

The Mediation Effect of Academic Self-Efficacy on Academic Procrastination, Performance, and Satisfaction of Chinese Local Technology University Undergraduates

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Purpose: To identify the relationship between academic procrastination, performance, self-efficacy, and satisfaction, we investigate the mediational role of academic self-efficacy between academic procrastination and satisfaction, and between academic performance and satisfaction, respectively, among undergraduate students of local technology universities in China.

Methods: A cross-sectional study was conducted involving 388 undergraduate students from 22 local technology universities in Hubei, China. Data was collected through an online questionnaire measuring academic procrastination, performance, self-efficacy, and satisfaction. Descriptive statistics and Pearson correlation coefficients were used to analyze the relationship between variables. Structural equation modeling analysis and the bootstrap method were employed to examine the mediating effect of academic self-efficacy on the relationship between academic procrastination, academic performance, and academic satisfaction, respectively.

Results: (a) Academic procrastination was widespread, with 47.6% of respondents exhibiting high levels and 30.2% showing moderate tendencies. (b) Academic procrastination exhibited a negative and statistically significant relationship with academic self-efficacy and satisfaction, respectively. Conversely, academic performance was positively and statistically significantly associated with self-efficacy and satisfaction. Furthermore, academic self-efficacy displayed a positive and statistically significant correlation with academic satisfaction. (c) Academic self-efficacy mediated the relationship between academic procrastination and satisfaction as well as between academic performance and satisfaction.

Conclusion: This study highlights the mechanism of academic satisfaction of undergraduate students, with a particular emphasis on the mediating role of academic self-efficacy, especially verifying its mediating role between academic performance and satisfaction. The findings hold significant implications for policymakers, university administrators, educators, and undergraduate students, offering insights for enhancing academic satisfaction in undergraduate learning and contributing to expanding the mechanistic understanding of academic satisfaction.

Keywords: academic procrastination, academic performance, academic self-efficacy, academic satisfaction, local technology undergraduate students, mediating effect

Introduction

The Organization for Economic Co-operation and Development (OECD) considers academic satisfaction a critical component of a student's educational experience and believes it contributes to the quality of education and student well-being.¹ High levels of academic satisfaction are linked to increased motivation,² improved academic performance,³ and personal growth,⁴ while low levels can lead to disengagement⁵ and a higher risk of dropout.⁶ The Horizon 2020 report (Teaching and Learning Edition), published by EDUCAUSE, emphasizes the urgent need for higher education institutions to implement comprehensive support programs for student well-being, satisfaction, and mental health,⁷ especially in response to the

increasing prevalence of anxiety, depression, and procrastination.⁸ It advocates for improving student achievement and refining university performance assessments through a comprehensive analysis of student engagement and academic outcomes.⁹ Therefore, educational institutions and policymakers can utilize surveys on academic satisfaction to better understand student needs and preferences,¹⁰ enabling them to develop more effective educational policies and management strategies aimed at enhancing educational quality¹¹ and overall student satisfaction.¹² To undergraduate students, increasing academic satisfaction helps stimulate their learning motivation, enhance self-confidence and sense of achievement, and promote their psychological health and personal growth.¹³ Recent studies have predominantly concentrated on identifying elements that determine academic satisfaction,¹⁴ with particular disciplines investigated to discern the correlation between educational experiences and professional contentment.¹⁵ However, contemporary attributes of undergraduate students and their effects on satisfaction remain under-explored.¹⁶ Additionally, comparative research into the underlying drivers of academic satisfaction spanning diverse cultural settings is sparse.¹⁷ In the Chinese context, with the increasing pressure of the current job market, the declining employment rate and quality of undergraduate employment, as well as the decreasing recognition of academic qualifications, academic satisfaction – a vital indicator of the quality of education, reflecting the needs of students and the achievement of educational goals – has become particularly important.¹⁸ At the same time, the promotion of the concepts of lifelong learning and independent learning has emphasized a student-centered research perspective, which views academic satisfaction research as an essential way to improve the quality of higher education,¹⁹ while raising the importance of the self-efficacy study. Considering the recent findings of the National Higher Education Satisfaction Survey in China, which indicates a satisfaction rate of 69.42%, it is imperative to do an additional investigation into student satisfaction due to the extensive size and varied features of the educational system.²⁰ This study aims to investigate the interrelationships among academic procrastination and academic performance as independent variables, academic satisfaction as the dependent variable, and academic self-efficacy as a mediating factor. The focus is on clarifying the mediating role of self-efficacy and uncovering the mechanisms by which academic procrastination and performance influence satisfaction, providing a theoretical and empirical foundation for educational interventions to enhance student satisfaction with their academic experience.

Academic Procrastination and Academic Satisfaction

Academic procrastination is a common phenomenon in universities.²¹ The behaviors related to academic procrastination are also common as well.²² Procrastinate behavior has seriously affected the living conditions of university students and directly led to their life and academic satisfaction and their academic performance.²³ It seems reasonable to assume that procrastination leads to a lifestyle rife with complications that decrease the overall quality of life and the university experience and adversely impact undergraduate student's academic performance and satisfaction, even their graduation.²⁴ It is supported by Temporal Motivation Theory (TMT), a comprehensive framework that integrates various motivational theories and is considered one of the suitable theories that improving academic procrastination can significantly increase student academic satisfaction.²⁵

There is much research concerning the relationship between academic procrastination and academic satisfaction. Balkis et al showed that academic procrastination leads to lower academic satisfaction, and lower academic satisfaction affects students' confidence and motivation in their studies, which in turn affects their academic achievement.²⁶ It can be seen that academic procrastination is significantly associated with negative emotion, low self-efficacy, low motivation, and poor grades, and these negative factors contribute to individuals' negative perceptions of themselves,²⁷ thereby reducing their academic satisfaction.²¹ Later, more researchers in this area have the same findings.^{28–30} From what the researcher has mentioned above, this study tested the relationship between academic procrastination and academic satisfaction of undergraduates at the local technology university of Hubei Province. The hypothesis goes as follows:

H1: There is a significant relationship between academic procrastination and academic satisfaction.

Academic Performance and Academic Satisfaction

Academic performance refers to the level of achievement or proficiency that students demonstrate in their educational pursuits.³¹ It is often measured by various indicators, and the most common one is GPA.³² Academic performance is influenced by a wide array of factors; academic satisfaction is one of them.³³ According to Bandura's triarchic reciprocal causality model, behavior (actions, choices, statements, learning), personal factors (cognitive abilities, motives, and self-efficacy), and environmental factors (feedback, instruction, and reinforcement) influence each other reciprocally.³⁴ Specifically, academic performance is a multifaceted environmental factor influenced by external conditions and personal outcomes, while academic satisfaction represents a behavior shaped by both personal and environmental factors.³⁵ Thus, the relationship between academic performance and academic satisfaction has been discussed among education researchers in recent years.³⁶ Existing literature shows that academic satisfaction is a fundamental asset that is positively related to student's academic performance and overall life satisfaction.³⁷ However, studies investigating the relationship between academic performance and satisfaction have not always yielded consistent results. In their research, Dhaqane and Afrah found a strong relationship between students' satisfaction and academic performance.³⁸ Their study found not only an academic degree to be a measure of success but also attaining academic satisfaction as a measure of success.³⁸ People achieved the highest academic degree but did not enjoy their academic study life. On the contrary, other researchers did not find a correlation between students' satisfaction and performance.³⁹ Academic satisfaction was determined by non-cognitive factors such as motivation and course organization.⁴⁰ In contrast, academic performance was determined by cognitive factors such as final school grades and students' learning behavior.³⁹ Some evidence shows somewhat weaker links between academic satisfaction and academic performance.⁴¹ So, this study used academic satisfaction as the dependent variable to see whether local university undergraduate students' academic performance in Hubei Province was related to their academic satisfaction. The second hypothesis of this study is:

H2: There is a significant relationship between academic performance and academic satisfaction among local technology university undergraduates in Hubei Province of China.

