*J Euro Eco His.*
*ISSN : 0391-5115*
*Volume 7, Isue 1 ( 2026)*
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

# The Influence of Academic Procrastination on Psychological Well-being among College Students in Guizhou, China: The Moderated Mediating Effect of Students' Sense of Belonging and Gender

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**Abstract**
This study examined the relationship between academic procrastination and psychological well-being among vocational college students in Guizhou, China. Testing the mediating role of school belonging and the moderating role of gender. A cross-sectional survey was conducted with 377 full-time students from three vocational colleges in Zunyi, Guizhou Province, using stratified random sampling by institution and grade. Previously validated five-point Likert scales were used, and hypotheses were tested using structural equation modelling with bias-corrected bootstrapping (5,000 resamples). Academic procrastination negatively predicted psychological well-being ($\beta = -0.359$, $p < .001$) and school belonging ($\beta = -0.376$, $p < .001$), while school belonging positively predicted psychological well-being ($\beta = 0.252$, $p < .001$). School belonging partially mediated the procrastination–well-being association (indirect effect $\beta = -0.095$, 95% BC CI [−0.146, −0.053], $p < .001$). Gender did not moderate the procrastination-to-belonging pathway ($\beta = 0.009$, $p = .845$). The model explained 14.2% of the variance in school belonging and 26.0% in psychological well-being. Overall, the findings indicate a partially mediated mechanism whereby academic procrastination is associated with poorer psychological well-being both directly and indirectly through reduced school belonging, whereas the hypothesised gender moderation was not supported. These results position school belonging as a salient contextual mechanism linking academic procrastination to vocational students' psychological well-being in this Chinese sample. Findings suggest that enhancing school belonging, alongside reducing procrastination, may improve vocational students' psychological well-being.

**Key Words:** Academic procrastination; Psychological well-being; Students' sense of belonging;

## Introduction

In recent years, research on the psychological state of students in higher education has been increasing Studies reveal markedly high prevalence rates of depressive and anxiety symptoms among higher-education students with combined rates of diagnosed or detected depressive and anxiety symptoms reaching approximately 30% (depression at around 33.6%) (Zhang & Wang, 2022). Consequently, the college population has emerged as one of the primary groups experiencing significant challenges related to psychological well-being. A large-scale umbrella review covering millions of students revealed that prevalence rates for depression, anxiety, stress, and suicide-related indicators among college students were generally high, whilst

exhibiting substantial variation across studies. This suggests that 'describing the problem solely in terms of detection rates' is insufficient to explain how risks emerge and accumulate within educational settings (Paiva et al., 2025). Therefore, a more incrementally valuable line of inquiry is not to reiterate that college students' psychological health is at risk, but to identify modifiable learning behaviours and school-context experiences that are associated with students' psychological well-being (PW).

We observe that the proliferation of research into college students' psychological well-being points to a complex reality: whilst academic pressure may enhance students' academic performance, it simultaneously exacerbates accompanying anxiety, depression, and physiological dysfunction (Benítez-Agudelo et al., 2025). On the other hand, many factors that contribute to psychological well-being do not stem from a single "stressful event", but rather from the depletion of sustained learning patterns and psychosocial resources. Academic procrastination (AP) is widely observed among students and is often framed in moral terms. Although earlier work reported a weak association between procrastination and academic performance (Kim & Seo, 2015), this does not imply that procrastination is psychologically harmless. On the contrary, current research indicates a consistent association between academic procrastination and poorer psychological well-being (Gayary & Kalita, 2025). Moreover, an increasing number of studies are endeavouring to progress from establishing "correlation" towards "time-series analysis and causal inference". Procrastination is perceived by students as a source of stress (Rozental et al., 2022), which to some extent affects their psychological well-being. The more severe the academic procrastination among college students, the more pronounced their issues with psychological well-being become (Abood & Al-Adamat, 2024; Umar et al., 2023). Higher levels of procrastination correlate with subsequently elevated symptoms of depression, anxiety, and stress, maintaining significant associations even after controlling for multiple variables (Johansson et al., 2023). Academic procrastination is jointly influenced by individual resources and situational stressors (Nie et al., 2025). This provides stronger evidence supporting the directionality that 'academic procrastination precedes psychological distress'. Consequently, the key theoretical question in this field has shifted from whether procrastination is harmful to identifying the psychological mechanisms through which academic procrastination relates to psychological well-being, as well as the conditions under which this association may be stronger or weaker.

