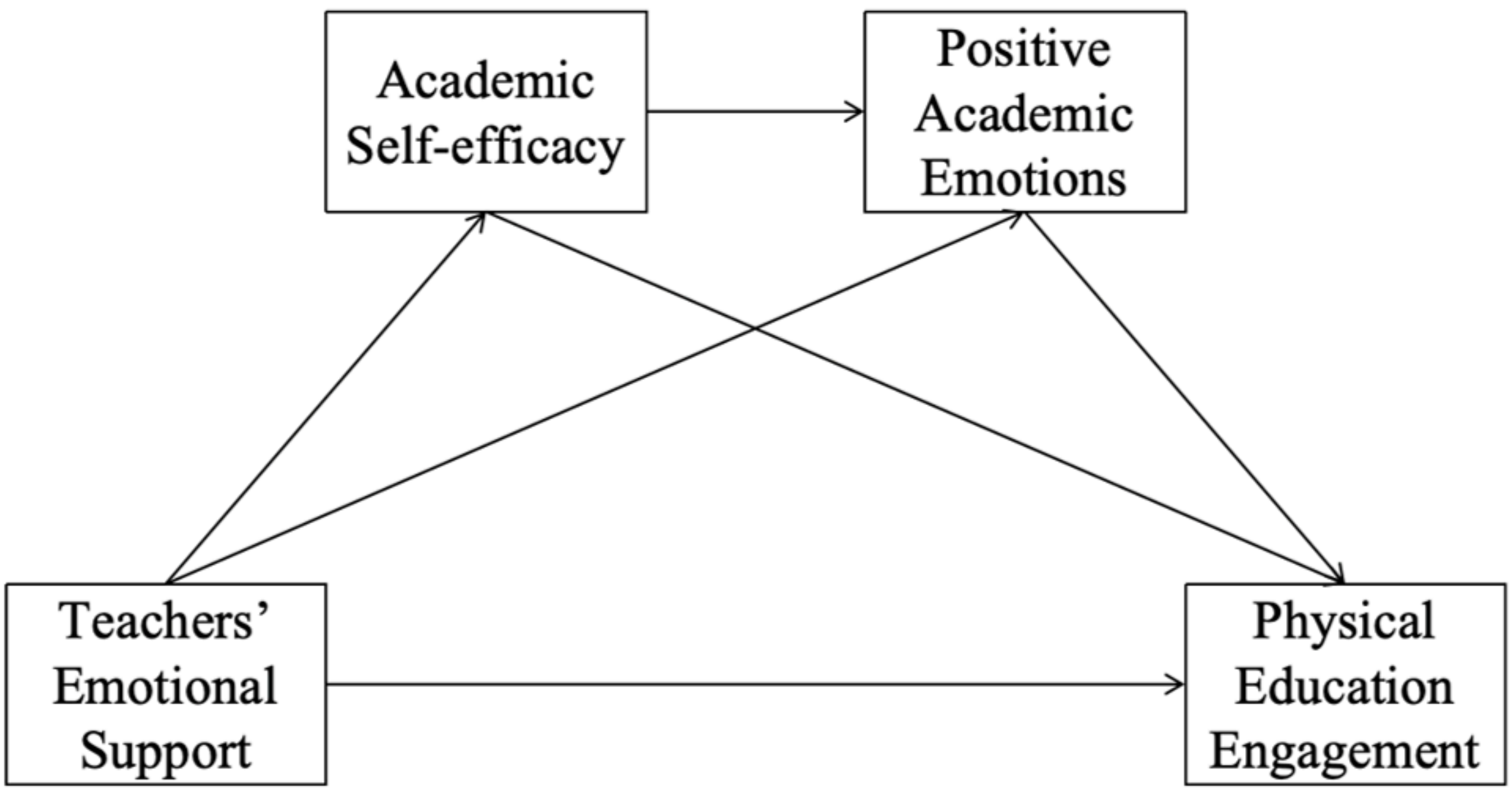
The authors declare no competing interests.