Academic Procrastination and Academic Self-Efficacy

Academic self-efficacy, based on Albert Bandura's Social Cognitive Theory, is one of the most critical factors in understanding student procrastination behavior.⁴² It refers to an individual's conviction concerning their capability to perform academic tasks successfully and attain certain marks in an educational setting.⁴³ This belief influences how learners approach learning, persist when faced with obstacles, and ultimately, their performance in school.^{44,45} In the triarchic reciprocal causality model propounded by Bandura,⁴⁶ academic self-efficacy as a personal factor strengthens students' challenge perception, motivation, and resilience, leading them into ambitious goal settings through unending learning efforts, whereas academic procrastination as an environmental factor is constructed by and impacts upon the learning ecosystem influencing study routines and academic outcome.⁴⁷ Existing research has suggested that individuals with higher academic self-efficacy are more confident in their ability to complete academic tasks and can engage in learning activities in a positive and focused manner, with relatively less procrastination.⁴⁸ However, some studies have found contradictory results. One research concluded that students who used procrastination as a positive learning strategy showed high levels of self-efficacy, while those who used procrastination as a negative learning strategy had lower self-efficacy.⁴⁹ Furthermore, another researcher noted that self-oriented perfectionist students were less likely to procrastinate than other students and that self-efficacy fully mediated the relationship between these two variables.²¹ Additionally, Tuckman and Sexton observed that self-beliefs acted as an intermediary between performance and self-regulation and that external problems and low self-efficacy often led to academic procrastination.⁵⁰ Based on the existing research, the third hypothesis for this study is:

H3: There is a significant relationship between academic procrastination and academic self-efficacy among local technology university undergraduates in Hubei Province, China.

Academic Performance and Academic Self-Efficacy

Academic performance and self-efficacy are mutually influential characteristics in the academic domain.⁵¹ According to social cognition theory, successful academic performance – such as a higher GPA– directly increases a student's academic self-efficacy by reinforcing their belief in their capabilities.⁵² When students see tangible evidence of their academic achievements, it strengthens their confidence in their skills and knowledge.⁵³ Conversely, poor performance can decrease self-efficacy if students interpret these outcomes as indicative of their abilities.⁵⁴ Numerous studies have shown academic self-efficacy's positive effects on students' academic performance. Studies showed that students' academic self-efficacy is an essential variable in predicting students' academic performance.⁵⁵ According to social cognitive theory,⁴⁶ self-efficacy results from measuring and evaluating one's abilities, which determines people's behavioral choices and outcomes.⁵⁶ As a result, students with high academic self-efficacy tend to have higher levels of confidence in their academic performance, put more effort into their studies, and are more likely to do well in academic performance.⁵⁷ In the meantime, the students with higher GPA scores might have a high level of academic self-efficacy.⁵⁵ Based on this theoretical framework and empirical evidence, we hypothesize:

H4: There is a significant relationship between academic performance and academic self-efficacy among local technology university undergraduates in Hubei Province, China.

Academic Self-Efficacy and Academic Satisfaction

Academic satisfaction plays a vital role in keeping students enrolled, engaged, and maintaining their overall well-being.^{26,58} Therefore, academic self-efficacy and academic satisfaction are closely connected as characteristics that contribute to a student's overall educational experience.⁵⁹ As social cognitive theory suggests that self-efficacy beliefs contribute to an individual's overall life satisfaction, individuals who have a strong sense of self-efficacy are able to counteract negative emotions, such as depression and anger, which can reduce their overall life satisfaction.⁶⁰ Moreover, self-efficacy is a significant positive predictor of subjective well-being, and satisfaction is an important component of subjective well-being.⁶¹ Within the university setting, where the main focus for undergraduate students is on their studies, it is important to recognize the significance of academic self-efficacy. Research has found that a high level of academic self-efficacy is effective in reducing internet addiction, alleviating academic burnout, and increasing students' sense of well-being during the study.⁶² These factors can influence students' evaluation of their overall learning status and, consequently, their academic satisfaction. Conversely, some studies have reported different findings, suggesting that self-efficacy beliefs do not directly contribute to satisfaction. Instead, their influence may be mediated by perceptions of progress toward goals.⁶³ Based on the theoretical framework of social cognitive theory and the empirical evidence from previous research, we hypothesize:

H5: There is a significant positive relationship between academic self-efficacy and academic satisfaction among undergraduate students at local technology universities in Hubei Province, China.

Potential Mediation Effect of Self-Efficacy

There is a lack of extensive study on how academic self-efficacy mediates the relationship between academic procrastination and academic satisfaction.^{64,65} Following a thorough analysis of existing literature, it is evident that only a limited number of studies have directly investigated this particular mediational pathway.⁴² A study examining the role of academic self-efficacy in moderating the relationship between academic procrastination and academic satisfaction in a sample of 600 college students from a university in Shandong Province, China, indicated that academic self-efficacy had a role in somewhat mediating the connection between academic procrastination and academic satisfaction.⁶⁶ Although there is a lack of thorough empirical research on this subject, the current theoretical and empirical evidence from the social cognitive theory framework⁶⁷ and related studies indicate that academic self-efficacy acts as a mediator in the connection between academic procrastination and academic satisfaction.⁶⁸ Based on this theoretical perspective, academic procrastination, which is a type of counterproductive behavior, can weaken students' belief in their ability to succeed academically, which, in turn, can result in less satisfaction with their academic performance.⁶⁹ On the other

hand, having a strong belief in one's own academic abilities can encourage positive behaviors and effective methods of learning, which can lead to better academic success and more satisfaction with one's academic experience.⁷⁰

The study on the mediating effect of academic self-efficacy between academic performance and satisfaction is far from abundant.⁵⁹ Many studies have used academic performance as the dependent variable rather than academic satisfaction.⁷¹ Those researchers used these three similar variables tended to focus on areas of work or focused on pupils or secondary school.⁷² A study involving 1161 pupils in Grades 4 to 5 from five public elementary schools was conducted to investigate the relationship between growth mindset, academic self-efficacy, academic performance, and life satisfaction, and revealed a positive association between academic self-efficacy and both academic performance and life satisfaction, with self-efficacy acting as a significant predictor of life satisfaction.⁷³ Although there is little research on the specific role of academic self-efficacy in mediating the relationship between academic performance and academic satisfaction, especially in higher education, the current theoretical and empirical evidence supports the proposed hypothesis.⁷⁴ Bandura's social cognitive theory and its triarchic reciprocal causation model propose that there is a mutual relationship between academic performance, academic self-efficacy, and academic satisfaction.⁵⁹ Achieving good academic results can boost students' belief in their ability to succeed academically, which in turn can lead to increased pleasure in their academic experience.⁷⁵ Additionally, having a strong belief in their academic abilities can also enhance students' academic performance by encouraging them to adopt adaptive behaviors and employ effective learning strategies.^{76,77} By examining this mediational pathway within the specific context of local technology universities in Hubei Province, China, the current study aims to contribute to the existing body of knowledge and provide a more nuanced understanding of the underlying mechanisms governing these relationships. The proposed hypotheses are as follows:

H6: Academic self-efficacy plays a mediating role in the relationship between academic procrastination and academic satisfaction.

H7: Academic self-efficacy plays a mediating role between academic performance and academic satisfaction.