From a mechanistic perspective, the students' sense of belonging (SSB) offers a plausible mediating framework that links academic risk behaviours to psychological well-being outcomes. Prior research has consistently associated SSB with academic functioning and psychological well-being. As a "socio-psychological resource", belonging may influence psychological well-being by alleviating isolation and enhancing perceived value and meaning (van Kessel et al., 2025). Students with a strong sense of belonging to their school may experience minimal impact on their overall psychological well-being from occasional academic procrastination, as their robust sense of belonging fosters greater life satisfaction and enhanced happiness (Samadieh & Rezaei, 2024). Conversely, when students with weaker students' sense of belonging exhibit academic procrastination, it significantly impairs their psychological well-being. Individuals with a low students' sense of belonging, fearing they cannot integrate into their class and peer group, increasingly adopt avoidance strategies towards learning (Tian et al., 2023), leading to academic procrastination. Moreover, research has confirmed that students with a lower students' sense of belonging are more prone to negative emotions such as loneliness and anxiety (Zhai et al., 2020). This implies that students

with a strong students' sense of belonging possess greater motivation to learn (Gutiérrez et al., 2022), exhibit less academic procrastination, and consequently enhance their psychological well-being.

Whether the connections between academic procrastination, students' sense of belonging, and psychological well-being are consistent across different groups is also a question that the research needs to consider. Gender is often regarded as one of the important factors causing such differences. Studies have confirmed that there are differences between male and female students in the same situations. Under the same background conditions of social economic status, race, and educational background, the degree of procrastination among men is much higher than that among women (Lu et al., 2021). Because male have poorer self-regulation abilities, they are more likely to exhibit academic procrastination when faced with the need to invest a long period of time in study and complete study tasks (Song et al., 2025). Other studies have presented opposing viewpoints, with researchers confirming that gender does not significantly moderate the relationship between internet addiction and academic procrastination (Rinaldi & Damayanti, 2025). Coincidentally, some studies have also found that the moderating effect of gender on the relationship between self-regulation and academic procrastination has not been confirmed (Rahmawati et al., 2025). We observe divergent perspectives and evidence regarding whether distinct differences exist among different groups within the same context. This study contends that clarifying whether gender plays a moderating role in the relationships between academic procrastination, students' sense of belonging, and psychological well-being is crucial for refining the theoretical framework. Concurrently, this approach mitigates the risk of overgeneralisation or overlooking the distinct operational mechanisms across different groups. Consequently, this research examines the moderating effect of gender within an integrated moderation-mediation framework model.

In summary, this study examines the relationship between academic procrastination and college students' psychological well-being, tests the mediating role of students' sense of belonging, and evaluates whether gender moderates the relationship between academic procrastination and students' sense of belonging. The study aims to provide empirical evidence to inform school-based efforts to promote psychological well-being among college students. Accordingly, the following five hypotheses are proposed:
*H1: Academic procrastination can negatively predict psychological well-being.*
*H2: Academic procrastination can negatively predict students' sense of belonging.*
*H3: Students' sense of belonging can positively predict psychological well-being.*
*H4: Students' sense of belonging plays a mediating role between academic procrastination and psychological well-being.*
*H5: Gender moderates the relationship between academic procrastination and students' sense of belonging.*

Based on the above research hypotheses, this study constructs a moderated mediating model diagram, as shown in Figure 1.