References

1. Hu QS, Guo HF. Current situation, causes and countermeasures of students' participation in physical education curriculum implementation under the background of new curriculum reform [新课改背景下学生参与体育课程实施的现状、制因及对策]. J Shanghai Univ Sport [上海体育学院学报]. 2009;33(6):71–7. https://doi.org/10.16099/j.cnki.jsus.2009.06.017.
2. Wang Y. (2024). The influence of teachers' transformational leadership behavior on physical education learning engagement of level three students [教师变革型领导行为对水平三学生体育学习投入的影响研究] (Unpublished master's thesis). Wuhan Sports University, Wuhan, China. https://doi.org/10.27384/d.cnki.gwhtc.2024.000523
3. Shen JJ. (2023). The influence of classroom interaction in physical education teaching on social anxiety and physical education learning engagement of seventh-grade students [体育教学课堂互动对初一学生社交焦虑和体育学习投入的影响] (Unpublished master's thesis). Liaoning Normal University, Dalian, China. https://doi.org/10.27212/d.cnki.glnsu.2023.001233
4. Huang WZ. (2024). The influence of exercise self-efficacy on college students' physical education learning engagement: A chain mediating model [锻炼自我效能感对大学生体育学习投入的影响：一个链式中介模型] (Unpublished master's thesis). Guangzhou Sport University, Guangzhou, China. https://doi.org/10.27042/d.cnki.ggztc.2024.000188
5. Bronfenbrenner U. The ecology of human development: Experiences by nature and design. Harvard University Press; 1979.
6. Chou XC. (2023). The relationship between teachers' emotional support, academic self-efficacy and learning engagement of senior high school students and educational countermeasures [高中生教师情感支持、学业自我效能感与学习投入的关系及教育对策研究] (Unpublished master's thesis). Shaanxi University of Technology, Hanzhong, China. https://doi.org/10.27733/d.cnki.gsxlg.2023.000158
7. Li J. (2023). The influence of teachers' emotional support on middle school students' learning engagement [教师情感支持对中学生学习投入的影响研究] (Unpublished master's thesis). East China Normal University, Shanghai, China. https://doi.org/10.27149/d.cnki.ghdsu.2023.001781