Method

Respondents and Procedure

All respondents in this study who registered in the first term of the academic year 2020–2021 were selected from 22 local technology universities in Hubei province. The 22 universities were divided into three groups according to admission batch to ensure that each undergraduate had an equal chance to be selected and could be well-represented in the population by stratified random sampling. After determining the population (198, 225 undergraduate students), the sample size (110 in the pilot study and 384 for the field study),⁷⁸ and sample size for each category were decided according to their proportion to the whole population. An extra 30%⁷⁹ of the students were selected to guarantee that the number of questionnaires met the criteria of the subsequent analysis. To be detailed, the first tier has three universities, with 56,101 undergraduates, accounting 28.3% of the population; the second tier has six universities, with 67,212 undergraduates, accounting 33.9% of the population; the third tier has thirteen universities, with 74,912 undergraduates, accounting 37.8% of the population. As a result, 41, 48, and 54 undergraduates, as well as 141, 169, and 189 undergraduates, were the sample size for each group of the pilot (total 143) and field study (total 499). With the help of the teaching affairs office of each university, a sampling frame was built, and a random generator was employed to choose each student. All selected students received an Email with the basic information about how to answer each part and item in the questionnaire, together with the link/QR code to access it. The researcher collected all the data from the respondents through the software Questionnaire Star. The questionnaire was carried out anonymously and voluntarily.

The pilot and field study data were collected with the permission of the university authorities and the respondents. To be detailed, a total of 143 pilot questionnaires were distributed of which 138 (97 male accounting 70.3%, 41 female accounting 29.7%; age: 11 under 18 accounting 8.0%, 109 between 19 and 22 account 79.0%, 18 from 23 and above accounting 13.0%; college year: 37 freshmen account 26.8%, 40 sophomores account 29.0%, 30 juniors accounting 21.7%, 36 seniors accounting 26.1%) were valid for pilot research analysis. In the field study, after removing the 143

respondents chosen from the pilot study from the sampling frame, 499 undergraduate students were randomly selected using the same stratified random sampling method. After screening and cleaning the field data, 388 (259 male accounting 66.7%, 129 female accounting 33.3%; age: 43 from 18 under below group accounting 11.2%, 297 from 19 and 22 group account 76.5%, 48 from 23 and above group accounting 12.3%; college year: 99 freshmen account 25.5%, 107 sophomores account 27.6%, 86 juniors accounting 22.1%, 96 seniors accounting 24.8%) valid data were collected for the field study.

The study contained two phrases. Phrase one: A pilot study was conducted through reliability analysis, which included the overall questionnaire and each variable and their dimensions to ensure the reliability and consistency of the scales, and exploratory factor analysis (EFA) to validate the relevant scales before conducting the field study. Phrase Two: With the field study data collected by the modified questionnaire, confirmatory factor analysis (CFA) was conducted before establishing the structural equation model to the goodness-of-fit of the questionnaires used and of a mediating effect model. The variable models were tested using χ^2/df , RESEA, CFI, TLI, and SRMR.⁸⁰ Average Variance Extracted (AVE) and Composite Reliability (CR) were also tested in this process. Structural Equation analysis was used to construct the academic satisfaction model if the variables were valid with the model fit indices of χ^2/df , RMSEA, CFI, TLI, SRMR, AVE, and CR. Finally, bootstrapping tests the mediating role of academic self-efficacy in the model by testing confidence intervals for indirect effects. If a confidence interval does not include 0, the effect is considered statistically significant.

Measures

Academic Satisfaction Scale (USASS)

Academic satisfaction in this study was assessed using the University Students Academic Satisfaction Scale (USASS), a twelve-item instrument developed by Li and Wang.⁸¹ The scale encompasses three dimensions, and each of them has four items: Learning Satisfaction (LS), which pertains to student contentment with the learning process and outcomes; Teaching Satisfaction (TS), concerning student satisfaction with the teaching methods and processes of instructors; and University Resource Satisfaction (URS), which relates to student satisfaction with institutional systems and educational facilities. Responses are self-reported on a 5-point Likert scale, ranging from 1 (highly inconsistent) to 5 (highly consistent), with respondents instructed to answer based on their actual learning experiences. Sample items include, “Most teachers’ teaching method meets my personal expectations”. All items, except the third, which is reverse-scored, are positively phrased. The score for each dimension is calculated as the sum of its constituent items’ scores, with higher scores indicating greater satisfaction in that domain. The scale demonstrated a Cronbach’s alpha of 0.83 in the original study. Furthermore, the USASS is included in the *China Educational Psychology Assessment Manual*, recognized as a reputable tool within the realms of psychology and education.

Academic Procrastination Scale (PASS)

The Procrastination Assessment Scale for Students (PASS)⁸² is a commonly used measure of academic procrastination.⁸³ The 44-item scale was designed to assess procrastination in two different areas: part one is “frequency of procrastination”, with 18 items to measure how often students procrastinate on six different academic tasks. Part two is titled “reasons for procrastination”, and it has 26 items that can be used to access a range of various reasons for procrastination.

As the purpose of this study and the research question only related to the frequency of academic procrastination, only the first part of the PASS was utilized to measure the independent variable of academic procrastination in this study. This scale evaluated the prevalence of procrastination in six academic areas with three items each: (a) writing a term paper; (b) studying for an exam; (c) keeping up with weekly reading assignments; (d) performing administrative tasks; (e) attending meetings, and (f) performing academic tasks in general. Respondents were asked to rate the degree to which they procrastinate in each of the academic tasks (1 = never procrastinate to 5 = always procrastinate), the degree to which procrastination in each of the academic tasks was a problem to them (1 = not at all a problem to 5 = always a problem) and lastly the degree to which they wanted to decrease their procrastination in each of the academic tasks (1 = do not want to decrease to 5 = definitely want to decrease). The scoring is based on summing the first two questions of each of

the six procrastination areas to get a total score. A higher score indicates more self-reported procrastination. PASS (Part 1) has a coefficient alpha reliability of 0.85 for the overall scale.

In this study, each of the questions of the six academic tasks represented a dimension. They were (a) frequency of procrastination (FP; the first question of the six academic tasks), (b) causing problems (CP; the second question of the six academic tasks), and (c) willing to decrease procrastination (TD; the third question of the six academic tasks). The first part of the original PASS was used to measure undergraduate student procrastination levels.

Academic Self-Efficacy Scale (ASES)

Academic Self-efficacy was measured by the Academic Self-efficacy Scale, a 22-item multidimensional instrument widely used in China. Referring to the relevant dimensions of the Academic Self-Efficacy Questionnaire developed by P. R. Pintrich and E. De Groot in 1990, Liang developed the Academic Self-efficacy Scale (ASES) in 2000.⁸⁴ The ASES is divided into two sub-dimensions: learning ability self-efficacy with the first 11 questions and learning behavior self-efficacy with the last 11 questions each. Except for reversed items 14, 16, 17, and 20, the rest of the questions were forward. A 5-point Likert was used in this scale for the respondents, with a score of 1 for them to strongly disagree with the statement and a score of 5 for them to agree with the statement strongly. The total score of academic self-efficacy was calculated by adding the results from the two dimensions. The higher the score of the respondents, the higher their sense of academic self-efficacy would be. The Cronbach's alpha coefficients of the two dimensions of the original research were 0.7941 and 0.6162, respectively, and the overall Cronbach's alpha coefficient of the scale was 0.8171.

Grade Point Average (GPA)

Academic performance refers to the paper-based examination, which judges the quality of students' answers and obtains a quantifiable score. It reflects the student's knowledge and quality of teaching. The academic performance in this study was measured by using the grade point average (GPA) from the first semester of the academic year 2020–2021.

Data Analysis

Data were collated and analyzed using SPSS 26.0 and AMOS 26.0. The collected data were checked by screening and cleaning, missing value analysis, assessment of outliers, normality test, multicollinearity test, common method variance, and reliability test before the pilot and field studies.