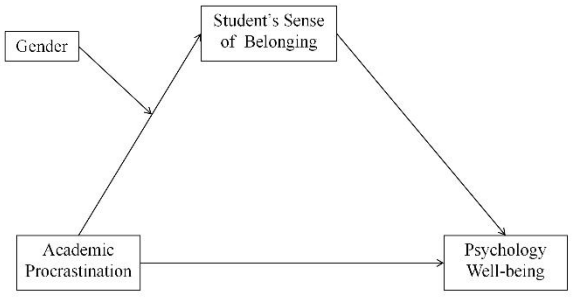


Figure 1. Conceptual model proposed in this study

## 2. Research Methods

### 2.1 Sample size determination

To justify the target sample size for structural equation modelling (SEM), several established guidelines were considered. As posited by Hameed et al., sample sizes ≤ 100 are generally inadequate, 200 are sufficient, 300 are optimal, and 500 are highly effective for empirical research (Hameed et al., 2018). In addition, a minimum of 15 subjects has been suggested for multiple regression analysis (Schikorski & Stevens, 1997). For factor analysis, a minimum sample size of 300 has been recommended to support stable estimation (Stefana et al., 2024). For SEM, a minimum sample size of 200 has also been proposed (Rahi, 2017). Given these recommendations, the study aimed to retain at least 377 valid cases, which has been considered an adequate sample size for SEM applications (Halim Ahmad & Hasnita Halim, 2017).

The target population comprised all full-time enrolled students in three vocational colleges in Zunyi City, Guizhou Province, with an estimated total population of approximately 21,000 students across the three institutions. According to the sample size requirements proposed by Krejcie and Morgan (1970), a sample size in the high-300s is appropriate for a population of this magnitude (Krejcie & Morgan, 1970). Therefore, the planned sample size was set slightly above the minimum required valid cases to accommodate invalid or incomplete responses.

### 2.2 Sampling and participants

To ensure the validity of the samples, the research adopted a stratified random sampling method for the sampling. The research selected three vocational colleges in Guizhou Province, China to collect data. Year of study (first-year, second-year, and third-year) was used as the stratification basis, and questionnaires were administered to students sampled within each grade stratum. To ensure comparable coverage across institutions, approximately 130 questionnaires were distributed in each college (target N = 390). A total of 390 questionnaires were distributed, and after deleting the invalid ones, 377 valid questionnaires were finally obtained, with an effective rate of 96.67%. In terms of gender distribution, there were 209 males (55.4%) and 168 females (44.6%), showing a balanced gender distribution. In terms of grade distribution, there were 122 students in the first year (32.4%), 222 students in the second year (58.9%), and 33 students in the third year (8.8%). This uneven grade distribution reflects the achieved sample under field conditions rather than an intended equal allocation across year groups. In terms of majors, the three colleges were respectively comprehensive vocational colleges, engineering vocational colleges, and medical vocational colleges. The majors covered science and engineering, economics, education, and medicine, demonstrating a certain degree of disciplinary diversity.

### 2.3 Measurement

Psychological well-being (PW) was assessed using the Liddle and Carter scale(Liddle & Carter, 2015). Items were answered on a five-point Likert scale with response options ranging from strongly disagree to strongly agree. The scale showed good internal consistency in this study (Cronbach's $\alpha$ = 0.80).Academic procrastination (AP) was measured using the scale developed by Wang et al.(Wang et al., 2024). All items were rated on a five-point Likert scale with response options ranging from strongly disagree to strongly agree. In the present study, the scale demonstrated good internal consistency (Cronbach's $\alpha$ = 0.849).Students' sense of school belonging (SSB) was assessed using the scale developed by Akar-Vural et al.(Akar-Vural et al.,

2013). All items were rated on a five-point Likert scale with response options ranging from strongly disagree to strongly agree. The scale showed good internal consistency in this study (Cronbach's α = 0.850).

SPSS 27.0 was used for data coding and preliminary analyses, including descriptive statistics, Pearson correlations, and reliability and validity assessments. Structural equation modelling was then conducted in AMOS using maximum-likelihood estimation to test the hypothesised mediation and moderated mediation models. Model fit was evaluated using $\chi^2$/df, CFI, TLI, and RMSEA. Indirect and interaction effects were examined using bias-corrected bootstrapping (5,000 resamples), and statistical significance was determined using 95% confidence intervals and p values.

