

The Mediating Role of Learning Engagement Between Self-Efficacy and Academic Achievement Among Chinese College Students

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Purpose: The link between academic self-efficacy and academic achievement and its potential mediation by learning engagement was investigated in college students in China.

Methods: The Chinese versions of the Academic Self-Efficacy Scale, Academic Achievement Scale, and Learning Engagement Scale were administered to 1158 Chinese college students (544 men, 614 women; age [years]: $M=19.37$, $SD=1.16$, ranging from 17 to 30 years; college year: 641 freshmen, 302 sophomores, 197 juniors, 18 seniors).

Results: The results showed that, among Chinese college students, there were positive correlations between academic self-efficacy and both academic achievement and learning engagement, and between learning engagement and academic achievement. Additionally, a structural equation model demonstrated that learning engagement could mediate the association between academic self-efficacy and achievement.

Conclusion: Academic self-efficacy, learning engagement, and academic achievement were found to be significantly and positively associated in Chinese college students, with the association between self-efficacy and achievement observed to be significantly mediated by learning engagement, which mediates the link between self-efficacy and achievement. As the study was cross-sectional, causal inferences were difficult to determine; thus, longitudinal studies should be conducted in the future for further analysis of the causal relationships between these three variables. The present research results reveal the mechanism by which academic self-efficacy of college students impacts their academic achievement, expanding the research perspective of learning engagement, and can help guide the development of interventions to improve college students' academic achievement.

Keywords: academic self-efficacy, academic achievement, learning engagement, Chinese college students, mediating effect

Introduction

The Organization for Economic Co-operation and Development has identified academic achievement as one of the key indicators for assessing student outcomes and the quality and equity of education in different countries.⁵⁴ Achievement in academia refers to the results one obtains in subjective or objective evaluations of his/her knowledge or skills after a period of study (eg, exams); thus, it is an indicator of an individual's academic performance^{10,11} and an important factor that influences future growth and development.¹² Academic achievement has a far-reaching impact on individual development: good academic achievement can be conducive to good individual development and subsequent entry into virtuous social circles, while low academic achievement or academic problems can predict many problematic behaviors.¹³ Therefore, academic achievement has been the focus of research in the field of educational psychology. Among the many factors that influence academic achievement, academic self-efficacy is seen as a very important non-intellectual factor. Studies have found that academic self-efficacy can reliably predict academic achievement.^{5,6} Many empirical studies have not only demonstrated that self-efficacy is predictive of achievement in the academic environment,⁷⁻⁹ but have also observed that improving self-efficacy can improve individual academic performance. As

research has progressed, researchers have not only focused on the relationship between academic self-efficacy and academic achievement but also explored the mechanisms by which academic self-efficacy affects academic achievement. Among the studies on the mechanisms of influence, academic self-efficacy has often been used as a mediating variable for other factors affecting academic achievement, while few studies have used academic self-efficacy as an independent variable.⁵⁵⁻⁵⁸ In fact, many empirical studies have demonstrated a moderate correlation between academic self-efficacy and academic achievement,^{59,60} and it is necessary to investigate the influence of academic self-efficacy on academic achievement and its mechanisms of action. However, the current research on Chinese college students is still at the preliminary stage of exploration, and more empirical studies are needed to support the study. Therefore, this study aims to examine the relationship between academic self-efficacy and academic achievement among college students in China and focus on the mediating role of learning engagement between the two, in order to reveal the inner mechanism of academic self-efficacy affecting academic achievement among college students, and then provide some theoretical basis and empirical support for educational interventions for college students' academic achievement.