In the pilot study, the reliability test was conducted on the overall questionnaire and every variable and its dimensions to ensure the scales' reliability and consistency. Thus, three main criteria for item elimination to filter and purify the items on the pilot questionnaire. There were firstly, the correlation coefficient of the corrected item is less than 0.50; secondly, Cronbach's alpha value after the item is removed is greater than when it is not removed, and lastly, the overall Cronbach's alpha value is less than 0.70. Exploratory factor analysis with the Kaiser–Meyer–Olkin (KMO) coefficient and Bartlett's test of sphericity was performed with the sample to determine whether the three scales used in the current study are appropriate for principal component analysis (PCA). Then, scree plot and parallel analyses were utilized to validate the result of the finding of PCA and determine the number of factors for modifying the questionnaire used in the field study.

A response bias analysis was carried out for the field study to ensure the data was not affected by response bias during the modified questionnaire collection process. After data checking, confirmatory factor analysis was conducted on the three variables (Academic Satisfaction, Academic procrastination, and Academic Self-efficacy) to assess each construct validity, convergent validity, composite reliability, and structural fit of each variable by testing AVE, CR, χ^2/df , RMSEA, SRMR, CFI, and TLI. It was recommended a good model fit that if χ^2/df less than 3, SRMR less than 0.08, CFI and TLI greater than 0.90, together with AVE greater than 0.5, and CR greater than 0.7.^{80,85}

Descriptive and Pearson correlation analyses were conducted to answer research questions and check the hypotheses. The current levels of academic procrastination, academic performance (GPA), academic self-efficacy, and academic satisfaction were identified for descriptive analysis. The correlation analyses established the relationships among the variables. A structural equation model (SEM) was used to examine the fit of the proposed model by RMSEA, SRMR, CFI, TLI, and χ^2/df .⁸⁰ SEM was also employed to check the mediating role of academic self-efficacy in the model by,

respectively, analyzing the impact of the independent variables (academic procrastination and performance) on the mediator (academic self-efficacy) (path a) and the impact of the mediator (academic self-efficacy) on the dependent variable (academic satisfaction) (path b). Subsequently, the product of these two (ab) was calculated to determine whether the mediator (academic self-efficacy) serves a mediating function between the independent variables (academic procrastination and performance) and the dependent variable (academic satisfaction). If the proposed models showed a good model fit, afterward, the bootstrap method was utilized to calculate the distribution of the mediating effect, thereby providing an accurate estimate of the mediating effect and a confidence interval to verify the statistical significance of the mediating effect of academic self-efficacy in the academic satisfaction model.

Results

The item correlation matrix used in the pilot and field studies assessed the multicollinearity. For the pilot data, the correlation values between the variables and their dimensions were less than 0.85,⁸⁶ the VIF value was 1.113, and the tolerance value was 0.898. For field data, the correlation values between the variables and their dimensions were less than 0.85,⁸⁶ the VIF value was 1.083, and the tolerance value was 0.924. Both data sets have low correlation, a VIF value below 10, and a tolerance value above 0.10, suggesting no threat of multicollinearity in the pilot data set and field data set.⁸⁷ Harman's single-factor test showed that the principal component unrotated factor solution, together with the number of factors fixed to 1, resulting in a total variance of 30.304% (52 items, N = 138) in the pilot study and a total variance of 28.749% (49 items, N = 388) in the field study. The results were less than 50% of the variance, indicating no common method variance.⁸⁸

Pilot Study

Before conducting EFA, a reliability analysis was conducted on the entire questionnaire, along with each variable and item. Cronbach's alpha for the overall questionnaire with 52 items was 0.874, indicating high internal consistency. For academic procrastination (18 items), Cronbach's Alpha was 0.963, with three dimensions as follows: TP (6 items) was 0.950, CP (6 items) was 0.954, and TD (6 items) was 0.938. Cronbach's alpha of academic self-efficacy (22 items) was 0.921, with its two dimensions: SEA (11 items) being 0.898 and SEB (11 items) being 0.872. For academic satisfaction (12 items), the overall Cronbach's Alpha was 0.921, with the three dimensions as follows: LS (4 items) was 0.815, TS (4 items) was 0.868, and URS (4 items) was 0.874. Since the pilot study used the three main indicators mentioned earlier to remove items, every questionnaire item was checked based on the dimensions of the scales. To be detailed, SEB7 (0.307) and SEB8 (0.252) of learning behavior self-efficacy under academic self-efficacy and LS2 (0.271) of learning satisfaction under academic satisfaction were failing the reliability test due to the correlation coefficients of correction items were less than 0.50; moreover, the Cronbach's alpha values after deleting them were greater than overall Cronbach's alpha value. To sum up, there remained 20 items for academic self-efficacy and 11 items for academic satisfaction.

EFA

EFA was applied to the pilot phase with three goals: firstly, to determine the structure between constructs; secondly, to detect and assess the unidimensionality of the theoretical constructs; and finally, to reduce the number of variables. The results were presented by variables as follows:

EFA for Academic Satisfaction

After deleting one item (LS2), the EFA on academic satisfaction construct in this study identified three factors, which are consistent with the results obtained from the original and EFA analyses. Table 1 displayed that the KMO value was 0.888, together with Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 1140.981$, $p < 0.001$), indicating that the data is suitable for factor analysis. The eigenvalues obtained from EFA were 5.976, 1.381, and 1.213, explaining a total of 77.911% of the variance. The eigenvalues are greater than those in the simulation data from the parallel analysis data ($5.976 > 1.5014$, $1.381 > 1.3601$, $1.213 > 1.1687$), supporting the presence of three distinct factors. The rotation of the component matrix for the academic satisfaction construct with 11 items revealed a three-component solution. The

Table 1 Exploratory Factor Analysis (EFA)

Variables/ constructs	Original Factors	EFA Factors	KMO Value	Bartlett's Test Results	Eigenvalues (EFA)	Total % Variance	Parallel Analysis Results
Academic Satisfaction	3	3	0.888	$\chi^2=1140.981$, df=55, $p < 0.001$	5.976, 1.381, 1.213	77.911	Actual > simulation 5.976 > 1.6757, 1.381 > 1.5049, 1.213 > 1.2451 (3 factors)
Academic Procrastination	3	3	0.933	$\chi^2=2791.149$, df=153, $p < 0.001$	11.055, 1.973, 1.312	79.667	Actual > simulation 11.055 > 1.6757; 1.973 > 1.5049, 1.312 > 1.2451 (3 factors)
Academic Self- efficacy	2	4	0.899	$\chi^2=2002.709$, df=190, $p < 0.001$	8.464, 3.089, 1.557, 1.250	71.791	Actual > simulation 8.464 > 1.8977; 3.089 > 1.7348, 1.557 > 1.5090, 1.250 > 1.2061 (4 factors)

remaining 11 items collapsed neatly into three components like the original scale, with factor loading from 0.730 to 0.908.

Based on the results of EFA, there was no mix of items from the three sub-constructs of academic satisfaction and consistent with the literature.⁸² Therefore, the labels of the dimensions of academic satisfaction remained as the original scale, namely: learning satisfaction (LS, 3 items), teaching satisfaction (TS, 4 items), and university resource satisfaction (URS, 4 items).

EFA for Academic Procrastination

As shown in Table 1, EFA confirmed three factors aligning with the original scale for academic procrastination. The KMO was exceptionally high at 0.933. Bartlett's test yielded $\chi^2 = 2791.149$, $p < 0.001$, indicating that the data is suitable for factor analysis. The EFA-derived eigenvalues were 11.055, 1.973, and 1.312, cumulatively explaining 79.667% of the variance. These values exceed the parallel analysis thresholds ($1.6757 < 11.055$; $1.5049 < 1.973$, and $1.2451 < 1.312$), confirming the validity of this three-factor construct. The rotation of the component matrix for the academic procrastination construct with 18 items revealed a three-component solution, with the items falling neatly according to the stated sub-constructs with factor loading from 0.698 to 0.858.

To sum up, the EFA finding was consistent with the original scale, so 18 items remained in 3 dimensions with no modification.