## 3. Result

### 3.1 Group differences by gender and year of study

Before testing the hypothesised structural relations, group differences in psychological well-being (PW), academic procrastination (AP), and students' sense of school belonging (SSB) were examined across gender and years of study. Independent-samples t-tests indicated no significant gender differences in PW, AP, or SSB (p≥ .667). One-way ANOVAs also showed no significant differences across years of study for PW, AP, or SSB (PW: F(2,374)=0.953, p=.387; AP: F(2,374)=1.395, p=.249; SSB: F(2,374)=0.174, p=.840). Levene's tests were non-significant for all three variables (p> .05), supporting the use of standard ANOVA results. Descriptive statistics and test results are presented in Table 1.

Notably, the absence of mean differences does not preclude moderation. Moderation tests evaluate whether gender conditions the strength of the association between academic procrastination and school belonging, rather than whether males and females differ in average levels of PW, AP, or SSB. Therefore, the interaction term (AP × gender) was retained in the subsequent structural model to test the hypothesised conditional effect.

Table 1. Group differences in PW, AP, and SSB by gender and year of study (N = 377)

| Variable | Male (n=209) Mean±SD | Female (n=168) Mean±SD | t(df) | p |
|---|---|---|---|---|
| PW | 3.4190 ± 0.9052 | 3.3976 ± 0.9559 | 0.222 (375) | .824 |
| AP | 2.5940 ± 0.9321 | 2.5529 ± 0.9068 | 0.431 (375) | .667 |
| SSB | 3.3799 ± 0.9170 | 3.3560 ± 0.9425 | 0.249 (375) | .804 |

*Note. Levene's tests were non-significant for PW (p = .339), AP (p = .734), and SSB (p = .784); equal variances were assumed.*

| Variable | Year 1 (n=122) Mean±SD | Year 2 (n=222) Mean±SD | Year 3 (n=33) Mean±SD | F(2,374) | p |
|---|---|---|---|---|---|
| PW | 3.3179 ± 0.9345 | 3.4618 ± 0.9226 | 3.3961 ± 0.9299 | 0.953 | .387 |
| AP | 2.6757 ± 0.9405 | 2.5099 ± 0.9068 | 2.6488 ± 0.9199 | 1.395 | .249 |
| SSB | 3.3344 ± 0.9347 | 3.3928 ± 0.9444 | 3.3394 ± 0.7945 | 0.174 | .840 |

*Note. Levene's tests indicated homogeneity of variance for PW (p = .976), AP (p = .916), and SSB (p = .297); therefore, standard ANOVAs are reported. No post-hoc tests were conducted because omnibus tests were not significant.*

### 3.2 Descriptive statistics and correlations

Non-significant mean differences by gender do not preclude moderation because moderation tests slope differences rather than mean differences. Accordingly, gender and the AP × gender interaction were included in the SEM to test whether the AP–SSB association varies across male and female students. Subsequent analyses report correlations and then evaluate the mediation and moderated mediation models.

Table 2 presents the means, standard deviations, and Pearson correlations for academic procrastination (AP), students' sense of school belonging (SSB), and psychological well-being (PW). AP was negatively correlated with PW ($r = -0.453$, $p < .001$) and SSB ($r = -0.350$, $p < .001$). SSB was positively correlated with PW ($r = 0.373$, $p < .001$). These correlations were consistent with the hypothesised directions and provided preliminary evidence for subsequent structural model testing.

Table 2The correlations among key variables (N = 377)

| Variables | Mean | SD | 1 | 2 | 3 |
|---|---|---|---|---|---|
| PW | 3.410 | 0.927 | 1 | | |
| AP | 2.576 | 0.920 | -0.453*** | 1 | |
| SSB | 3.320 | 0.942 | 0.373*** | -0.350*** | 1 |

