Environment and Social Psychology (2025) Volume 10 Issue 7 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v10i7.3472 2424-7979 (P)

RESEARCH ARTICLE

The influence of teachers' independent support on college students' learning engagement：Mediator and regulatory effects

Linlin Zhu*, Lijun Wang

Education Management Major, Lampang Inter-Tech collage

*** Corresponding author:** Dr.S. Lara Priyadharshini,larapriyadharshini@gmail.com

ABSTRACT

Objective: To deeply analyze how the independent support of higher vocational teachers affects college students' learning engagement and explore its internal operating mechanism. At the same time, this study will also examine the mediating effect of academic self-efficacy and the regulating effect of basic psychological needs. **Methods:** A series of standardized scales, including teacher autonomy support scale, learning engagement scale, academic self-efficacy scale and basic psychological needs scale, were used to conduct a comprehensive questionnaire survey on 903 students from three different universities. SPSS27.0 statistical software was used to analyze the collected data in detail. In order to more deeply reveal the mediating effect of academic self-efficacy between teachers' independent support and learning involvement, a structural equation model was built with the help of AMOS28.0 software, and Bootstrap method was applied to test the mediating effect, so as to accurately describe the path relationship between variables. **Results:** It was found that there were significant correlations among teachers' independent support, learning engagement, academic self-efficacy and basic psychological needs. Direct effect analysis showed that teacher autonomy support had a significant direct effect on learning engagement ($\beta = 0.610$, $P < 0.001$). The mediation effect analysis further revealed that academic self-efficacy played a partially mediating role in the influence of teacher autonomy support on learning engagement, with an effect size of 0.312 and a 95% confidence interval of [0.238, 0.373]. At the same time, basic psychological needs also played an important moderating role in this process ($\beta = 0.149$, $P < 0.001$). **Conclusion:** The independent support of higher vocational teachers can not only directly promote college students' learning engagement, but also have an indirect positive impact on college students' learning engagement through the transfer effect of academic self-efficacy and the regulating effect of basic psychological needs.

Keywords: college students; learning engagement; teachers' independent support; academic self-efficacy; basic psychological needs

The independent support experience provided by teachers in the school educational environment has a profound impact on students' emotional state, interpersonal relationship and academic achievement. The so-called independent support of teachers means that teachers can put themselves in the position of students, respect students' personal will, give high recognition and respect to students' independent thinking and behavior, and empower students with the right and opportunity to make free choices and decisions, while reducing coercive intervention on students[1]. Previous studies have not only defined this concept from the

ARTICLE INFO
Received: 24 February 2025 | Accepted: 21 April 2025 | Available online: 11 July 2025

CITATION
Zhu LL, Wang LJ. The influence of teachers' independent support on college students' learning engagement：mediator and regulatory effects. *Environment and Social Psychology* 2025; 10(7): 3472. doi:10.59429/esp.v10i7.3472

perspective of teachers, but also emphasized the importance of defining teachers' autonomous support from the perspective of students' perception. Specifically, when students perceive that teachers create an environment full of autonomy and support, feel the trust of teachers, and think that teachers can understand themselves and are willing to give themselves free space to explore and try, rather than frequently adopt compulsive attitudes or behaviors, such teacher independent support will be reflected. Therefore, teachers' independent support is not a unilateral act, but needs to be perceived and recognized by students. When students feel that the teacher has created an autonomous and supportive learning environment for them, they are greatly encouraged. This kind of environment makes students deeply realize the trust and understanding of teachers, and makes them believe that they have the right to explore and experiment freely. In such an atmosphere, students are more willing to actively participate in learning and actively interact with others, thereby achieving better academic results and establishing more harmonious interpersonal relationships.

Learning engagement reflects students' emotional feelings and behavioral displays of active participation in learning activities. It measures students' efforts, enthusiasm, resources and skills in the educational environment. These factors are often closely related to educational outcomes that attract much attention, such as students' academic performance[2]. Learning engagement is a comprehensive concept covering three dimensions: cognition, behavior and emotion[3]. At the cognitive level, it involves how students adjust learning strategies, such as deep processing of information, fine processing and critical thinking, to achieve learning goals. Emotional engagement refers to the positive emotional experience that students experience in their academic tasks. Behavioral engagement, on the other hand, is embodied in students taking the initiative to create a more supportive learning environment that meets their psychological needs, and making unremitting efforts and persistence in the face of academic challenges, which are embodied in good attendance, proactive preview and timely completion of homework. These observable and dynamically changing behaviors are often influenced by students' internal motivation and external social environment, such as psychological needs satisfaction and teachers' academic support[4]. As a motivational strategy, teacher autonomy support is a tendency that teachers use to motivate students and maintain their learning enthusiasm in teaching practice. Based on the theory of self-determination motivation, when teachers meet students' basic psychological needs -- autonomy needs (experience will and self-identity), competency needs (ability to feel effective interaction with the outside world) and relational needs (experience emotional connection with others) -- they can effectively promote students' learning, keep them in the best state and experience happiness[5]. Studies have shown that a high level of learning engagement is closely related to the autonomous support provided by teachers[6]. Teachers who respect students' choices and understand their feelings are often active participants who care about their students' emotional experiences. Therefore, teachers' autonomous support can meet students' autonomous and relational needs at the same time. Teachers' independent support has a significant effect on improving students' learning involvement. Such teachers are usually able to empathize and understand problems from the perspective of students. Provide students with choices and avoid coercive orders; Help students realize the personal value and significance of learning tasks; Identify and understand students' negative emotions and show concern. A study by foreign scholar Reeve et al. (2004) found that when teachers demonstrate the motivational style of independent support, students tend to show a higher level of learning engagement[7]. Similarly, when teachers provide structural support, such as appropriate academic guidance, timely and constructive feedback, challenging tasks, clear expression of expectations, and interpretation of rules, students also show high levels of learning engagement [8]. For example, Hospel and Galand's (2016) research on adolescents shows that, at the class level, structured support provided by teachers can predict students' self-reported behavior and emotional learning engagement, while the interaction between autonomous support and structural support

significantly predicts emotional learning engagement[9]. Therefore, this paper proposes hypothesis H1: Teacher autonomy support can positively predict college students' learning engagement.