Academic Self-Efficacy and Academic Achievement

The theory of self-efficacy posits that one's self-efficacy determines his/her expectations and beliefs regarding the outcomes of his/her own behaviors.¹ High self-efficacy leads individuals to believe in their ability for successfully performing a specific task, while low self-efficacy results in a belief that they will fail at that task.² Academic self-efficacy is an important subset of self-efficacy, reflecting the perception of the student of their potential success or failure in academic-related tasks³ and has been defined as a student's belief and confidence in their capability of succeeding in academic endeavors.⁴ It has been found to reliably positively predict academic achievement.⁴⁸ According to the theory of social cognition, students' academic performance may be affected by modifications in their academic self-efficacy, which can occur through the influence of environmental factors.¹⁴ Supporting this hypothesis, a close relationship between self-efficacy and achievement in academic situations has been observed,¹⁵⁻¹⁷ with empirical research finding a positive link between the two variables.¹⁸⁻²⁰ Based on these observations, we propose the hypothesis that there is a positive association between academic self-efficacy and academic achievement (H1).

Academic Self-Efficacy and Learning Engagement

Learning engagement refers to instances when learners enter a continuous, positive emotional, and fulfilling mental state while learning. It includes the following three characteristics: vigor, dedication, and absorption.²¹ Learning engagement thus acts as an effective reflection of a student's current academic performance²² and, furthermore, has also been found to be effective for the longitudinal prediction of future progress and success or failure over the following 10 years,²³ thus exerting a profound influence on the student's development and progress.²⁴ According to the self-efficacy model proposed by Bandura, a student's motivation to study, study habits, and academic performance are all influenced by their subjective view of their ability to perform and achieve.²⁵ In particular, academic self-efficacy is a significant near-end factor that impacts the degree of input into study²⁶ and is able to positively predict investment in learning, specifically, higher self-efficacy is linked to a higher level of learning investment.^{27,28} A student with a high level of self-efficacy tends to put more work into their studying, has higher levels of confidence and optimism when setbacks are encountered, and is more capable for addressing challenges, leading to an overall enhancement of their participation in learning.²⁹ In contrast, a student with low self-efficacy tends to set lower learning goals, have more negative attitudes toward academic challenges, be unwilling to make efforts to overcome setbacks, and face difficulty mobilizing positive learning strategies.^{30,31} In accordance with these findings, the following hypothesis is proposed: there is a positive association between academic self-efficacy and learning engagement (H2).

Learning Engagement and Academic Achievement

Learning engagement can significantly predict academic performance and, compared with academic self-efficacy, tends to be more directly and stably linked to academic achievement.^{32,33} Both these associations are of serious interest to education researchers.^{34,35} Learning engagement is a specific index that reflects students' degree of involvement in the learning process; high involvement can positively predict academic achievement and negatively predict course dropout;

that is, the higher the learning input, the higher the student's academic performance.^{36–38} Further, a student who has a higher level of engagement with studying is more likely to have mastered strategies for successful studying and usually has a higher level of self-control.³⁹ Some researchers, using a meta-analysis, found a significant medium-strength correlation between student engagement and academic achievement, and also found that the relationship between the two is affected by cultural values and gender.⁴⁰ Furthermore, the associations between self-efficacy, learning engagement, and achievement in an academic environment were confirmed. It has been found that learning engagement can significantly mediate other psychological characteristics and academic achievement among diverse groups of individuals.^{41,42} Considering these previous findings, we propose the following hypotheses: there is a positive association between learning engagement and academic achievement (H3), and the relationship between academic self-efficacy and academic achievement is mediated by learning engagement (H4).

Methods

Participants

The study participants were recruited from Southwest University and China West Normal University in China. Data were collected by survey questionnaires, involving the distribution of 1400 questionnaires of which 1257 were returned, a recovery rate of 90%; of these, 99 questionnaires were not included as they were incomplete, resulting in the final inclusion of 1158 valid questionnaires. Thus, the final participants were 1158 Chinese college students (544 men, 614 women; age [years]: $M=19.37$, $SD=1.16$, ranging from 17 to 30 years; college years: 641 freshmen, 302 sophomores, 197 juniors, and 18 seniors). All adult participants provided informed consent and consent was obtained from the parents/legal guardians of non-adult participants. Only individuals who met the following eligibility criteria were included in our study: 1. could speak and understand Mandarin, 2. were enrolled in college, and 3. volunteered to participate in the survey. The prerequisites for exclusion were as follows: diagnosed with a serious mental illness or cognitive impairment.