8. Meyer DK, Turner JC. (2007). Scaffolding emotions in classrooms. In Emotion in education (pp. 243–258).
9. Jia J. (2012). Teachers' emotional support and its influence on middle school students' self-esteem and academic self-efficacy [教师情感支持及其对中学生自尊、学业自我效能感的影响研究] (Unpublished master's thesis). Southwest University, Chongqing, China.
10. Yeung R, Leadbester B. Adults make a difference: The protective effects of parent and teacher emotional support on emotional and behavioral problems of peer-victimized adolescents. J Community Psychol. 2010;38(1):80–98.
11. Lyu ZC. (2022). The influence of exercise self-efficacy on senior high school students' physical education learning engagement: The mediating role of exercise self-handicapping [锻炼自我效能感对高中生体育学习投入的影响：锻炼自我妨碍的中介作用] (Unpublished master's thesis). Northeast Normal University, Changchun, China. https://doi.org/10.27011/d.cnki.gdbsu.2022.001176
12. Bevans K, Fitzpatrick LA, Sanchez B, et al. Individual determinants of student engagement in physical education. J Teach Phys Educ. 2010;29(4):399–416.
13. Liao YX. (2022). The relationship between teachers' emotional support and primary school students' learning engagement in Linwu: The mediating role of school belonging and its intervention research [临武教师情感支持与小学生学习投入的关系：学校归属感的中介作用及其干预研究] (Unpublished master's thesis). Central China Normal University, Wuhan, China.
14. Stroet K, Opdenakker MC, Minnaert A. Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. Educational Res Rev. 2013;9(9):65–87.
15. Jiang JW, Hao XF. (2014). The influence of praise and criticism on junior high school students' learning engagement [表扬与批评对初中生学习投入的影响]. Journal of Xinyang Normal University (Philosophy and Social Sciences Edition) [信阳师范学院学报 (哲学社会科学版)], 34(3), 13–17.
16. Lin CD, Cai L, Jia XJ. The relationship between senior high school students' perceived teacher support and learning engagement: The chain mediating role of academic self-efficacy and achievement goal orientation [高中生感知教师支持与学习投入的关系：学业自我效能感和成就目标定向的链式中介作用]. Volume 36. Psychological Development and Education [心理发展与教育]; 2020. pp. 700–7. 6.
17. Han BN, Liang Q. (2021). The influence of special teacher support on senior high school students' physical exercise satisfaction [专项教师支持对高中生体育锻炼满意感的影响]. J Teach Manage [教学与管理], (6), 40–3.
18. Schunk DH. Self-efficacy and achievement behaviors. Educational Psychol Rev. 1989;1(1):173–208.
19. Bandura A. Self-efficacy mechanism in human agency. Am Psychol. 1982;37(2):122–46. https://doi.org/10.1037/0003-066X.37.2.122.
20. Liao YG. (2010). The current situation and relationship of college students' learning values, learning self-efficacy and learning engagement [大学生学习价值观、学习自我效能感和学习投入的现状及其关系研究] (Unpublished master's thesis). Fujian Normal University, Fuzhou, China.
21. Zhao SS. (2023). The relationship between senior high school students' growth mindset and learning engagement: The longitudinal mediating role of academic self-efficacy and effort belief [高中生成长型思维和学习投入的关系：学业自我效能感和努力信念的纵向中介作用] (Unpublished master's thesis). Tianjin Normal University, Tianjin, China. https://doi.org/10.27363/d.cnki.gtsfu.2023.000060
22. Hao LY. (2023). The influence of teachers' emotional support on junior high school students' learning engagement: The mediating role of academic self-concept [教师情感支持对初中生学习投入的影响：学业自我概念的中介] (Unpublished master's thesis). Nanchang University, Nanchang, China. https://doi.org/10.27232/d.cnki.gnchu.2023.004661
23. Feng YP. (2020). The relationship between teachers' emotional support, learning self-efficacy and learning engagement of upper primary school students and educational enlightenment [小学高年级学生教师情感支持、学习自我效能感与学习投入的关系及教育启示] (Unpublished master's thesis). Henan University, Kaifeng, China.
24. Guo WB, Su M. A study on the influence of teachers' emotional support in online learning space on college students' learning engagement: Based on the mediating role of academic self-efficacy [网络学习空间教师情感支持对大学生学习投入的影响研究 — 基于学业自我效能感的中介作用]. Theory Pract Educ [教育理论与实践]. 2021;41(30):50–4.
25. Zhang HX. The influence of perceived head teacher's emotional support on learning engagement of first-year senior high school boarders: The mediating role of academic emotions [感知班主任情感支持对高一寄宿生学习投入的影响：学业情绪的中介作用]. Mental Health Education in Primary and Secondary Schools [中小学心理健康教育]; 2024. pp. 17–21. 24.
26. Pekrun R, Linnenbrink-Garcia L. (2012). Academic emotions and student engagement. In Handbook of research on student engagement (pp. 259–282).
27. Perry RP, Hladkyj S, Pekrun RH, et al. Academic control and action control in the achievement of college students: A longitudinal field study. J Educ Psychol. 2001;93(4):776. https://doi.org/10.1037/0022-0663.93.4.776.
28. Goetz T, Frenzel AC, Hall NC, et al. Antecedents of academic emotions: Testing the internal/external frame of reference model for academic enjoyment. Contemp Educ Psychol. 2008;33(1):9–33. https://doi.org/10.1016/j.cedpsych.2007.03.001.