*Note. *** p<0.001*

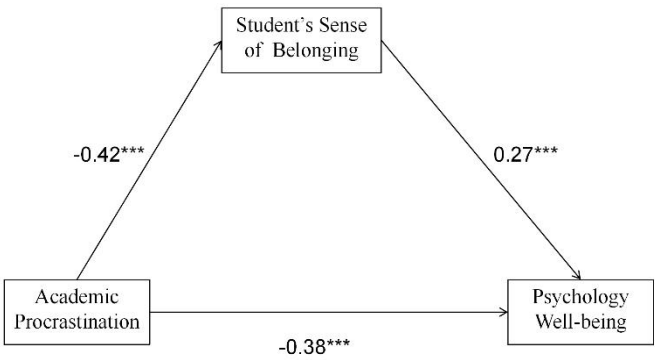
### 3.3 Structural model testing: direct effects and mediation

To test the proposed mechanism, a mediation model was estimated using structural equation modelling (SEM) with maximum-likelihood estimation. Model fit was acceptable ($\chi^2/df = 1.645$, CFI = 0.975, NFI = 0.938, IFI = 0.975, TLI = 0.971, RMSEA = 0.061; Table 2), indicating that the hypothesised mediation structure was supported by the data. The model explained 14.2% of the variance in SSB ($R^2 = 0.142$) and 26.0% of the variance in PW ($R^2 = 0.260$), suggesting moderate explanatory power for PW and smaller—but meaningful—explanatory power for SSB.

Table3 Fit indices for the mediation SEM

| | Chi-square/df | CFI | NFI | IFI | TLI | RMSEA |
|---|---|---|---|---|---|---|
| Results | 1.645 | 0,975 | 0,938 | 0,975 | 0.971 | 0.061 |

Figure 2: Mediation model linking AP to PW via SSB (standardised coefficients shown)




### Direct effects

As shown in Figure 2, AP had a significant negative direct effect on PW ($\beta = -0.359$, 95% BC CI

[–0.452, –0.263], p < .001). Thus, H1 is accepted. AP also significantly predicted lower SSB (β = –0.376, 95% BC CI [–0.471, –0.276], p < .001). Thus, H2 is accepted. In turn, SSB positively predicted PW (β = 0.252, 95% BC CI [0.153, 0.351], p < .001). Thus, H3 is accepted. These direct paths provide the structural evidence for the hypothesised associations after simultaneously accounting for the full model.

**Indirect effect (mediation)**

The indirect effect of AP on PW through SSB was evaluated using bias-corrected bootstrapping (5,000 resamples). The standardised indirect effect was –0.095, and its 95% BC CI [–0.146, –0.053] excluded zero (p < .001), indicating a significant mediation effect. Table 3 reports the decomposition of the total, direct, and indirect effects. The total effect of AP on PW was –0.453 (95% BC CI [–0.540, –0.353], p < .001). The indirect pathway accounted for approximately 21.0% of the total effect (–0.095/–0.453), while the direct effect remained substantial (–0.359), supporting a partial mediation pattern. Thus, H4 is accepted.

Table4 Effect decomposition for AP predicting PW (standardised; BC bootstrap, 5,000 resamples; N = 377)

| Effect of AP on PW | Estimate | 95% BC CI | p (BC) |
|---|---|---|---|
| Total effect | –0.453 | [–0.540, –0.353] | < .001 |
| Direct effect | –0.359 | [–0.452, –0.263] | < .001 |
| Indirect effect via SSB | –0.095 | [–0.146, –0.053] | < .001 |

*Note. BC CI = bias-corrected bootstrap confidence interval. Effects are standardised.*

### 3.4 Structural model testing: moderation by gender

To test H5, a moderated mediation model was estimated by adding the interaction term (AP × Gender) as a predictor of SSB. Gender was coded as 0 = male and 1 = female, and interaction terms were computed from centred variables. Maximum-likelihood estimation was used, and bias-corrected bootstrapping (5,000 resamples) was applied to obtain robust confidence intervals. The moderated model demonstrated good fit: $\chi^2(5) = 2.194$, p = .822, $\chi^2/df = 0.439$, CFI = 1.000, TLI = 1.034, RMSEA = 0.000, 90% CI [0.000, 0.043].

As reported in Table 5, the interaction term was not significant (AP × Gender → SSB: β = 0.009, 95% BC CI [–0.089, 0.114], p = .845). The direct effect of gender on SSB was also not significant (β = –0.021, 95% BC CI [–0.118, 0.072], p = .629). In contrast, the main effect of AP on SSB remained significant (β = –0.376, p < .001). Thus, H5 is not accepted.