Procedure

Questionnaires were distributed to the participants between March 18 and April 28, 2020. The Human Research Ethics Committee of Southwest University granted permission. The survey was undertaken in classrooms with the approval of both teachers and participants. This study complied with the Declaration of Helsinki. Before distribution of the questionnaire, the students were provided with written information on the study procedures and consent to participate, stressing that participation was both voluntary and anonymous.

Measures

Four questionnaires were used, as described below.

Demographic Information

This questionnaire was self-developed to provide demographic information on the students, including age, gender, and academic-related information, such as college majors and grades. For the exploratory factor analysis, the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test of sphericity were performed with the sample to determine whether the Academic Self-Efficacy Scale, the Learning Engagement Scale, and the Academic Achievement Scale are appropriate for principal component analysis. Results are presented in Table 1.

Academic Self-Efficacy Scale

Self-efficacy was assessed using Pintrich and De Groot's Academic Self-Efficacy Scale (1990) modified for Chinese application. This scale contains two dimensions, reflecting self-efficacy in learning ability and learning behavior, respectively. Each dimension comprises 11 items, meaning the scale contains 22 items in total. Representative items are "I think I have the ability to solve the problems I encounter in learning questions" and "I am often unable to accurately summarize the primary meaning of learning content I read." The answers are given according to a scale between 1 ("very non-compliant") and 5 ("very much"); thus, a higher total score is indicative of greater academic self-

Table 1 Exploratory Factor Analysis (EFA)

Scales	Kaiser Meyer Olkin	χ^2	p	Eigenvalues	Total % of Variance
Academic Self-Efficacy Scale	0.928	10,362.009	<0.001	7.602	34.554
Learning Engagement Scale	0.961	13,790.002	<0.001	9.609	56.524
Academic Achievement Scale	0.933	11,993.296	<0.001	8.199	43.155

efficacy. Cronbach's alpha was found to be 0.892 in this study, which indicated high reliability. We also conducted confirmatory factor analysis (CFA), which indicated good model fit of the one-dimensional scale structure, specifically, $\chi^2/\text{df}=2.729$, root mean square error of approximation (RMSEA)=0.039, goodness of fit index (GFI)=0.969, Tucker-Lewis Index (TLI)=0.961, confirmatory fit index (CFI)=0.975, standardized root mean square residual (SRMR)=0.036, showing significant structural validity of the questionnaire. The factor loadings for the items were from 0.412 to 0.681. The scale has previously been determined to have good reliability and validity when administered to Chinese college students.⁵²

Learning Engagement Scale

Schaufeli's Learning Engagement Scale (2002), modified for Chinese students, was used. The scale includes three dimensions, reflecting, vitality, dedication, and focus, with 17 items in all. A representative item is "I feel energetic while studying." Answers are given on a scale from 1 ("never") to 7 ("always"); thus, a higher overall score indicates a greater level of learning engagement. Cronbach's alpha was found to be 0.951, indicative of good reliability and the model fit was verified by CFA: $\chi^2/\text{df}=2.535$, RMSEA=0.036, GFI=0.980, TLI=0.985, CFI=0.991, SRMR=0.019, demonstrating good structural validity. The factor loadings were between 0.440 and 0.732. This scale has been used in previous studies, and has been determined to have good reliability and validity when administered to Chinese college students.⁵³

Academic Achievement Scale

The Academic Achievement Scale comprises 19 items,⁴³ and consists of four dimensions, which reflect academic dedication, learning performance, interpersonal promotion, and objective achievement, respectively. Representative items are "The quality of my learning" and "My completion of homework on time." The questionnaire items are scored using a six-point scale with a higher overall score indicative of higher academic achievement. For the present study, Cronbach's alpha was found here to be 0.925, indicating good internal consistency. CFA confirmed that the one-dimensional structure of the scale showed good model fit (CFA): $\chi^2/\text{df}=2.403$, RMSEA=0.035, GFI=0.981, TLI=0.980, CFI=0.990, SRMR=0.024, demonstrating the structural validity of the questionnaire. The factor loadings were between 0.538 and 0.694. The scale was determined to have good reliability and validity when it was administered to Chinese college students.⁴⁴