29. Xu N. (2021). The relationship between parental educational expectations, perceived social support, academic emotions and learning engagement of senior high school students [高中生父母教育期望、领悟社会支持、学业情绪与学习投入的关系研究] (Unpublished master's thesis). Harbin Normal University, Harbin, China.
30. Duan SY. (2020). The relationship between teacher support, psychological capital and academic emotions of senior high school students (Unpublished master's thesis). Tianjin Normal University, Tianjin, China.
31. Wang YT. (2022). The relationship between teacher-student relationship, academic emotions and academic self-efficacy of middle school students and educational enlightenment [中学生师生关系、学业情绪、学业自我效能感之间的关系及教育启示] (Unpublished master's thesis). Tianjin Normal University, Tianjin, China. https://doi.org/10.27363/d.cnki.gtsfu.2022.000805
32. Pekrun R. The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. Educational Psychol Rev. 2006;18(4):315–41. https://doi.org/10.1007/s10648-006-9029-9.
33. Chang JJ. (2017). The relationship between parental rearing styles, academic self-efficacy and academic emotions of junior high school students (Unpublished master's thesis). Hebei University, Baoding, China.
34. Zhou Y, Dong Q. A study on the relationship between learning motivation, attribution, self-efficacy and students' self-regulated learning behavior [学习动机、归因、自我效能感与学生自我监控学习行为的关系研究]. Psychological Development and Education [心理发展与教育]; 1994. pp. 30–3. 3.
35. Tai SH. (2017). A study on the relationship between academic self-efficacy, academic emotions and academic achievement of senior high school students [高中生学业自我效能感、学业情绪与学业成绩的关系研究] (Unpublished master's thesis). China West Normal University, Nanchong, China.
36. Li J, Song SG. (2011). The relationship between academic emotions and academic self-efficacy of college students [大学生学业情绪与学业自我效能感的关系]. J Univ Jinan [济南大学学报], (4), 418–21.
37. Fang LT, Shi K, Zhang FH. Reliability and validity of the Chinese version of the Learning Engagement Scale [中文版学习投入量表的信效度研究]. Chin J Clin Psychol [中国临床心理学杂志]. 2008;16(6):618–20.
38. Liang YS. (2000). A study on college students' achievement goals, attribution styles and academic self-efficacy [大学生成就目标、归因方式与学业自我效能感的研究] (Unpublished master's thesis). Central China Normal University, Wuhan, China.
39. Ma HX. Development of the General Academic Emotion Questionnaire for college students [大学生一般学业情绪问卷的编制]. Chin J Clin Psychol [中国临床心理学杂志]. 2008;16(6):594–6.
40. Zhang LB. (2020). The relationship between teachers' emotional support, academic self-concept and learning engagement of senior high school students and educational enlightenment [高中生教师情感支持、学业自我概念和学习投入的关系研究及教育启示] (Unpublished master's thesis). Henan University, Kaifeng, China. https://doi.org/10.27114/d.cnki.ghnau.2020.000180
41. Lu XT. (2020). An empirical study on the influence of teacher support on the learning engagement of migrant children [教师支持对流动儿童学习投入影响的实证研究] (Unpublished master's thesis). Gannan Normal University, Ganzhou, China.
42. Han BN, Liang Q. (2021). The influence of special teacher support on senior high school students' physical exercise satisfaction [专项教师支持对高中生体育锻炼满意感的影响]. J Teach Manage [教学与管理], (6), 40–3.
43. Wentzel KR, Battle A, Russell SL, et al. Social supports from teachers and peers as predictors of academic and social motivation. Contemp Educ Psychol. 2010;35(3):193–202. https://doi.org/10.1016/j.cedpsych.2010.01.001.
44. Gasser L, Grütter J, Buholzer A, Wettstein A. Emotionally supportive classroom interactions and students' perceptions of their teachers as caring and just. Learn Instruction. 2017;49:1–11. https://doi.org/10.1016/j.learninstruc.2016.11.003.
45. Zhu HT, Yao XX. Academic stress, academic self-efficacy and learning engagement of military academy college students: Interaction effect and mediating effect [军校大学生学业压力、学业自我效能感与学习投入：交互效应与中介效应]. Psychological Technology and Application [心理技术与应用]; 2015. pp. 35–41. 8.
46. Wang SB. (2019). A study on the relationship between college students' learning engagement, academic self-concept and social support [大学生学习投入与学业自我概念、社会支持的关系研究] (Unpublished master's thesis). Nanchang University, Nanchang, China.
47. He QJ, Feng XZ. A discussion on the relationship between perfectionism, academic self-efficacy and learning engagement of junior high school students [初中生完美主义、学业自我效能感与学习投入的关系探讨]. Western China Qual Educ [西部素质教育]. 2015;1(7):86–7.
48. Ye JW. (2019). A study on the influence of improving perceived teacher emotional support on the academic self-efficacy and English academic performance of art and sports students [提升感知教师情感支持对艺体生学业自我效能感、英语学业成绩的影响研究] (Unpublished master's thesis). Sichuan Normal University, Chengdu, China.
49. Guo WB, Su M. A study on the influence of teachers' emotional support in online learning space on college students' learning engagement: Based on the mediating role of academic self-efficacy [网络学习空间教师情感支持对大学生学习投入的影响研究 — 基于学业自我效能感的中介作用]. Theory Pract Educ [教育理论与实践]. 2021;41(30):50–4.
50. Wubbels T, Brekelmans M, Brok D et al. P.,. (2014). Teacher-student relationships and classroom management. In Handbook of classroom management (Vol. 2, pp. 363–386).