Self-determination theory (SDT) deeply analyzes three kinds of motivation sources: intrinsic motivation, extrinsic motivation and non-motivation, which are the products of the interaction between individuals and the environment. When students feel supported by teachers, this support can enhance their sense of self-efficacy and stimulate their internal and external motivation to learn. The studies of foreign scholars Scott and Walczak, Deci and Ryan, and Kim et al all consistently show that teacher support has a significant positive effect on the improvement of students' academic self-efficacy, in which teachers' trust and care play a crucial role[10]. In addition, domestic studies by Alivernini[11] and Ye Baojuan[12] have further confirmed the importance of teacher support to students' academic self-efficacy in school and classroom environments. When we consider the support of parents, teachers and peers, the close relationship between teacher support and students' learning motivation becomes more obvious, which is supported by Wentzel's study[13]. Academic self-efficacy has always been a focus of attention in the field of psychology and education, because it has a profound impact on students' learning behavior and outcomes. It can not only accurately predict an individual's academic emotional state, but also promote students' learning engagement and thus improve their academic achievement, which has been fully verified in the studies of Rohatgi[14] and Sokmen[15]. In addition, academic self-efficacy also directly affects students' learning engagement and duration of learning, as highlighted by Shoulders[16]. Social cognitive theory emphasizes that self-efficacy is a key factor to stimulate and maintain the motivation and persistence of individuals in adaptive learning activities. Many studies at home and abroad have pointed out that there is a close relationship between academic self-efficacy and students' learning engagement. Linnenbrink and Pintrich's study revealed that academic self-efficacy plays a core role in students' learning process, which profoundly affects students' participation and enthusiasm in various learning activities[17]. Specifically, students with a high sense of self-efficacy tend to show more positive behavior and cognitive engagement when facing learning challenges, while students with a low sense of self-efficacy may show a negative attitude and a relatively low willingness to engage in learning. This view has been further confirmed in the research of Ucar[18] et al. The study of Wei Jun et al. also shows that there is a significant positive correlation between academic self-efficacy and learning engagement[19]. However, Shen Yongjiang et al. further pointed out that academic self-efficacy has a significant predictive effect on junior middle school students' learning engagement, and jointly affects learning engagement with other relevant factors[20]. Bandura's research shows that students with high academic self-efficacy are more willing to accept challenges, and they have higher input and participation in the course, thus achieving better academic performance[21]. Conversely, students with low academic self-efficacy may be inclined to avoid learning tasks and show less engagement in class. A 4-month quasi-experimental study conducted by Breso et al. showed that students' learning engagement could be stimulated to a certain extent by enhancing individual self-efficacy[22]. Therefore, hypothesis H2 is proposed in this paper: Teacher autonomy support has a positive impact on college students' learning engagement through the mediating effect of academic self-efficacy.

When an individual's basic psychological needs are fulfilled, they will experience happiness, and the degree of satisfaction is proportional to the intensity of happiness. It is worth noting that such psychological needs can be satisfied either in real life or in a virtual network environment[23]. Zhao et al. 's research reveals the positive impact of autonomously supported teaching on students' intrinsic learning motivation[24]. The satisfaction of an individual's basic psychological needs is often reflected by his external emotional performance, whether positive or negative. Yu et al. 's study on adolescents found that teachers' independent support significantly improved students' satisfaction with psychological needs[25]. When students' basic

psychological needs are supported externally, these needs will develop in a positive direction, which in turn encourages students to become more engaged in various activities. Niemiec et al. pointed out that basic psychological needs are closely related to parental support, and parental support is also an important factor in happiness[26]. From a global perspective, there are relatively few foreign studies on the combination of social support and basic psychological needs. In contrast, domestic research in this field is more abundant, and most studies show that there is a significant positive correlation between social support and basic psychological needs. Luo Xuefeng et al. 's study further confirmed the positive correlation between social support and its dimensions and basic psychological needs and its dimensions[27]. Chen Yan et al. found that teachers' autonomous support is significantly positively correlated with high school students' basic psychological needs, including autonomy needs, competency needs and belonging needs[28]. This shows that teachers' autonomous support can satisfy students' basic psychological needs and stimulate students' autonomous motivation. Luo Yun et al. 's research also shows that the teachers' independent support perceived by junior high school students is significantly positively correlated with their satisfaction of basic psychological needs[29]. Yang Lihong et al. 's survey shows that there is also a positive correlation between middle school students' perceptive social support and basic psychological needs[30]. Maralani's research shows that the satisfaction of basic needs has a direct and positive impact on students' learning engagement, and further verifies the importance of basic psychological needs on students' learning achievement[31]. Lee's research found that basic psychological needs are closely related to the life goals pursued by individuals, and the satisfaction of basic psychological needs directly determines the level of life goals[32]. At the same time, basic psychological needs can also promote students' motivation and academic engagement. Tarbetsky's research shows that the improvement and satisfaction of students' ability will promote their learning engagement, and the improvement of students' ability and satisfaction of psychological needs will further promote their learning engagement[33]. In China, the related research also found that the lack of basic needs is one of the reasons that lead to the decrease of students' learning engagement and academic burnout. There is a significant positive correlation between middle school students' satisfaction of basic psychological needs and their involvement in English learning. The satisfaction of junior high school students' basic psychological needs is conducive to improving their learning autonomy and enthusiasm, and thus improving their learning engagement. Therefore, this paper proposes hypothesis H3: Basic psychological needs positively regulate the relationship between teachers' autonomous support and college students' learning engagement.

To sum up, there seems to be a close correlation between teachers' autonomous support, learning engagement, academic self-efficacy and basic psychological needs. This study is committed to building a comprehensive theoretical framework that includes mediating and moderating variables in order to deeply analyze how academic self-efficacy, as a mediating factor, plays a role in the influence of teacher autonomy support on college students' learning engagement. At the same time, this study also focuses on the possible effects of basic psychological needs as a moderating variable. Through the construction and analysis of this theoretical model, we hope to reveal more clearly the complex relationship between teachers' autonomous support, learning engagement, academic self-efficacy and basic psychological needs. This not only helps us to deeply understand the mechanism of these psychological factors in the learning process, but also provides a solid theoretical basis for formulating effective intervention strategies to promote college students' learning engagement. Therefore, the significance of this study lies not only in the theoretical exploration and innovation, but also in its practical application potential, that is, it can provide scientific basis for educators to guide them how to better stimulate the learning motivation of students and improve the learning effect.