Data Analysis

Data were collated and analyzed using SPSS 22.0 and AMOS 21.0. CFA was conducted before establishing the structural equation model to determine the goodness-of-fit of the questionnaires used and of a multiple mediating effect model. The model was tested using χ^2/df , RMSEA, GFI, TLI, CFI, and SRMR.⁴⁵ Structural model analysis was undertaken if the variables showed good discriminant validity.

Results

Assessment of Common Method Bias

Common method bias represents a risk in the collection of questionnaire-derived data. We, therefore, used Harman's single-factor test to control for this bias, as suggested previously.⁴⁶ The test found 10 factors with eigenvalues over 1, with the first factor having an explanatory variance of 31.48%, less than the 40% recommended threshold. This result suggested that the preset results were unlikely to be affected by common method bias.

Demographic Differences Among Variables

Gender differences in the three variables were assessed using *t*-tests. This showed significantly greater academic self-efficacy in male college students ($M=3.44$, $SD=0.547$) compared with female college students ($M=3.32$, $SD=0.469$) ($t=3.803$, $P<0.001$). However, male and female students did not differ in terms of learning engagement or academic achievement.

F-tests were then applied to assess the differences between the three variables in relation to college year. This indicates that the degree of academic self-efficacy differed significantly across the four different years ($F=4.109$, $p<0.01$; ie, junior > freshman, junior > sophomore); there were also significant differences in learning engagement across the four different years ($F=7.356$, $p<0.001$; ie, senior > freshman, junior > freshman, junior > sophomore). However, academic achievement did not differ significantly across the four years ($F=1.336$, $p>0.05$).

Correlation Analysis

As shown in Table 2, for our sample, academic self-efficacy was positively linked with both academic achievement and learning engagement. Furthermore, there was a positive correlation between learning engagement and academic achievement. These results thus verified hypotheses H1, H2, and H3, providing a foundation for further investigation of possible mediating effects.

The Mediating Effect Test

The presence of mediating effects was investigated by structural equation modeling (SEM), in relation to the following question: does learning engagement mediate the relationship between self-efficacy and academic achievement? After controlling for age and gender, repeated sampling and testing were performed using a percentile bootstrap method. A significant mediating effect was recognized if 95% confidence interval (CI) of the effect did not include 0; if this was not the case, there was no significant mediating effect. In accordance with a previously established procedure for the identification of mediating effects,⁴⁵ the test first assessed the direct effects of self-efficacy on achievement, after which the model fitness and significance of the various path coefficients were determined after the addition of the mediating variable. It was found that the path coefficient for academic self-efficacy having a direct effect on achievement was significant ($\beta=0.706$, $P<0.001$), as shown in Figure 1.

The possible mediating effects of learning engagement on the association between self-efficacy and achievement in the academic environment were then investigated. This generated the following fitness results: $\chi^2/df=1.875$, RMSEA=0.028,

Table 2 Descriptive Statistics and Correlations ($N = 1158$)

Variables	1	2	3	4	5
1. Gender	–				
2. Age	–0.20***	–			
3. Academic self-efficacy	–0.11***	0.10***	–		
4. Learning engagement	–0.03	0.14***	0.51***	–	
5. Academic achievement	0.05	0.04	0.54***	0.58***	–
<i>M</i>	1.53	19.37	3.38	4.22	4.19
<i>SD</i>	0.49	1.16	0.51	0.92	0.67

Notes: ***Indicates $P < 0.001$, Statistically significant.

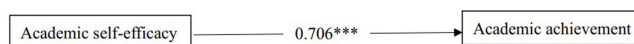


Figure 1 The direct effect of academic self-efficacy on academic achievement in college students (standardized coefficients).