51. Skinner EA, Belmont M. Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. J Educ Psychol. 1993;85(4):571–81. https://doi.org/10.1037/0022-0663.85.4.571.
52. Jiao M. (2014). A study on the relationship between parental expectations, academic self-efficacy and academic emotions of senior high school students [高中生父母期望和学业自我效能感与学业情绪的关系研究] (Unpublished master's thesis). Inner Mongolia Normal University, Hohhot, China.
53. Zhou Y, Wang XC. Middle school students' learning concept and its influence path on academic achievement [中学生的学习观及其对学业成绩的影响路径]. Psychological Exploration [心理学探新]; 2010. pp. 69–74. 6.
54. Li YX, Wang ZY, Zhou MY, Yang YC, Zhao MX, Dong Y. The relationship between peer academic support and academic emotions in high school physics and chemistry: The mediating role of learning efficacy and the moderating role of gender [高中生物理和化学学科中同伴学业支持与学业情绪的关系：学习效能感的中介作用和性别的调节作用]. Psychological Development and Education [心理发展与教育]; 2023. pp. 58–67. 1.
55. Zhang RS, Yuan LM. A study on the relationship between college students' foreign language anxiety, self-efficacy and foreign language achievement [大学生外语焦虑、自我效能感与外语成绩关系的研究]. Psychological Development and Education [心理发展与教育]; 2004. pp. 56–61. 3.

Figures

Figure 1

Chain mediation hypothesis model

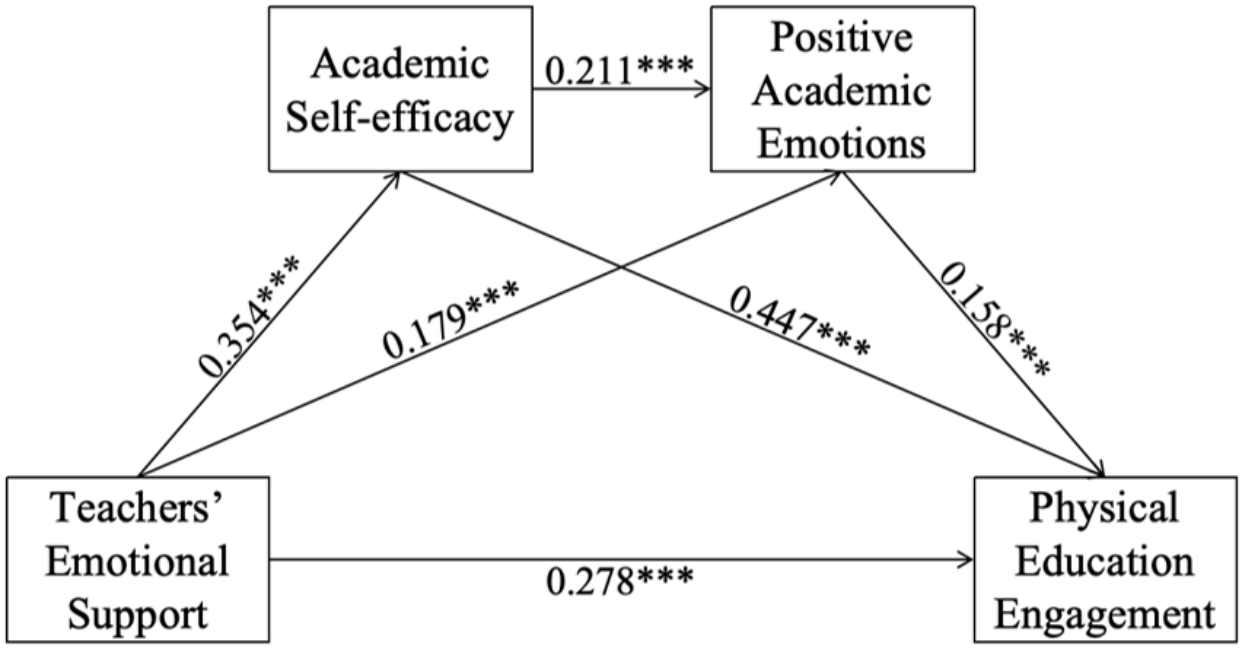


Figure 2

Serial Mediation Model Diagram