1. Research objects and methods

1.1. Research objects

The research objects are mainly selected from Zhanjiang Preschool Teachers College, Yancheng Preschool Teachers College, Hunan City Vocational College, humanities and social sciences, science and technology, arts and sports students, a total of 950 people. The questionnaire was distributed in the form of questionnaire star, and the corresponding data were obtained. There were a total of 903 questionnaires in this survey. According to the screening principle, some invalid questionnaires were deleted and valid questionnaires were statistically recovered. A total of 903 valid questionnaires were obtained, with a recovery rate of 95%.

1.2. Measurement Tools

1.2.1. Teacher Autonomy Support Scale

This study adopted the revised version of the Learning Climate Questionnaire (LCQ) by Liu Guirong (2010) based on the original version of Williams and Deci[34](1996). Using a 5-point Likert scale, the 14-item questionnaire was designed to assess students' perception of the degree of autonomous support provided by teachers in the daily campus environment. The final score of the questionnaire is the average score of all items, and the score directly reflects the strength of the students' perceived level of teacher autonomy support. The scale exhibits excellent structural validity and its internal consistency reliability α coefficient is as high as 0.941.

1.2.2. Learning Engagement Scale

This study adopted the Learning Engagement Scale (UWES-S) developed by Schaufeli et al., and translated into Chinese by Fang Wentan, Shi Kan and Zhang Fenghua[35]. The scale covers three core areas: energy, dedication, and focus. Specifically, the vitality field contains 6 questions (question numbers 1 to 6); The dedication area consists of 5 questions (Nos. 7 to 11); The focus area also contains 6 questions (questions 12 to 17). The scale adopts Likert five-level scoring system. The higher the score of each field and total score, the deeper the learner's involvement will be reflected. In this study, the Cronbach 'Salpha coefficient of the scale was as high as 0.940, showing good reliability, and is now widely used to assess college students' learning engagement.

1.2.3. Academic self-efficacy scale

This study adopted the Academic Self-efficacy Scale designed by Liang Yusong[36], which has a total of 22 items. By using the five-level Likert scoring model, the self-efficacy of high school students was deeply explored from two aspects: self-efficacy of learning ability and self-efficacy of learning behavior. The rating options are graded on a scale of 1 to 5 from "complete mismatch" to "complete coincidence". It is worth noting that items 14, 16, 17 and 20 adopt the reverse scoring principle. In general, the higher the participants' total score on the scale, the greater their sense of self-efficacy. In this study, the Cronbach 'Salpha reliability coefficient of this scale was as high as 0.953. At present, this scale has been widely adopted and applied in evaluating students' academic self-efficacy.

1.2.4. Basic psychological needs Scale

Based on the 2013 revision of Liu Junsheng et al.[37], this scale contains 19 assessment items, which are carefully divided into three main parts: The autonomous demand part (covering 6 questions No. 2, 4, 8, 11, 13, 17), the ability demand part (including question No. 3, 7, 9, 12, 15, 18, the same 6) and the belonging demand part (consisting of 7 questions No. 1, 5, 6, 10, 14, 16, 19). The scale adopts a five-level scoring

mechanism, and 9 questions (question No. 2, 3, 6, 9, 13, 14, 16, 17, 18) are specially set up to adopt the reverse scoring method. In general, the higher a subject's score, the more significant their satisfaction of basic psychological needs. In this study, the Cronbach 'Salpha reliability coefficient of this scale was as high as 0.939, and it is now widely used in the assessment of basic psychological needs of students and other groups.

1.3. Common method deviation test

In this study, Harman single factor test was used to test the common method bias. The results show that there are 9 factors with characteristic roots greater than 1, and the first factor explains the cumulative variation of 36.002%. As long as it is below the critical value of 40%, there is no serious common method bias problem.

2. Research results

2.1. Correlation coefficients of each variable

Table 1. Correlation coefficient matrix of each variable.

	1	2	3	4	5	6	7	8	9
Teacher autonomy support	1								
Invigoration	0.513**	1							
dedicate	0.491**	0.715**	1						
Focus	0.499**	0.728**	0.720**	1					
Learning ability	0.508**	0.491**	0.506**	0.522**	1				
Learning behavior	0.508**	0.529**	0.510**	0.519**	0.744**	1			
autonomy	0.482**	0.550**	0.542**	0.552**	0.569**	0.559**	1		
competence	0.475**	0.540**	0.537**	0.535**	0.546**	0.550**	0.670**	1	
belongingness	0.469**	0.529**	0.525**	0.557**	0.561**	0.513**	0.687**	0.666**	1

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

The average scores of each variable are correlated with each other, and the results show that there is a significant positive correlation between teacher autonomy support and learning engagement. There is a significant positive correlation between teacher autonomy support and academic self-efficacy. There is a significant positive correlation between academic self-efficacy and learning engagement. There is a significant positive correlation between teachers' autonomous support and basic psychological needs. There was a significant positive correlation between basic psychological needs and learning engagement.

2.2. Direct effect analysis

AMOS28.0 software was used to build a direct impact model of teacher autonomy support on learning engagement, and corresponding results were obtained after analysis, as shown in the figure below:

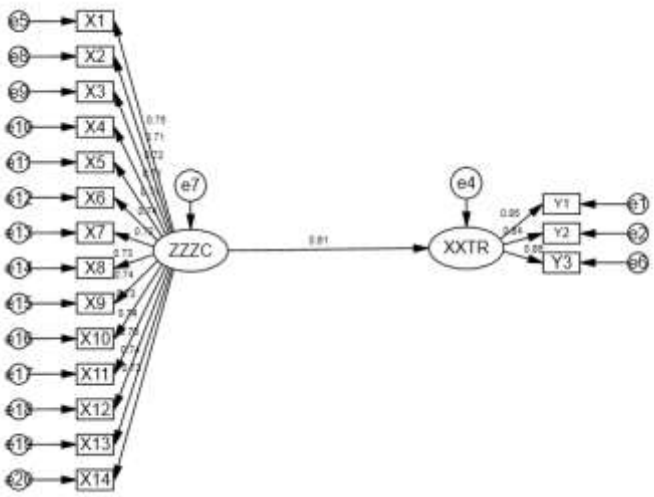

Figure 1. The direct influence model of teacher autonomy support on learning engagement.