EFA for Academic Self-Efficacy

After removing two items (SEB7 and SEB8), the EFA for academic self-efficacy in this study suggests four factors rather than the initial two. As displayed in Table 1, the KMO value was 0.899, and Bartlett's test was statistically significant with $\chi^2 = 2002.709$, $p < 0.001$, validating the appropriateness of data for factor analysis. The eigenvalues were 8.464, 3.089, 1.557, and 1.250, explaining 71.791% of the variance. This factor structure was supported by parallel analysis results, where the actual eigenvalues surpass simulation values ($8.464 > 1.8977$, $3.089 > 1.7348$, $1.557 > 1.5090$, $1.250 > 1.2061$), leading to the identification of four factors.

The rotated component matrix results of the academic self-efficacy construct with 20 items revealed a four-component solution. All the items have factor loading above 0.7. The newly discovered four academic self-efficacy dimensions were named based on the items and literature.⁸⁹ In the new scale, component 1, named self-efficacy learning ability (SEA), consists of eight items (SEA2, SEA7, SEA1, SEA5, SEA4, SEA6, SEA8, and SEA3); component 2, named self-efficacy of learning efforts (SEE), consists of six items (SEB 4, SEB1, SEA11, SEB2, SEA10, and SEA9); component 3, named self-efficacy self-doubt (SED), consists three items (SEB5, SEB6, and SEB3); component 4, named self-efficacy of learning behavior (SEB), consists three items (SEB10, SEB9, and SEB11).

In summary, four components were extracted by PCA on the 20 items of academic self-efficacy. The final four sub-constructs and items of academic self-efficacy in this study were: self-efficacy of learning ability (SEA, 8 items), self-efficacy of learning efforts (SEE, 6 items), self-efficacy of learning self-doubt (SED, 3 items), and self-efficacy of learning behavior (SEB, 3 items).

Field Study

The dataset of the field study comprising 412 received questionnaires (82.5% response rate) was subjected to several data screening and cleaning processes to ensure its suitability for analysis. Missing data were minimal and handled appropriately by offering sufficient time to respond and checking each questionnaire carefully during collection and data entry. No significant response bias was detected upon examination. Outlier analysis identified a few extreme values, resulting in removing 24 extreme outliers identified by boxplots and the remaining 388 cases without multivariate outliers. Normality tests indicated that the data ($N = 388$) approximated a normal distribution, satisfying the assumptions required for subsequent analyses. Additionally, the common method variance was evaluated using Harman's single-factor test, revealing no substantial concerns. Before conducting the CFA, reliability was examined, with the results of Cronbach's alpha of academic procrastination, self-efficacy, satisfaction, and total questionnaire (49 items, $N = 388$) were 0.960, 0.906, 0.892, and 0.872. Therefore, the dataset ($n = 388$) was considered clean and appropriate for further statistical evaluation.

CFA

Table 2 showed the model fit indices, AVE value, and CR value of the three sub-construct models based on the EFA results, which demonstrated good structural validity by CFA. The academic satisfaction model for fitness indices⁸⁰ was achieved by RMSEA = 0.048 and had a 90% confidence interval ranging from 0.031 to 0.064, SRMR = 0.0457, CFI = 0.985, TLI = 0.979, $\chi^2/df = 1.881$. Together with the AVE value = 0.569 and CR value = 0.798, it can be concluded that the academic satisfaction construct has been found to have convergent validity and composite reliability.^{80,87} The factor loadings for the items were from 0.67 to 0.95. The results of Academic procrastination model fitness were RMSEA = 0.062 and had a 90% confidence interval ranging from 0.053 to 0.071, SRMR = 0.0296, CFI = 0.974, TLI = 0.970, $\chi^2/df = 2.486$. AVE value = 0.640 and CR value = 0.841, it can be concluded that the academic procrastination construct has a well-convergent validity and composite reliability. The factor loadings for the items were from 0.80 to 0.93. The model fitness indices of academic self-efficacy were RMSEA = 0.057 and had a 90% confidence interval ranging from 0.049 to 0.065, SRMR = 0.0427, CFI = 0.964, TLI = 0.958 > 0.95, $\chi^2/df = 2.046$, AVE value=0.456, and CR value = 0.755. The factor loadings for the items were from 0.64 to 0.89. Except for the AVE value, other indicators were above the threshold values. According to Fornell and Larcker⁹⁰ and Lam,⁹¹ if the value of AVE is less than 0.5, but the value of CR is higher than 0.6, the convergent validity of the construct is still adequate.⁹² Therefore, it can be inferred that the academic self-efficacy construct has been determined to possess convergent validity and composite reliability.

Table 2 Model Fit Indices AVE and CR

Measurement Models	RMSEA [LO 90; HI 90] < 0.08	SRMR < 0.08	CFI > 0.90	TLI > 0.90	χ^2/df < 3.0	AVE > 0.5	CR > 0.7
Academic Satisfaction Model	0.048 [0.031; 0.064]	0.0457	0.985	0.979	1.881	0.569	0.798
Academic Procrastination Model	0.062 [0.053; 0.071]	0.0296	0.974	0.970	2.486	0.640	0.841
Academic Self-efficacy Model	0.057 [0.049; 0.065]	0.0427	0.964	0.958	2.046	0.456	0.755

Descriptive and Correlation Analysis

As shown in Table 3, Academic procrastination ($M = 3.41$, $SD = 1.140$) was prevalent among undergraduate students in the local technology university of Hubei Province, China, and academic procrastination was at a medium level. Among the various academic procrastination behaviors, school activities related to general (49.5% reported a high level) and academic administrative tasks (46.4% reported a high level) were the top two most common procrastinated activities. Academic self-efficacy ($M = 3.85$, $SD = 0.70$) and academic satisfaction ($M = 3.97$, $SD = 0.75$) were at a high level.

Table 3 also presented that academic procrastination has a negative and statistically significant relationship with academic satisfaction and a negative and statistically significant relationship with academic self-efficacy. Moreover, academic performance has a positive and statistically significant relationship with academic satisfaction and self-efficacy. Furthermore, academic self-efficacy has a positive and statistically significant relationship with academic satisfaction. The results confirmed hypotheses H1, H2, H3, H4, and H5, establishing a foundation for further exploration of mediating effects.

Mediating Effect Analyses

Structural equation modeling (SEM) analysis of mediation was conducted to examine the mediating effect of the academic self-efficacy variable on the relationship between academic procrastination and satisfaction, and between academic performance and satisfaction, respectively. The model fit of the structural model⁸⁰ was first examined, as shown in Figure 1. The specific indicators were as follows: RESEA = 0.041, had a 90% confidence interval ranging from 0.036 to 0.064, SRMR = 0.0549, TLI (NNFI) = 0.948, CFI = 0.951, and $\chi^2/df = 1.641$. These results indicate that the model offers a satisfactory representation of the underlying structure and serves as a robust basis for further analysis.

The mediation analysis was conducted to test Hypothesis 6 (Figure 2) and Hypothesis 7 (Figure 3). According to the fitness indices of the structural results, these proposed structural models of academic self-efficacy (ASE) as a mediator between academic procrastination (AP) and academic satisfaction (AS), as well as between academic performance (GPA) and academic satisfaction (AS), achieved the required goodness-of-fit. Specifically, for Figure 2, the fit indices were $\chi^2/df = 2.130$, RMSEA = 0.054, had a 90% confidence interval ranging from 0.040 to 0.078, SRMR = 0.0380, CFI = 0.972, and TLI (NNFI) = 0.961. Similarly, for Figure 3, the indices were $\chi^2/df = 2.590$, RMSEA = 0.064, SRMR = 0.0454, CFI = 0.970, and TLI (NNFI) = 0.948.