Notes: *** $P < 0.001$.

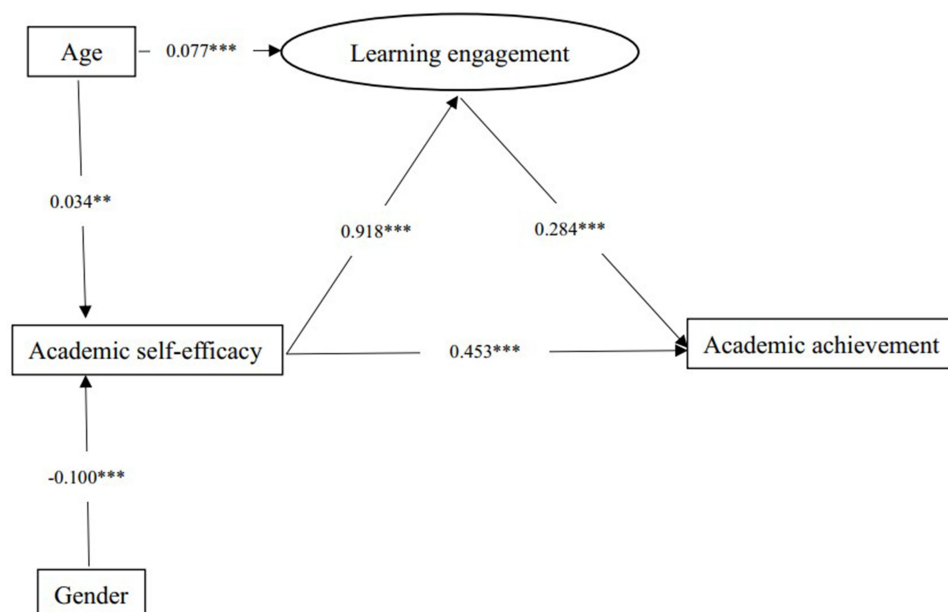


Figure 2 The mediating effect of learning engagement in college students (standardized coefficients).

Notes: ** $P < 0.01$, *** $P < 0.001$.

GFI=0.996, TLI=0.996, CFI=0.998, and SRMR=0.017 (Figure 2 and Table 3). Significant path coefficients were observed between academic self-efficacy and achievement ($\beta=0.453$, $P<0.001$), learning engagement and academic achievement ($\beta=0.284$, $P<0.001$), academic self-efficacy and learning engagement ($\beta=0.918$, $P<0.001$), gender and academic self-efficacy ($\beta=-0.100$, $P<0.001$), age and academic self-efficacy ($\beta=0.034$, $P<0.01$), and age and learning engagement ($\beta=0.077$, $P<0.001$). However, when the potential mediating variable was added, the path coefficient between academic self-efficacy and achievement was reduced from $\beta=0.706$ ($P<0.001$) to $\beta=0.453$ ($P<0.001$), indicating that learning engagement acts as a mediator of the association between self-efficacy and achievement. This, therefore, supports H4.

To further examine gender differences in mediating effects, the same analysis method as described above was used to control the demographic variable age, and the mediating function of learning engagement between self-efficacy and achievement in male and female students, respectively. This showed that, for men, learning engagement functioned as a mediator, with the following fitness results (see Figure 3): $\chi^2/df=2.068$, RMSEA=0.044, GFI=0.993, TLI=0.993,

Table 3 Intermediate Effect Bootstrap Test

Path	Standard Path Effect Value	P value
AS→AA	0.453	<0.001
AS→LE	0.918	<0.001
LE→AA	0.284	<0.001
Gender → AS	-0.100	<0.001
Age → AS	0.034	<0.01
Age → LE	0.077	<0.001

Abbreviations: AS, academic self-efficacy; AA, academic achievement; LE, learning engagement.