Notes: *ZZZC (Teacher autonomy support), XXTR (Learning input), X1-X14 (title), Y1 (Invigoration), Y2 (dedicate) , Y3 (Focus)，e(error term).*

After completing the construction of the direct effect model, strict verification steps should be carried out for its suitability and goodness of fit. For details of relevant tests, please refer to the following table:

Table 2. Structural equation model fitting index.

Adaptation index	χ2/df	RMSEA	NFI	IFI	TLI	CFI	RFI
Actual value	2.373	0.039	0.938	0.933	0.963	0.960	0.963

From the data overview provided, it can be seen that the Chi-square degree of freedom ratio (χ^2/df) has a specific value of 2.373 and the root-mean-square error approximation (RMSEA) is 0.039 in evaluating the fit of the model. According to the established evaluation criteria, when the value of RMSEA remains below 0.1, the adaptation requirements are considered to be met. Further, several other key fit indices - Relative Fit Index (RFI), Normative Fit Index (NFI), Non-standard Fit Index (TLI), Increasing Fit Index (IFI), and Comparative Fit Index (CFI) - all show excellent performance above 0.9. This series of data strongly proves that the constructed model has reached a high level in fitting fit.

Table 3. Direct effect path coefficient estimation table.

Path	Non-standardized coefficients	Standardization coefficient	S.E	t	p
Teacher independent support → Learning engagement	0.561	0.611	0.037	14.974	0.000

As can be seen from the above table, the standardization coefficient is 0.561 ($p<0.001$), indicating that teachers' independent support has a significant positive impact on learning engagement.

2.3. Intermediation effect test

In this study, structural equation model is used as an analytical tool to explore the relationship between variables. In practice, we followed the mediation effect model testing process proposed by Professor Wen Zhonglin[38], and used the professional software Amos28.0 to conduct a rigorous test of the preset mediation model. In the test step, we adopted the deviation-corrected percentile Bootstrap method, which constructed a robust statistical basis by repeating 5000 times of random sampling. Based on the sample data, we calculated a 95% confidence interval, which provides an important basis for evaluating the significance of the

mediating effect. Through the above efforts, we successfully built a mediation model, whose detailed structure is shown in **Figure 2**, which intuitively shows the mediation relationship between variables.

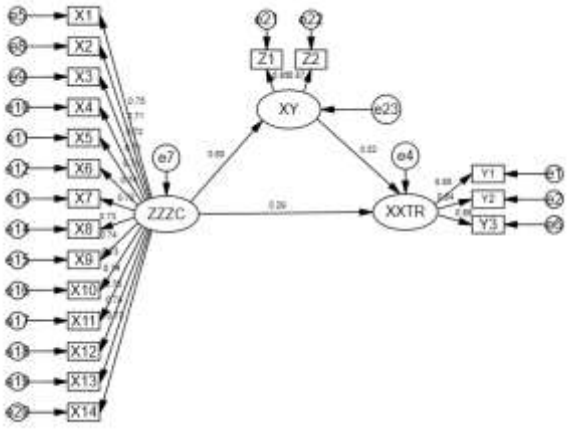

Figure 2. Mediation mechanism model of teachers' self-supporting involvement in learning

Notes: *ZZZC (Teacher autonomy support), XXTR (Learning input), xy (Academic self-efficacy),X1-X14 (title), Y1 (Invigoration), Y2 (dedicate) , Y3 (Focus)，Z1 (Learning ability), Z2 (Learning behavior), e(error term).*

Table 4. Fitting index of structural equation model

Adaptation index	$\chi 2$/df	RMSEA	NFI	IFI	TLI	CFI	RFI
Actual value	2.344	0.039	0.898	0.894	0.939	0.936	0.939

According to the data provided in **Table 4**, we can conclude that the Chi-square degree of freedom ratio (χ^2/df) is 2.344 and the root-mean-square error approximation (RMSEA) is 0.039, which is much lower than the commonly considered threshold of 0.08. At the same time, several other key goodness-of-fit indicators - Canonical Fit Index (NFI), noncanonical Fit Index (TLI), Increasing Fit Index (IFI), and Comparative Fit Index (CFI) - showed excellent performance above 0.9. These data show that the constructed model reaches a high level of goodness of fit, indicating a good agreement between the model and the data.

Table 5. Path coefficient estimation table.

Path	Non-standardized coefficients	Standardization coefficient	S.E	t	p
Teacher autonomy support → academic self-efficacy	0.535	0.608	0.037	14.572	0.000
Teacher independent support → Learning engagement	0.274	0.300	0.036	7.614	0.000
Academic self-efficacy → Learning engagement	0.533	0.512	0.048	11.169	0.000

Note: **** stands for p<0.001*

According to **Table 5**, the standardized coefficient of the path "teacher independent support → academic self-efficacy" is 0.535 (p<0.001), indicating that teacher independent support has a significant positive impact on academic self-efficacy. The standardized coefficient of the path "teacher independent support → learning engagement" is 0.274 (p<0.001), indicating that teacher independent support has a significant positive impact on learning engagement. The standardized coefficient of the path "academic self-efficacy → learning engagement" was 0.533 (p<0.001), indicating that academic self-efficacy had a significant positive impact on learning engagement.