Table5 Standardised coefficients for moderation paths and bootstrap tests (N = 377)

| Impact Pathway | β | SE | 95% BC CI | P |
|---|---|---|---|---|
| AP→SSB | -0.376 | 0.050 | [-0.471, -0.276] | <0.001 |
| Gender→SSB | -0.021 | 0.048 | [-0.118,0.072] | 0.628 |
| AP*Gender→SSB | 0.009 | 0.052 | [-0.089, 0.114] | 0.845 |

*Note: N = 377. BC CI = Bias-corrected Bootstrap confidence interval. SE = Bootstrap standard error. Interaction terms were calculated from centred variables.*

### 3.5 Overall results of the structural equation model

The final model supported a partially mediated association between AP and PW via SSB and did not support gender moderation on the AP → SSB pathway. AP negatively predicted SSB (β = –0.376, p < .001), and SSB positively predicted PW (β = 0.252, p < .001). AP also showed a

significant direct negative effect on PW (β = −0.359, p < .001). Gender neither predicted SSB nor interacted with AP to predict SSB (p > .05). The model explained 14.2% of the variance in SSB and 26.0% of the variance in PW.

Table 6 Summary of hypothesis testing results

| Structural pathway | Effect tested | β | 95% BC CI | p | Hypothesis | Decision |
|---|---|---|---|---|---|---|
| Direct effect | AP → PW | −0.359 | [−0.452, −0.263] | < .001 | H1 | Supported |
| Mediator path | AP → SSB | −0.376 | [−0.471, −0.276] | < .001 | H2 | Supported |
| | SSB → PW | 0.252 | [0.153, 0.351] | < .001 | H3 | Supported |
| Indirect (mediated) effect | AP → PW (via SSB) | −0.095 | [−0.146, −0.053] | < .001 | H4 | Supported (partial mediation) |
| Moderation on path | AP × Gender → SSB | 0.009 | [−0.089, 0.114] | .845 | H5 | Not supported |

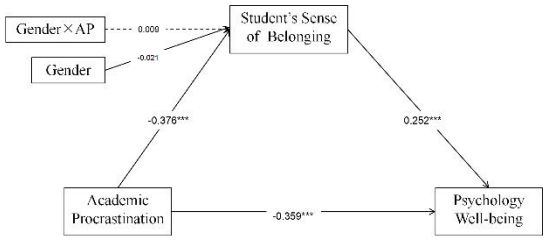



Figure 3: Standardised Path Diagram of the Moderated Mediating Model of AP's Impact on PW

## 4.Discussion

Academic procrastination and psychological well-being have attracted sustained attention in higher education not because they are straightforward to examine, but because their association reflects an enduring theoretical tension. One perspective views procrastination as a strategic delay in response to academic pressure. Only when the time pressure resulting from the long-term procrastination task is transformed into a challenge will the task be completed. (Abbasi & Alghamdi, 2015) An alternative perspective conceptualises procrastination as a self-regulation failure, whereby students delay despite recognising potential negative consequences(Kühnel et al., 2023). This view is often linked to heightened distress through processes such as guilt, rumination, and perceived loss of control. Against this background, this study moves beyond a simple "harmful versus harmless" debate by focusing on a key socio-psychological resource embedded in the school context, namely students' sense of school belonging. By testing belonging as a mediating pathway, the analysis specifies how academic procrastination may relate to reduced psychological well-being within vocational college students' everyday academic experience.