The results of the mediation analysis were displayed in Table 4. In the relationship among academic procrastination, self-efficacy, and satisfaction: firstly, the effect of AP on ASE was statistically significant and negative ($\beta = -0.108$, S.E. = 0.025, C.R. = -4.316, $p < 0.01$) (path a), indicating that higher levels of procrastination are associated with lower self-efficacy; secondly, the effect of ASE on AS was statistically significant and positive ($\beta = 1.641$, S.E. = 0.277, C.R. = 5.930, $p < 0.01$) (path b), suggesting that higher self-efficacy leads to greater satisfaction; thirdly, the effect of AP on AS was statistically significant and negative ($\beta = -0.144$, S.E. = 0.041, C.R. = -3.558, $p < 0.01$) (path c), indicating that procrastination reduces satisfaction. Since the value of $a \times b < c$ ($-0.108 \times 1.641 = -0.172 < -0.144$), the indirect path from AP to AS through ASE is statistically significant. These results suggested that academic self-efficacy partially mediates the relationship between academic procrastination and satisfaction. Higher academic procrastination is associated with lower academic self-efficacy, which in turn reduces academic satisfaction.

In the relationship among academic performance (GPA), self-efficacy, and satisfaction: firstly, the effect of GPA on ASE was statistically significant and positive ($\beta = 0.154$, S.E. = 0.039, C.R. = 3.912, $p < 0.01$) (path a), meaning better

Table 3 Descriptive Statistics and Correlations

Variables	M \pm SD	1	2	3	4
1. Academic Procrastination	3.41 \pm 1.140	–			
2. Academic Performance	2.98 \pm 0.51	–0.179**	–		
3. Academic Self-efficacy	3.85 \pm 0.70	–0.276**	0.238**	–	
4. Academic Satisfaction	3.97 \pm 0.75	–0.347**	0.382**	0.585**	–

Note: ** $p < 0.01$.

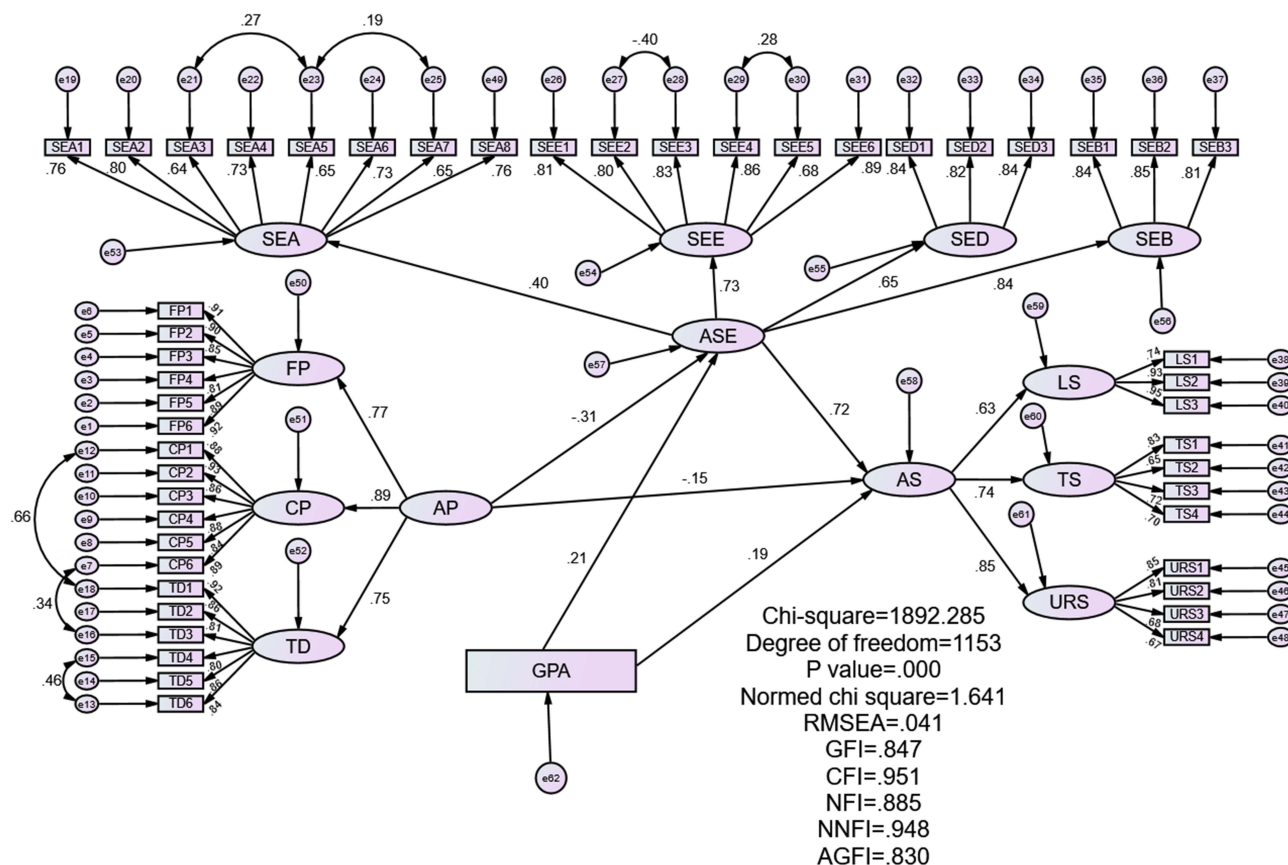


Figure 1 Academic Satisfaction Model Mediated by Academic Self-efficacy.

Abbreviations: AP, academic procrastination; GPA, academic performance; ASE, academic self-efficacy; AS, academic satisfaction.

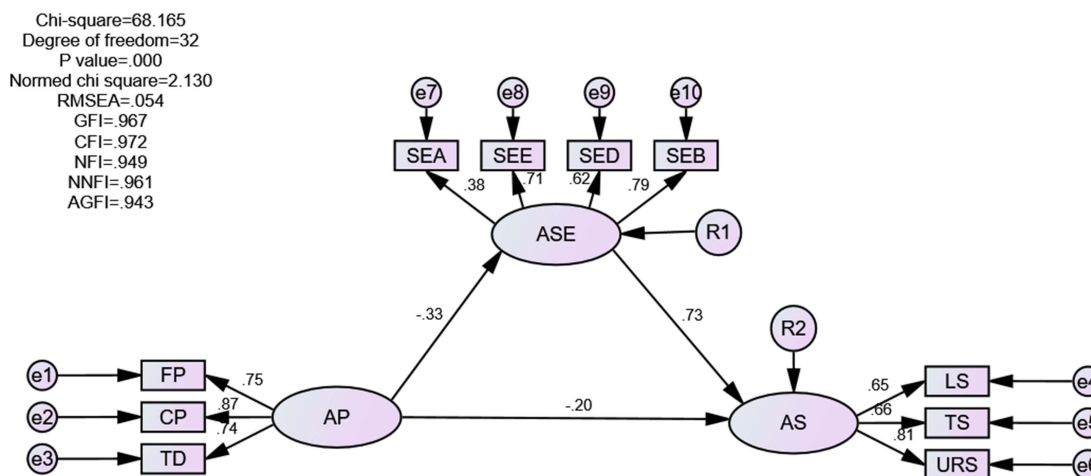


Figure 2 Academic Self-efficacy as a Mediator between Academic Procrastination and Academic Satisfaction.