Table 6. Tests the mediating effect of emotional regulation on self-efficacy.

path	point estimate	Product of coefficients		Boostrap 5000 times			
				Bias-Corrected 95%CI		Percentile95%CI	
		Standard error	Z value	floor	Upper limit	floor	Upper limit
The total effect of teacher autonomy support on learning engagement	0.611	0.031	20.043	0.560	0.665	0.555	0.661
Teacher independent support → academic self-efficacy → indirect effect of learning engagement	0.312	0.038	9.008	0.238	0.373	0.242	0.378
The direct effect of teacher autonomy support on learning engagement	0.512	0.051	10.746	0.424	0.601	0.422	0.601

As can be seen from **Table 6**, the direct effect value of teachers' autonomous support on learning engagement is 0.512, the bia-corrected95%CI confidence interval is [0.424,0.601], and the percentile 95%CI confidence interval [0.422,-0.601] does not contain 0, indicating that the direct effect is significant. The indirect effect of teacher autonomy support on learning engagement through academic self-efficacy was 0.312. The results of the mediation effect test based on Bootstrap method showed that the biascorrected95%CI confidence interval was [0.238,0.373], and the Percentile95%CI confidence interval [0.242,0.378], excluding 0, indicating that the mediation effect was significant. The total effect value of teacher autonomy support on learning engagement was 0.611, biascorrected95%CI confidence interval was [0.560,0.665], Percentile95%CI confidence interval [0.555,0.661], excluding 0, indicating that the total effect was significant. Therefore, academic self-efficacy plays a partial mediating role between teachers' autonomous support and learning engagement.

Based on the above results, this study proposed H1 and H2 hypotheses on the direct and mediating effects of teacher autonomy support on learning engagement, and the H1 and H2 hypotheses have been verified by testing, as shown in the following table:

Table 7. Results of hypothesis verification of direct action and mediation mechanism.

Hypothetical number	Suppose the content	Test result
H1	Teacher autonomy support has a positive effect on learning engagement	support
H2	Teacher autonomy support has a positive effect on learning engagement through the mediating effect of academic self-efficacy	support

2.4. Adjustment effect test

Based on the existing literature, this study innovatively introduced moderating variables, aiming to comprehensively and deeply analyze the specific influence mechanism of teachers' autonomous support on learning engagement. In this process, we carefully selected four key factors - gender, grade, major and place of origin - as control variables to ensure the accuracy and reliability of the research results. In the statistical analysis stage of data, we adopted the statistical software SPSS27.0, which can efficiently process and analyze complex data sets. In addition, to further our research, we also used PROCESS software to perform more detailed statistical tests. Specific test steps and results are summarized in the following table for subsequent analysis and discussion:

Table 8. Test of the regulatory effects of psychological resilience.

Regression equation (N = 903)		Fitting index			Coefficient significance	
Result variable	**Predictor**	**R**	**R²**	**F(df)**	**β**	**T**
Learning engagement		0.716	0.513	134.704		
	sex				-0.074	-2.562*
	grade				-0.001	-0.032
	profession				-0.003	-0.195
	Source of students				-0.012	-0.399
	Teacher autonomy support				0.193	7.683***
	Basic psychological needs				0.530	19.773***
	Teachers' independent support × basic psychological needs				0.149	5.063***

Note: *"×" represents the cross-multiplication term, * represents p <0.05, *** represents p <0.00.*

According to the results presented in **Table 8**, we can draw the following conclusions: Among the variables examined, the β value of grade and its corresponding T-value coefficient all showed statistical significance (P<0.05), while the β value and T-value coefficient of gender, major and place of origin did not reach the significance level (P>0.05), which indicates that within the sample and data range of this study, These factors did not show significant effects on learning engagement or related dependent variables. By examining the main effect, it is concluded that teacher autonomy support has a significant positive impact on learning engagement (β=0.193, P<0.001,), and basic psychological needs have a significant positive impact on learning engagement (β=0.530, P<0.001). By testing the moderating effect of basic psychological needs, we can see that the influence of "teacher's independent support × basic psychological needs" on learning engagement is 0.149 (P<0.001), indicating that basic psychological needs have a positive moderating effect between teachers' independent support and basic psychological needs, that is, teachers' independent support has a positive impact on learning engagement, and the interaction term is also positive. It is positive adjustment.

Based on the above results, we can see that the H3 hypothesis on the direct and mediating effects of teachers' autonomous support on learning engagement has been proposed in this study and verified, as shown in the following table:

Table 9. Results of hypothesis verification of direct action and mediation mechanism.

Hypothetical number	Suppose the content	Test result
H3	Teachers' autonomous support has a positive effect on teachers' autonomous support through the adjustment of basic psychological needs	support

3. Discussion

3.1. The direct role of teachers' independent support on learning input

When discussing the multi-dimensional expression of college students' learning engagement, including behavior, emotion and cognition, the teacher's independent support has been proved to be a crucial positive factor. This finding is in line with many previous research conclusions. In foreign studies, Parker[39], Froiland[40], Eccles[41], as well as in domestic studies by Liu Bin[42] and Sha Jingrong[43], all emphasized the positive role of teachers' independent support in improving students' learning engagement.

First of all, teachers' autonomous support strategies can accurately match college students' intrinsic needs for autonomy, competence and emotional satisfaction. Such support not only promotes students to experience a more positive emotional state in learning, but also stimulates their willingness to make more efforts for academic achievement. In the face of challenges, students are able to show perseverance, and they are more inclined to adopt flexible learning strategies to improve learning efficiency and optimize learning outcomes. One of the significant differences between universities and primary and secondary schools in the educational environment is that universities create a more open and free learning atmosphere. At this stage, college students' desire for autonomy is particularly significant. In order to ensure the healthy growth of college students on campus, they are given the right to freely express their personal opinions and creativity. The protection of this right is crucial because it can effectively prevent students from experiencing discomfort due to the constraints of the environment, thus avoiding the adverse impact of such discomfort on academic progress and psychological adjustment. Under the unique educational background of university, teachers should take the initiative to adjust their role positioning, stand in the position of students, take students' interests and hobbies as the starting point and core of teaching, and carefully listen to students' true aspirations and suggestions. This approach can maximize students' freedom of choice and encourage them to make independent decisions, so as to better meet the needs of students' autonomy.