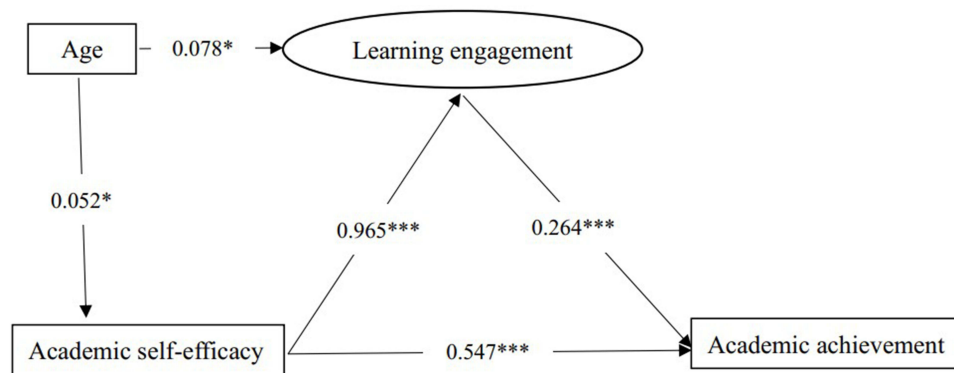


Figure 3 The mediating effect of learning engagement in male college students (standardized coefficients).

Notes: * $P < 0.05$, *** $P < 0.001$.

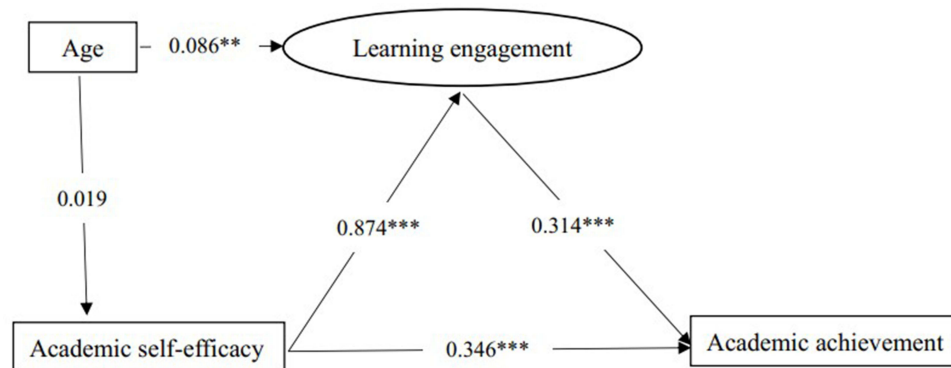


Figure 4 The mediating effect of learning engagement in female college students (standardized coefficients).

Notes: ** $P < 0.01$, *** $P < 0.001$.

CFI=0.997, and SRMR=0.016. A similar result was found for women (see Figure 4): $\chi^2/df=1.455$, RMSEA=0.027, GFI=0.995, TLI=0.997, CFI=0.999, and SRMR=0.012.

Discussion

It was observed that male Chinese college students had greater self-efficacy although the genders did not differ with regard to learning engagement or academic achievement. Academic self-efficacy and learning engagement were also higher in senior students, although no significant differences were seen in terms of academic year in achievement, suggesting that the self-efficacy and learning engagement of students tends to increase in proportion to their seniority. These findings indicate that it is necessary to consider inter-gender and inter-year differences when seeking to improve the self-efficacy and learning engagement of students and, ultimately, their achievement.

Correlation analyses demonstrated that the academic self-efficacy of the college students significantly positively predicted their academic achievement; this confirms the findings of earlier investigations^{47,48} as well as our research hypothesis H1. As suggested by both social cognitive theory¹⁴ and self-efficacy theory,¹ self-efficacy is an indication of an individual's confidence in their capability of performing a specific behavior, and this belief influences the person's actions and views to impact the performance of the behavior in question. Previous studies have found, through reviews⁴⁹ and longitudinal research,^{50,51} that academic achievement increases with improvement in individual academic self-efficacy, which further supports the two aforementioned theories. Bandura also suggested that individuals with higher self-efficacy have high confidence in their own abilities and added that such individuals may work hard to complete tasks.¹ This is notable because college students can encounter many difficulties, such as learning pressure. Higher levels of self-efficacy enhance academic achievement, ultimately leading to good academic performance. Thus, the levels of academic self-efficacy can predict academic achievement. This study

explored the association between self-efficacy and achievement in students; the findings expand upon relevant research in the field and have a positive role in promoting and underlining the significance of improving college students' academic achievement.