Abbreviations: AP, academic procrastination; ASE, academic self-efficacy; AS, academic satisfaction.

performance enhances self-efficacy; secondly, the effect of ASE on AS was also statistically significant and positive ($\beta = 1.712$, S.E. = 0.284, C.R. = 6.032, $p < 0.01$) (path b), indicating that higher self-efficacy leads to greater satisfaction; thirdly, the effect of GPA on AS was statistically significant and positive ($\beta = 0.329$, S.E. = 0.069, C.R. = 4.771, $p < 0.01$) (path c), showing that higher performance leads to greater satisfaction. The value of $a \times b < c$ ($0.154 \times 1.712 = 0.264 <$

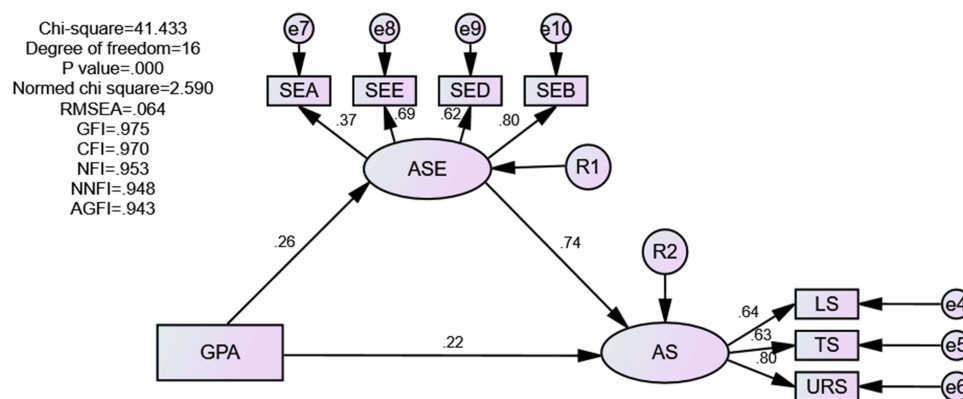


Figure 3 Academic Self-efficacy as a Mediator between Academic Performance (GPA) and Academic Satisfaction.

Abbreviations: GPA, academic performance; ASE, academic self-efficacy; AS, academic satisfaction.

0.329), the indirect path from GPA to AS through ASE, was statistically significant. These findings suggested that academic self-efficacy partially mediates the relationship between academic performance and satisfaction. Higher academic performance (GPA) increases academic self-efficacy, which subsequently enhances academic satisfaction. Therefore, Hypothesis 6 and Hypothesis 7 were both valid, meaning academic self-efficacy plays a statistically significant mediating role in the relationships between academic procrastination and self-efficacy, as well as between academic performance and satisfaction. Specifically, academic self-efficacy serves as a mechanism through which both academic procrastination and performance influence academic satisfaction.

The Bootstrap test was employed to verify the mediating role of academic self-efficacy. The results from Table 5 have shown that academic self-efficacy statistically significantly mediates the relationship between academic procrastination and satisfaction, with an indirect effect value of -0.242 . This mediation is supported by the 95% confidence interval for the bias-corrected estimate, not including 0.00, and a p -value of 0.001, less than the conventional threshold of 0.05. Additionally, the direct effect of academic procrastination on satisfaction is statistically significant, with a direct effect value of -0.144 , a corresponding p -value of 0.003, and a 95% confidence interval that excludes 0.00. The total effect of academic procrastination on satisfaction is substantial and statistically significant, evidenced by a total effect value of 0.440, a p -value of 0.001, and a 95% confidence interval that does not contain 0.00. Collectively, these findings confirmed that academic self-efficacy partially mediates the negative association between academic procrastination and satisfaction, indicating that while academic procrastination directly reduces satisfaction, it also does so indirectly by lowering self-efficacy.

Table 5 also revealed that academic self-efficacy statistically significantly mediates the relationship between academic performance (GPA) and satisfaction. The indirect effect is substantial with a value of 0.188, and the 95% confidence interval for the bias-corrected estimate does not include 0.00, confirming the mediation with a p -value of 0.001, which is below the 0.05 significance threshold. Moreover, the direct effect of academic performance (GPA) on satisfaction is also statistically significant, with an effect value of 0.235 and a p -value of 0.001, and the confidence interval does not contain

Table 4 Mediation Analysis

Path	β estimate	SE.	CR.	p -value	Result
ASE \leftarrow AP	-0.108	0.025	-4.316	<0.001	Significant
AS \leftarrow ASE	1.641	0.277	5.930	<0.001	Significant
AS \leftarrow AP	-0.144	0.041	-3.558	<0.001	Significant
ASE \leftarrow GPA	0.154	0.039	3.912	<0.001	Significant
AS \leftarrow ASE	1.712	0.284	6.032	<0.001	Significant
AS \leftarrow GPA	0.329	0.069	4.771	<0.001	Significant

Abbreviations: AP, academic procrastination; ASE, academic self-efficacy; GPA, academic performance; AS, academic satisfaction.

Table 5 Mediate Effect Bootstrap Test

Path	Estimate	95% Confidence Interval	
		p-value	BC
Indirect Effect AP→ASE→AS	−0.242	0.001	−0.349~−0.159
Direct Effect AP→AS	−0.144	0.003	−0.239~−0.057
Total Effect AP→AS	−0.440	0.001	−0.527~−0.352
Indirect Effect GPA→ASE→AS	0.188	0.001	0.082~0.304
Direct Effect GPA→AS	0.235	0.001	0.116~0.366
Total Effect GPA→AS	0.424	0.001	0.292~0.536

Abbreviations: BC, bias-corrected percentile method; AP, academic procrastination; ASE, academic self-efficacy; AS, academic satisfaction; GPA, academic performance.

0.00. The total effect of academic performance (GPA) on satisfaction is 0.424, with a statistically significant *p*-value of 0.001 and a confidence interval that excludes 0.00, indicating a solid overall impact. These results collectively suggested that while there is a direct positive relationship between academic performance and satisfaction, academic self-efficacy also plays a crucial role as a mediator in this relationship, leading to the conclusion that the mediation effect is partial.

Discussion

The descriptive analysis shows that academic procrastination is common among undergraduate students, and despite the prevalence of procrastination, academic self-efficacy, and academic satisfaction are unexpectedly high among students. This finding suggests that undergraduate students in the new era have confidence in their academic abilities, are able to face academic challenges positively and derive satisfaction from them. At the same time, it also suggests that undergraduate students' learning behavior and psychological states result from a combination of factors, which raises new demands for future research.

Correlation analyses demonstrated that academic procrastination of local technology university undergraduate students has a statistically significant negative relation with academic self-efficacy and academic satisfaction, which confirms the earlier investigation^{27,29,42,47,48} and research hypotheses H1 and H3. Temporal motivation theory (TMT)²⁵ suggests that procrastinating is often aggravated by low academic self-efficacy among students who lack the confidence to complete assignments successfully. Consequently, this uncertainty leads to a higher chance of avoiding the tasks assigned to them. Moreover, reduced intrinsic motivation resulting from less value students perceive in academic tasks tends to lead to procrastination. Regarding academic satisfaction, TMT²⁵ posits that positive perceptions of academic tasks can increase satisfaction and reduce procrastination. Therefore, the improvement of undergraduate students' self-efficacy and task value perceptions, as well as the control of impulsivity, is of significant importance in reducing academic procrastination and increasing academic satisfaction.

Academic performance has a statistically significant positive relation with academic self-efficacy and academic satisfaction, respectively, as revealed by this study. These findings are also supported by previous research^{37–39,55,56} and confirmed the research hypotheses H2 and H4. In the meantime, academic self-efficacy was significantly positively related to academic satisfaction, which confirms the findings of earlier research^{29,66} and research hypothesis H5. Academic self-efficacy, as conceptualized by Social Cognitive Theory (SCT),⁴⁶ plays a pivotal role in enhancing performance by motivating students to adopt effective learning strategies and maintain persistence through challenges. In turn, it reinforces their self-belief through a series of successful academic experiences, creating a virtuous cycle of

self-efficacy and accomplishment. Concurrently, the correlation between academic performance and satisfaction is evident, as school achievements align with the positive outcome students anticipate, culminating in increased satisfaction.⁴⁷ The significance of academic self-efficacy cannot be overstated, as it is the cornerstone that supports both the enhancement of academic performance and the enrichment of academic satisfaction.³⁵

As the role of academic self-efficacy became prominent, the researchers validated its mediating effect in the academic satisfaction model. Followed by the CFA and bootstrapping test, the mediational role of academic self-efficacy was found in the relation between academic procrastination and academic satisfaction, and between academic performance and academic satisfaction, respectively, as well as tested the research hypotheses H6 and H7.