Second, self-determination theory (SDT) provides us with a theoretical perspective to understand this phenomenon. The theory holds that when students' needs for autonomy are met, they will develop stronger intrinsic motivation, which is a key factor in promoting academic achievement. Therefore, when college students feel that their autonomy needs are fully respected and supported by teachers, they will have a deep interest in learning and a strong thirst for knowledge, and then actively participate in learning activities. During this process, students' self-awareness was also significantly strengthened, which helped them to form positive learning emotions such as a sense of accomplishment, satisfaction and happiness, which further promoted the increase in learning engagement.

It is worth noting that teachers' independent support is not isolated, but forms a virtuous circle of mutual promotion with students' learning input. Teachers' support behavior not only satisfies students' autonomy needs, but also stimulates their learning enthusiasm, and students' learning involvement in turn enhances teachers' career satisfaction, prompting teachers to provide independent support more actively. This interactive relationship is particularly important in college education, because college students are at an important stage of shaping independent personality and independent learning ability.

To sum up, the independent support of teachers plays an indispensable role in improving the level of college students' learning engagement. In the future educational practice, we should continue to explore and optimize teachers' autonomous support strategies to better respond to students' intrinsic needs, stimulate their learning enthusiasm, and promote their academic achievement and mental health. At the same time, we also need to pay attention to the role transformation and capacity improvement of teachers in the process of providing autonomous support to ensure the effective implementation and sustainable development of this strategy.

3.2. The mediating role of academic self-efficacy

Through this in-depth and detailed research exploration, we reveal an indirect influence mechanism of perceived teacher support on learning engagement, that is, through enhancing academic self-efficacy. This finding not only strongly supports our research presupposition, but also forms a good echo and complement with the previous research results of Liu[44], further consolidating the understanding framework of the complex relationship between teacher-student relationship and learning outcomes in the field of education.

Specifically, when teachers adopt a student-centered teaching strategy, pay careful attention to the individual problems and needs of students, and actively promote an open and inclusive educational atmosphere, the classroom becomes a dynamic space full of interaction and exploration. In such an environment, students not only have the opportunity to have in-depth exchanges with teachers on key issues such as learning progress, effective methods, and multiple evaluation methods, but also can continue to participate in learning activities in a positive atmosphere that encourages trial and error tolerance[45]. This environment promotes deep dialogue between teachers and students and provides a valuable platform for students to express themselves and reflect on the learning process.

More importantly, this kind of supportive behavior of teachers is not only the transmission of information or skills, but also a kind of emotional nourishment and affirmation. It encourages students to make independent decisions and have the courage to explore their own problem solving paths, so that students can deeply feel the care and recognition from teachers. This feeling of being seen and heard, as suggested by the intrinsic motivation theory emphasized by Deci and Ryan[46], can greatly enhance students' academic self-efficacy. When students believe that they have the ability to overcome learning obstacles and achieve learning goals, they will be more resilient in facing challenges, and their enthusiasm to participate in classroom activities will be significantly enhanced[47]. The improvement of academic self-efficacy, like a strong internal driving force, stimulates students' learning resilience - that is, the ability to adapt and recover in the face of difficulties, as well as continuous learning motivation. It encourages students to focus more on the learning task itself and not be easily swayed by external interference[48]. In this state, learning is no longer a heavy burden, but a process of self-realization, a joy of exploring the unknown and enjoying growth. In addition, the positive learning environment created by the perceived teacher support also promotes the establishment of positive peer relationships among students, forming a good atmosphere of mutual encouragement and common progress. The positive interaction among peers further strengthens students' learning motivation, enabling them to support each other and find solutions together when they encounter difficulties. This collective wisdom convergence undoubtedly adds more possibilities and depth to the individual learning journey.

In summary, perceived teacher support has a profound positive impact on learning engagement through the mediating variable of academic self-efficacy. This discovery not only enriches the research perspectives of pedagogy and psychology, but also provides important implications for educational practice: Educators should attach importance to building a supportive and participatory learning environment, and effectively improve students' academic self-efficacy through active listening, encouraging exploration, and providing personalized guidance, so as to stimulate their internal learning motivation and promote their all-round development. Future studies can further explore the differences in the performance of this mechanism in different cultural backgrounds and age groups, and how to optimize teacher-student interaction with technological means to better serve the goal of educational equity and quality improvement.

3.3. The regulating effect of basic psychological needs

In the field of pedagogy and psychology, basic psychological needs, as the core driving force of individual behavior, have been the focus of extensive research by scholars at home and abroad. Numerous foreign studies, especially the pioneering work of Deci and Ryan[49], clearly point out that the fundamental motivation of individual behavior comes from the satisfaction of basic psychological needs. This theoretical framework has laid a solid foundation for subsequent studies, in which the study of Molinari and Maraliani[50] further revealed the close relationship between basic psychological needs, learning motivation and academic engagement, pointing out that when students' basic psychological needs are met, their learning motivation and academic engagement will be significantly improved. Tarbetsky et al.[51] also emphasized the key role of

individual ability improvement and psychological needs satisfaction in enhancing students' learning engagement. In China, scholar Xu Yan[52] also found similar results in her research on junior high school students. She pointed out that the satisfaction of students' basic psychological needs can effectively improve their autonomy and enthusiasm in learning, and thus promote the improvement of learning engagement. This finding coincides with the theory of self-determined motivation, which holds that external motivation can be integrated and internalized only when an individual's basic psychological needs are met, thus stimulating the activity of internal motivation[53].

On this basis, this study conducted an in-depth exploration and found that there is a significant correlation between the teacher's sense of autonomous support and the level of students' learning engagement. Specifically, when teachers provide a higher level of autonomous support, the basic psychological needs of college students are better satisfied, and then they are more actively involved in learning. On the contrary, when the teachers' independent support is reduced, the students' satisfaction of basic psychological needs is reduced, and the level of learning engagement is also decreased. This finding indicates that teacher autonomy support can indirectly affect the level of learning engagement of college students by influencing the satisfaction of basic psychological needs, thus verifying the validity of hypothesis 3. At this stage, students will have significant changes in the way they treat people and emotional expression, which shows a certain maturity while retaining a little naivete. When their psychological needs are met, they tend to pursue higher goals, and the satisfaction of individuals' basic psychological needs is closely related to their pursuit of life goals[54]. Therefore, when junior high school students feel the support from teachers, their psychological needs are satisfied, thus producing more gratitude, and this emotion motivates them to devote more efforts to their studies. In the learning process, the junior high school students who get psychological satisfaction will show higher concentration and longer investment, they can not only face the learning task more actively, but also experience the fun of learning in the process. This positive emotional experience further enhances their motivation to learn, forming a virtuous cycle. In addition, the independent support of teachers also provides students with a safe and free space to explore, and encourages them to dare to try and innovate. This atmosphere undoubtedly provides a strong guarantee for the all-round development of students.