Overall, the results indicate that academic procrastination is negatively associated with psychological well-being through both direct and indirect pathways. Academic procrastination had a significant negative direct effect on psychological well-being (β = −0.359, p < .001) and also exerted a significant negative indirect effect via reduced school belonging (β_indirect = −0.095, 95% BC CI [−0.146, −0.053], p < .001). This pattern supports partial mediation, suggesting that weakened school belonging accounts for a meaningful portion of the procrastination–well-being association (approximately 21% of the total effect), while a substantial direct association remains.Students' sense of belonging mediates the relationship between academic procrastination and psychological well-being. Academic procrastination is not merely an idiosyncratic habit; rather, it should be interpreted within the broader linkage between academic engagement, campus social integration, and psychological functioning. Procrastination is often conceptualised as a manifestation of self-regulation failure (Rebetez et al., 2018). It has also been discussed as an avoidance-oriented strategy that may temporarily reduce distress and yield short-lived relief in well-being (Sirois, 2023). However, such short-term relief is frequently followed by accumulated task pressure and escalating academic difficulties, which are likely to intensify negative emotional experiences over time. Empirically, academic procrastination has been associated with reduced reading performance, poorer prospective memory, and lower self-efficacy (Cutipa-Flores et al., 2025; Torrens et al., 2025; Zuber et al., 2021). These correlates may undermine students' perceived competence and social-academic integration on campus, thereby weakening students' sense of school belonging. Given that students' sense of belonging is a robust correlate of psychological well-being (Xu & Fang, 2021), this pathway provides a coherent explanation for how procrastination may be linked to lower psychological well-being through school-based socio-psychological resources. Accordingly, the present findings support the interpretation that academic procrastination is associated with psychological well-being both directly and indirectly via reduced school belonging (direct: β = −0.359; indirect: β = −0.095).

At the same time, this interpretation warrants caution. Both school belonging and psychological well-being rely heavily on self-reported subjective evaluation (Matić & Musil, 2023), which increases the risk of common method variance and state-dependent reporting biases (e.g., negative affectivity influencing responses across measures). In addition, reverse-direction processes remain plausible, such that lower psychological well-being may shape students' perceptions of belonging (Pendergast et al., 2018). For these reasons, the mediating role of school belonging should not be treated as the sole explanation. Instead, a more defensible inference is that, in the Guizhou vocational college context, part of the psychological costs associated with academic procrastination may operate through weakened school belonging (Hamdan-Mansour et al., 2024). This interpretation links an "individual behavioural risk" to a "school-adjustable resource," offering a practically relevant leverage point for administrators concerned with student psychological well-being.

Second, academic procrastination negatively predicted psychological well-being and students' sense of belonging, and the direct effect of academic procrastination on psychological well-being remained significant. This pattern is consistent with the view that academic procrastination relates to psychological well-being through multiple pathways rather than a single social-embedded mechanism (Peixoto et al., 2021). In other words, procrastination may undermine psychological well-being not only indirectly via school belonging but also through more proximal intrapersonal and behavioural processes. From a critical standpoint, a model in

which school belonging fully absorbs the procrastination–well-being association would risk oversimplifying well-established mechanisms. Numerous studies have linked academic procrastination with rumination, stress accumulation, poorer sleep quality, and deteriorated lifestyle patterns (Agrawal, 2025; Hamvai et al., 2023; Xue et al., 2025), and these processes do not necessarily operate through belonging-related perceptions.

Notably, longitudinal evidence strengthens the interpretation that procrastination carries psychological costs that are not reducible to school belonging alone. For example, a follow-up study of Swedish college students found that, after controlling for baseline psychological conditions, academic procrastination still predicted subsequent depression, anxiety, and stress, alongside poorer sleep quality and higher loneliness (Johansson et al., 2023). These findings align with the persistence of a direct association in the present model. Nevertheless, the direct effect should not be interpreted as strictly causal in a cross-sectional design. Rather, it signals that interventions focused solely on improving school belonging are unlikely to fully offset the psychological risks associated with academic procrastination, given the remaining negative direct association ($\beta = -0.359$). Future research could strengthen explanatory precision by incorporating additional mechanisms into the same model, such as rumination, self-efficacy, and academic stress, and by employing longitudinal or experimental designs to better differentiate behavioural effects from confounding by stable traits.