The former conclusion is consistent with previous studies,^{29,66} which conclude that academic self-efficacy may mediate between academic procrastination and academic satisfaction. Specifically, high levels of self-efficacy should prevent students from procrastinating as much because they believe they can effectively manage their academic tasks.⁴⁸ This belief lowers their self-doubt and anxiety, which ultimately puts them in the zone, allowing them to be more confident with their academic abilities. Moreover, naturally, students with high self-efficacy are more likely to rise and meet academic challenges head-on rather than hide from those challenges or postpone facing them.⁴⁷ Having this approach helps them finish their work on time, which means good grades and hence a great academic experience. At the same time, this keeps their sense of engagement and interest towards learning high as they perceive challenges as a separate vehicle for formulating an alternative approach to problem-solving instead of an obstacle. In contrast, procrastination directly tears down the students' self-efficacy and can generate feelings that this is going to be too challenging or I cannot do it, resulting in lower academic contentment. Procrastination was found to decrease the likelihood of task completion, leading to lower grades and greater academic stress — all of which result in decreased academic satisfaction. Thus, cultivating students' academic self-efficacy is a critical task for reducing procrastination and promoting academic satisfaction.⁴⁵ An effective way of tackling this is by effective coaching to enhance students' confidence and lead to better time management, resulting in less procrastination, which in turn improves academic activeness.

However, few studies have tested the mediating role of academic self-efficacy between academic performance and academic satisfaction using academic satisfaction as the dependent variable, so the latter conclusion needs to be investigated further. Previous studies have either investigated the correlation between academic performance, academic self-efficacy, and academic satisfaction^{71,76} or the mediating role of academic self-efficacy between academic performance and academic satisfaction, taking academic performance as the dependent variable.⁵⁹ This research found that academic self-efficacy serves as a mediator between academic performance and academic satisfaction. In detail, high-GPA students feel satisfied because they have confidence in their abilities,⁵³ whereas many low-GPA students are dissatisfied due to self-faulting doubts. Even with a high GPA, if a student has low self-efficacy, they would be in dissatisfaction, while the highest levels of self-efficacy keep students satisfied even with low GPAs, which they believe can improve.⁹³

In addition, academic self-efficacy serves as a partial mediator of the proposed academic satisfaction mechanism. Specifically, enhancing self-efficacy can empower students to approach tasks with greater confidence, reducing the tendency to procrastinate and leading to higher satisfaction levels.³⁵ Furthermore, a strong sense of self-efficacy can amplify the positive impact of good academic performance on student satisfaction, as it fosters a growth mindset that values learning and personal development.^{45,47} These findings underscore the importance of integrating self-efficacy into the design of educational strategies, as it not only addresses the behavioral issues associated with procrastination but also enriches the subjective experience of academic success, ultimately contributing to a more satisfying educational journey for students. Interventions targeting undergraduate student satisfaction should focus on improving academic self-efficacy. Reducing procrastination falls to the educator, who can accomplish this by providing feedback emphasizing effort and strategy, generating incremental successes, and encouraging self-reflection. Educators can further support this by teaching them time management and offering a growth mindset. Additionally, giving feedback to students about how they might need extra help with lower GPAs and providing them balanced feedback based on effort rather than grades will boost self-efficacy. In that way, these strategies allow for the view of academic obstacles as opportunities for growth, hence the higher levels of academic satisfaction.

With the Chinese higher education framework, enhancing academic self-efficacy among undergraduate students is essential for elevating academic satisfaction. Having supportive educational settings, reducing procrastination, giving holistic support, providing balanced feedback, and concentrating on students with low GPAs can dramatically increase self-efficacy.⁵⁵ These practices enable students to view academic challenges as opportunities for growth, which then makes them more satisfied. The optimal distribution of resources is important, but this should be complemented by additional efforts, such as developing or improving university student support structures and teaching management systems that promote autonomous learning. These efforts are of utmost importance in promoting the intrinsic growth and progress of higher education in China.

In summary, this study contributes a comprehensive model integrating contemporary undergraduate traits to understand the factors influencing academic satisfaction. The findings reveal that academic self-efficacy mediates between academic procrastination and satisfaction as well as academic performance and satisfaction. These findings align with Social Cognitive Theory to some extent, provide novel insights into the study of academic self-efficacy, and will be useful for future research on the link between academic performance and academic satisfaction. Furthermore, these findings enrich the research on academic satisfaction as a dependent variable, especially concerning the influence of numerous non-intellectual, cognitive, and non-cognitive factors on academic satisfaction. Finally, the findings of this study can be applied by educational policymakers, educational administrators, teachers, and students to leverage academic self-efficacy to enhance the overall higher education experience.

Limitations

This research demonstrated the mediational role of academic self-efficacy between academic procrastination, academic performance, and academic satisfaction of local technology university undergraduate students, and proposed a mechanism to enhance academic satisfaction. However, there are several limitations to this study. Firstly, this research was conducted in all 22 local technology universities of Hubei Province of China, and the findings may generalize to undergraduate students in other local technology universities and other provinces of China. However, these findings might not be generalized to all undergraduates in other Asian countries or other parts of the world. Future studies should consider this factor and its limitations. Secondly, this study only used close-end questionnaires as an instrument of research without using observations and interviews. Since academic satisfaction is a subjective feeling of undergraduate students, subsequent studies may adopt a richer research approach to reveal the academic satisfaction mechanism comprehensively. Finally, this study considered only academic self-efficacy as a mediator; perhaps the role of other variables (such as autonomous learning ability, professional identity, and social support) as mediators could be explored in the future.

Conclusion

This study explored the internal mechanism of academic satisfaction from the perspective of the characteristics of undergraduates. The relations between academic procrastination, academic performance, academic self-efficacy, and academic satisfaction were tested. Moreover, academic self-efficacy mediates between academic procrastination and satisfaction, and between academic performance and academic satisfaction, respectively. These results reveal the importance of academic self-efficacy in the learning experience of university life of all undergraduate students no matter if they have delayed behaviors or bad grades. It also expands the research perspective of academic satisfaction and has confirmed that academic self-efficacy is not only related to academic performance and academic satisfaction but also plays a mediating role in the relationship between them. These results are relevant in lifting academic satisfaction among undergraduates through an integrated, multi-level approach that advances the culture of student-center learning and development. For one, policymakers can enact policies that prioritize student mental health or well-being, which is essential to self-efficacy. Moreover, they should also advocate programs that support curricular choices tailored to student interests and strengths. Second, university administrators should use faculty development to enhance teaching strategies and student engagement. They also must ensure resources are directed to create an environment that is favorable to learning and includes the provision of study spaces, tutoring, and technology. Third, by using interactive teaching methods, teachers can encourage critical thinking and active participation in their students, which are necessary tools for

building self-efficacy. Regular and constructive feedback that emphasizes effort and progress rather than just outcomes can also nurture a growth mindset among students. Fourth, university students can be encouraged to establish realistic goals and use self-monitoring techniques in academic learning by engaging in academic self-reflection, which might reduce procrastination and improve contentment among undergraduate students. By adopting these targeted strategies, each stakeholder can contribute to a cohesive educational ecosystem that nurtures academic self-efficacy, leading to a reduction in procrastination and an increase in academic satisfaction, thereby optimizing the academic experiences of students in higher education.

Data Share Statement

The data of the present study supporting the conclusions will be made available on request by the corresponding author.

Ethics Approval and Consent to Participate

The study was approved by the ethics committee of the Foreign Language School, Jingchu University of Technology, China; and the ethics committee of the Faculty of Business, Information & Human Sciences, Infrastructure University Kuala Lumpur, Malaysia.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Disclosure

The authors declare that there is no conflict of interest.

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