To sum up, this study verified the indirect influence mechanism of teachers' independent support on college students' learning engagement through empirical analysis, that is, teachers satisfy students' basic psychological needs by providing independent support, and then stimulate students' learning motivation and engagement. This finding not only enrichis the application of self-determined motivation theory in educational practice, but also provides useful enlightenment for educators: In daily teaching, teachers should pay attention to cultivating students' independent learning ability, provide necessary support and guidance, and respect students' individual differences and choices, so as to meet their basic psychological needs, so as to stimulate their internal learning motivation and promote the overall improvement of academic achievement.

4. Conclusions

This paper takes college students' learning engagement as the research background, based on the perspective of academic self-efficacy, and introduces academic self-efficacy to build an intermediary mechanism model of teachers' self-support for learning engagement. At the same time, taking basic psychological needs as the moderating variable, this paper analyzes the regulating mechanism of teacher autonomy support on learning engagement, and through correlation analysis and structural equation model and other statistical methods, the following conclusions are drawn:

(1)vocational teachers' autonomy support has a significant positive impact on learning engagement; Teacher autonomy support has a positive effect on learning engagement through the partial mediating effect of academic self-efficacy. Basic psychological needs positively regulate the relationship between teachers' autonomous support and learning engagement.

(2) Through the theoretical analysis of higher vocational teachers' independent support to improve college students' learning engagement, this paper introduces academic self-efficacy as a mediating variable and basic psychological needs as a moderating variable, and establishes a new path for teachers' independent support to promote college students' learning engagement.

(3) Through the research, it is found that the diversity of independent support of higher vocational teachers can improve the basic psychological needs of college students, regulate the independent support of teachers through the basic psychological needs, and promote the learning input of college students. It shows that the mediating effect of academic self-efficacy and the regulating effect of basic psychological needs are valid.

Conflict of interest

The authors declare no conflict of interest.

References

1. Chen Jiwen, Guo Yongyu, Hu Xiaoyong. Teachers' autonomous support and junior High School students' engagement in Learning: The Influence of family social class and students' autonomous motivation [J]. Psychological Development and Education,2015,31(02):180-187.
2. Wang M T, Degol J. Staying engaged: Knowledge and research needs in student engagement [J]. Child development perspectives, 2014, (3) : 137-143.
3. Fredricks J A, Blumenfeld P C, Paris A H.School engagement: Potential of the concept, state of the evidence [J]. Review of educational research, 2004, (1) : 59-109.
4. Li Xin, et al. New development of learning engagement measurement: from one-dimensional analysis to multimodal integration [J]. Research on audio-visual Education, 2021, (10) : 100-107.
5. Lai Danfeng, Wu Xinchun. A review of teacher Motivation Style Research based on Self-determination Theory [J]. Advances in Psychological Science, 2011, (4) : 580-588.
6. Cheon S H, Reeve J. Do the benefits from autonomy - supportive PE teacher training programs endure? A one-year follow-up investigation [J]. Psychology of Sport and Exercise, 2013, (4) : 508-518.
7. Reeve J, Jang H. What teachers say and do to support students' autonomy during a learning activity [J]. Journal of educational psychology, 2006, (1) : 209-218.
8. Reeve J, Jang H, Carrell D, et al. Enhancing students' engagement by increasing teachers' autonomy support [J]. Motivation and emotion, 2004, (2) : 147-169.
9. Hospel V, Galand B.A re both classroom autonomy support and structure equally important for students' engagement? A multilevel analysis [J]. Learning and Instruction, 2016, (41) : 1-10.
10. Kim, L. E., Dar-Nimrod, I., & MacCann, C. (2018). Teacher personality and teacher effectiveness insecondary school: Personality predicts teacher support and student self-efficacy but not academicachievement. Journal of Educatonal Psychology, 110(3), 309-323.
11. Alivernini, F., & Lucidi, F. (2011). Relationship between social context, self-efficacy, motivation,academic achievement, and intention to drop out of high school: A longitudinal study. The Journal ofEducational Research, 104(4), 241-252.
12. Ye Baojuan, Fu Haohao, Yang Qiang, You Ya Yuan, Lei Xi, Chen Jiawen. (2017). The influence of teachers' caring behavior on adolescents' Internet addiction: Understanding the chain mediating effect of social support and academic self-efficacy. Chinese Journal of Clinical Psychology, 25(6), 1168-1170.
13. Wentzel, K. R., & Brophy, J. E. (2014). Motivating students to learn (4th ed.). New York: Routledge.
14. Rohatgi, A., Scherer, R., & Hatlevik, O. E. (2016). The role of ICT self-efficacy for students' ICT use andtheir achievement in a computer and information literacy test. Computers & Education, 102, 103-116.
15. Sokmen, Y. (2021). The role of self-efficacy in the relationship between the learning environment andstudent engagement. Educational Studies, 47(1), 19-37.