After confirming the association between self-efficacy and achievement, the effect of learning engagement on the prediction of academic achievement was explored, together with the mechanism through which this might occur to determine the psychological relationship between the variables. First, its significant positive correlations between academic self-efficacy, learning engagement, and academic achievement were observed, supporting the observations of earlier studies,^{28,47} and confirms our research hypotheses H2 and H3. Further, this study explored the potential mediating role of learning engagement on the association between self-efficacy and achievement, demonstrating that learning engagement significantly mediated the relationship between the two variables. This agrees with earlier findings on the mediating function of learning engagement between various psychological characteristics and academic achievement^{41,42} and confirms our research hypothesis H4. Thus, academic self-efficacy is predictive of achievement both directly as well as indirectly by means of learning engagement. This indicates that greater levels of academic self-efficacy are able to mobilize and enhance learning engagement. Moreover, the more consciously the student makes their behavior conform to social or self-standards and the greater their motivation to forgo leisure activities and resist emotional interference in learning activities, the greater the likelihood of superior academic achievement.

In summary, the intermediary model proposed in this research describes the mechanism underlying the association between college students' academic self-efficacy and achievement. The findings not only indicate how self-efficacy affects achievement in an academic environment but also clarify the conditions under which it has this impact. These findings will be useful for future research on the link between self-efficacy and achievement in academic environments and also provide valuable information on these relationships.

The study of college students' academic self-efficacy also supports the self-efficacy theory to some extent and further expands the field of self-efficacy research. The results of this study will also provide a reference for college education administrators to recognize the importance of academic self-efficacy and learning engagement to academic achievement, and provide some theoretical basis and empirical support for improving college students' academic achievement in order to develop educational interventions in a more scientific way.

Limitations

This research demonstrated the means through which self-efficacy affects the academic achievement of college students and may be of value in the cultivation of positive psychology among college students' and improving their academic achievement. However, there are several limitations to the study. First, the cross-sectional design does not permit the investigation of causal links between variables; this issue could be addressed by future longitudinal tracking for verification of the current findings. Second, this study only investigated the impact of academic self-efficacy on academic achievement, and follow-up research should seek to incorporate other factors (such as learning strategies and academic procrastination) to further explore the mechanism of academic achievement. Finally, this study considered only learning engagement as a mediator; perhaps the role of other variables (such as self-esteem and self-control) as mediators could be explored in the future.

Conclusion

In the context of Chinese college students, academic self-efficacy, learning engagement, and academic achievement were found to be positively associated with learning engagement having a significant mediating action on the link between academic self-efficacy and academic achievement. The present research results reveal the mechanism by which the' academic self-efficacy of college students impacts their academic achievement, expanding the research perspective of learning engagement, and can help guide the development of interventions to improve college students' academic achievement. On the one hand, college education administrators should fully respect students' individual differences, guide students to set reasonable learning goals, change the "score-only" evaluation model, focus on process evaluation, and improve the comprehensive evaluation system to maximize students' strengths and stimulate their learning potential, so as to continuously improve students' academic self-efficacy. On

the other hand, universities should build a two-way interaction between teachers and students to help students establish the awareness of independent learning and enhance their initiative. At the same time, incentive mechanisms should be established to motivate students to learn and increase their commitment to learning.

Ethics Statement

The study was approved by the Southwest University's Human Research Ethics Committee and all participants provided written informed consent.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

None of the authors have conflicts of interest.

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