Finally, the moderating effect of gender on the academic procrastination → students' sense of belonging pathway was not significant. As shown in Table 5, the interaction term (AP × Gender) did not predict SSB ($\beta = 0.009$, 95% BC CI [−0.089, 0.114], $p = .845$), and the direct effect of gender on SSB was also non-significant ($\beta = -0.021$, 95% BC CI [−0.118, 0.072], $p = .629$).This result should be interpreted as evidence that gender did not meaningfully alter this specific pathway in the present sample, rather than evidence that gender is uniformly irrelevant. Meta-analytic and empirical work suggests that gender is often a relatively weak predictor of academic procrastination, with generally small effect sizes and substantial context-dependence (ÇIKRIKÇI, 2016). It is therefore plausible that gender differences, when observed, may emerge in other parts of the broader procrastination–well-being process rather than in the first-stage link between procrastination and school belonging. Consistent with this possibility, Balkis and Duru (2024)reported gender differences in the association between procrastination and subjective well-being and suggested that academic procrastination may exert a stronger effect on subjective well-being among men (Balkis & Duru, 2024). Taken together, this line of evidence implies that potential gender differences may be more likely to emerge in the latter part of the mediational process, namely the association between school belonging and psychological well-being, or in the direct association between academic procrastination and psychological well-being, rather than in the procrastination–belonging link tested here. In the Guizhou vocational college sample, the indirect pathway linking academic procrastination to lower psychological well-being via reduced school belonging appeared broadly similar for male and female students.

From an applied perspective, the absence of moderation on the association between academic procrastination and school belonging suggests that intervention components targeting procrastination reduction and belonging enhancement may not require gender-specific tailoring for this pathway. However, this does not preclude the value of gender-sensitive approaches in other mechanisms or outcomes. Future research with more fine-grained designs (e.g., multi-group SEM focused on alternative moderated links, or longitudinal tests of differential trajectories) would help determine whether gender-specific reinforcement is

warranted in broader intervention programmes.

**Limitations**

This study exhibits certain limitations warranting refinement in future work. Firstly, causal inference requires more rigorous design support: based on cross-sectional data, we cannot entirely rule out reverse causation, such as lower psychological well-being or higher emotional distress potentially leading to increased academic procrastination, which in turn diminishes the students' sense of belonging. Future research may employ longitudinal tracking designs or cross-lagged models to clarify temporal relationships between variables and engage more deeply with existing cohort study evidence. Secondly, measurement methods carry risks of common method bias: core variables such as the students' sense of belonging rely primarily on self-report scales, whose outcomes may be influenced by participants' current emotional states or satisfaction levels. Future work could enhance measurement validity and robustness by incorporating behavioural indicators (e.g., classroom attendance, online learning platform engagement) or employing multi-source assessments (e.g., peer and teacher evaluations). Finally, gender occupies a relatively peripheral position as a moderator variable: the study found no significant gender moderation effect, potentially reflecting its limited explanatory power as a macro-level demographic variable. Future research may further examine more proximate, theoretically grounded psychological and social moderating mechanisms (e.g., emotion regulation strategies, rumination, self-compassion, or academic self-efficacy). Should gender differences still warrant investigation, it is recommended to employ multi-group structural equation modelling for more rigorous comparisons of path coefficients across gender groups, while ensuring measurement equivalence.

**Conclusion**

This study used a moderated mediation model to explore the underlying mechanisms by which academic procrastination affects psychological well-being. It was found that academic procrastination negatively predicts psychological well-being and students' sense of belonging to school. That is, an individual's psychological well-being and students' sense of belonging to school decrease when the individual's academic procrastination behaviour is present. School sense of belonging mediates the relationship between academic procrastination and psychological well-being. That is, academic procrastination negatively affects psychological well-being by diminishing the students' sense of belonging to school. A key finding was that gender did not mediate this pathway of academic procrastination and belonging, which suggests that the effect of academic procrastination on belonging is a phenomenon that is prevalent across genders. These findings bring some insights into the need for schools to develop interventions that go beyond the surface of academic procrastination and build supportive school environments. For example, efforts should be made to enhance students' sense of belonging to school and optimise the atmosphere of classroom interactions. In addition, more malleable correlates should be explored, such as the development of students' emotional regulation and academic self-efficacy, which can more effectively block the attrition of academic procrastination on heart well-being.

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