16. Shoulders, T. L., & Krei, M. S. (2015). Rural high school teachers' self-efficacy in student engagement,instructional strategies, and classroom management. American Secondary Education, 44(1), 50-61.
17. Linnenbrink, E. A. , & Pintrich, P. R. . (2010). The role of self-efficacy beliefs instudentengagement and learning in the classroom. Reading & Writing Quarterly.
18. Ucar, F. M., & Sungur, S. (2017). The role of perceived classroom goal structures, self-efficacy,and engagement in student science achievement. Research in Science & TechnologicalEducation, 35(2), 149-168.
19. Luo Xuefeng, Mu Shoukuan. (2017). The impact of gratitude on psychological well-being in high school students: understanding the chain mediating role of social support and basic psychological needs. Psychological Science, (4), 878-884.
20. Chen Y, Huang Shoujin. (2016). The relationship between teachers' autonomous support and high school students' autonomous motivation and basic psychological needs. Journal of Southwest Normal University (Natural Science Edition), (10), 141-145.
21. Luo Y, Zhao M, Wang Z H. (2014). The impact of junior high school students' perceived teacher autonomy support on academic burnout: the mediating role of basic psychological needs and autonomous motivation. Psychological Development and Education, (3), 312-321.
22. Luo Y, Zhao M, Wang Z H. (2014). The impact of junior high school students' perceived teacher autonomy support on academic burnout: the mediating role of basic psychological needs and autonomous motivation. Psychological Development and Education, (3), 312-321.
23. Maralani, F, M., Shalbaf, A., & Lavasani, M, G. (2018). Agentic Engagement and Test Anxiety: The Mediatory Role of the Basic Psychological Needs. SAGE Open, 8(2), 1-7.
24. Lee, S. H., & Moon, S. B. (2017). A structural analysis on school-aged children's resilience, emotion regulation, basic psychological needs, and parental resilience. KoreanJournal of Human Ecology, 26(3), 199-212 [33] Tarbetsky, A., Martin, A.J., & Collie, R.J. (2017). Social and emotional learning (SEL) and students' motivation, engagement,and achievement:The roles of psychological need satisfaction, adaptability, and buoyancy. In E. Frydenberg, A.J. Martin, & R.J. Collie (Eds.). Social and emotional learning in Australia and the Asia-Pacific. Singapore: Springer.
25. Williams, G. C, Saizow, R, Ross, L, & Deci, E L. Motivation underlying career choice for internal medicine and surgery[J]. Social Science and Medicine, 1997,
26. Fang Laitan, Shi Kan, Zhang Fenghua. Study on the reliability and validity of Chinese version of learning engagement scale [J]. Chinese Journal of Clinical Psychology, 2008, 16 (06): 618-620. (in Chinese)
27. Liang Yusong. Study on the correlation between students' academic self-efficacy and mental health [J]. Chinese Journal of Clinical Rehabilitation, 2004,8 (24) : 4962-4963.
28. Liu Junsheng, Lin Liling, Lu Yuan, et al. A preliminary test on the reliability and validity of the Chinese version of the Basic Psychological Needs Scale [J]. Chinese Journal of Mental Health,2013,27(10): 791-795.
29. Wen Zhonglin, Ye Baojuan. Mediation effect analysis: Development of methods and models [J]. Advances in Psychological Science,2014,22(05):731-745. (in Chinese)
30. Parker Janise S. et al Perceived Teacher Autonomy Support and Self-Determination Skill Expression: Predictors of Student Engagement Among African American High School Students[J]. Journal of Black Psychology, 2021, 47(6) : 445-475.
31. Froiland J. M., Davison M. L., Worrell F. C. Aloha teachers: Teacher autonomy support promotes Native Hawaiian and Pacific Islander students' motivation, school belonging, course-taking and math achievement[J]. Social Psychology of Education, 2016, 19: 1-16.
32. Deci E. L., Eghrari H., Patrick B. C., Leone D. R. Facilitating internalization: The self-determination theory perspective[J]. Journal of Personality, 1994, 62(1): 119-142.
33. Liu Bin, Zhang Wenlan, Liu Junling. Research on the influence of teacher support on online learners' Learning Engagement [J]. Research on E-Education,2017,38(11):63-68+80. (in Chinese)
34. Sha Jingrong, Kan Zhaocao, Li Wei. An empirical study on the effect of teacher support strategies on college students' Learning engagement Level in blended teaching [J]. China Audio-visual Education,2020(08):127-133.
35. Liu, R., Zhen, R., Ding, Y., Liu, Y., Wang, J., Jiang, R., & Xu, L. (2018). Teacher support and mathengagement: roles of academic self-efficacy and positive emotions. Educational Psychology, 38(1), 3-16.
36. Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement andperformance. Journal of Educational Psychology, 95(1), 148-162.
37. Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. Journal ofPersonality and Social Psychology, 53(6), 1024-1037.
38. Boulton, M., Lloyd, J., Down, J., & Marx, H. (2012). Predicting undergraduates' self-reported engagementin traditional and cyberbullying from attitudes. Cyberpsychology, Behavior, and Social Networking,15(3), 141-147.
39. Kim, T. H., & Hwang, E. (2019). The mediating effects of academic resilience on the relationship betweenacademic self-efficacy and school adaptation by adolescents. Korean Journal of Youth Studies, 26(2),213-233.

40. Deci, Edward L.; Ryan, Richard M. (2000). The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior. Psychological Inquiry, 11(4), 227–268.
41. Molinari, L. , & Mameli, C.(2017). Basic psychological needs and school engagement: a focus on justice and agency. Social Psychology of Education.
42. Tarbetsky, A., Martin, A.J., & Collie, R.J. (2017). Social and emotional learning (SEL) and students' motivation, engagement,and achievement:The roles of psychological need satisfaction, adaptability, and buoyancy. In E. Frydenberg, A.J. Martin, & R.J. Collie (Eds.). Social and emotional learning in Australia and the Asia-Pacific. Singapore: Springer.
43. Xu Y. (2016). Research on the correlation between the satisfaction of basic psychological needs and autonomous learning of junior high school students. Journal of Heihe University, (2), 77-80.
44. Wang T T, Pang W G. (2009) Implications of self-determination theory on the development of students' autonomous learning ability. (in Chinese) Global Education Perspectives, 38(11):40-43.
45. Ionescu, D.(1999). The process of life goals' pursuit and the satisfaction of basic psychological needs: the predictive role of personality factors. Romanian Journal of Applied Psychology
46. Zi Y, Zhu D P, Li X Q, et al. The effect of physical exercise on anxiety of college students in post-pandemic era: the chain mediating role of self-efficacy and psychological elasticity [J]. Hubei Sports Science and Technology, 2019, 42 (5) : 442-446.