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Learning Stress and Academic Satisfaction Among Chinese University Calligraphy Majors: The Mediating Role of Self-Efficacy

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Abstract

University calligraphy education integrates technical practice, aesthetic judgment, and cultural interpretation, yet students may experience stress related to skill acquisition, evaluation, workload, and future development. However, the mediating role of self-efficacy remains unclear. This study examined the relationship between learning stress and academic satisfaction among Chinese university calligraphy majors and tested self-efficacy as a mediating mechanism. A cross-sectional questionnaire survey was conducted with 583 first-year calligraphy majors from three universities in Henan Province, China, between November 15 and 29, 2024. Data were analyzed using SPSS 25.0 and AMOS 27.0 through reliability and factorability tests, correlation analysis, structural equation modeling, and bootstrap mediation analysis. Learning stress was negatively correlated with academic satisfaction ($r = -.514$, $p < .01$) and self-efficacy ($r = -.532$, $p < .01$), whereas self-efficacy was positively correlated with academic satisfaction ($r = .497$, $p < .01$). In the structural model, learning stress showed significant negative paths to academic satisfaction ($\beta = -.453$, $p < .001$) and self-efficacy ($\beta = -.742$, $p < .001$), while self-efficacy showed a significant positive path to academic satisfaction ($\beta = .380$, $p < .001$). The indirect effect of learning stress on academic satisfaction through self-efficacy was significant (effect = -.282, 95% CI [-.461, -.119], $p = .003$). These findings indicate that self-efficacy is a plausible pathway linking learning stress with academic satisfaction. They contribute to academic discourse by integrating stress and self-efficacy into calligraphy education research and suggest that interventions that strengthen self-efficacy may reduce the negative association between learning stress and academic satisfaction.

Keywords: *Academic Satisfaction, Calligraphy Education, Learning Stress, Mediation, Self-Efficacy*

A. Introduction

Chinese calligraphy is simultaneously a writing practice, an art form, and a vehicle for transmitting aesthetic and cultural knowledge. In higher education, calligraphy courses can therefore extend beyond technical training to cultivate aesthetic perception, interpretive competence, cultural understanding, and personal expression. Recent scholarship has emphasized the role of calligraphy in university aesthetic education and curriculum construction, while empirical research has also linked calligraphic handwriting with executive functioning, positive affect, and academic emotions (Chen et al., 2017; Wu, Wang, & Wan, 2021; Kong, 2023; Wang et al., 2023; Chen et al., 2024). A recent study in this journal likewise demonstrated

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that students' satisfaction is a meaningful outcome in calligraphy learning and can be shaped by their educational environment (Dong, Kou, Pan, Wang, & Wang, 2026).

The educational value of calligraphy does not mean that the learning process is uniformly positive. Calligraphy majors are expected to master technically demanding forms, repeatedly practice fine motor skills, interpret aesthetic principles, complete assessed creative work, and prepare for future academic or professional development. Such demands can generate learning stress when students perceive course requirements as exceeding their available resources. Research involving university students has linked academic demands and coping resources with self-efficacy and psychological adjustment (Freire et al., 2020; de la Fuente et al., 2021). Evidence from adolescents also documents longitudinal associations among academic stress, self-efficacy, and distress (Kristensen, Larsen, Urke, & Danielsen, 2023). In Chinese educational settings, the negative association between academic stress and self-efficacy has also been documented longitudinally and across different student populations (Ye, Posada, & Liu, 2018; Liu, Zhu, Dong, & Luo, 2024).

Academic satisfaction represents students' overall evaluation of their learning experience, including perceptions of their academic progress, instructional quality, and learning environment. It is a relevant indicator of students' evaluations of academic experiences, although satisfaction alone does not establish learning effectiveness. Prior research has shown that academic stress and self-efficacy are closely associated with student satisfaction. In a study of nursing students, self-efficacy emerged as a significant positive predictor of academic satisfaction (Shehadeh et al., 2020). Evidence from other learning environments similarly indicates a positive relationship between self-efficacy and learning satisfaction (Aldhahi, Alqahtani, Baattaiah, & Al-Mohammed, 2022). Among Chinese university students, recent profile-based evidence further suggests that combinations of self-efficacy and coping resources differentiate the way academic stress relates to student satisfaction (Zhao, 2024).

Self-efficacy concerns individuals' beliefs about their capacity to organize and carry out actions required to manage challenges. The present study uses a three-domain self-efficacy measure described in the original research documentation as assessing confidence, self-regulation, and task difficulty. The term “self-efficacy” is used because the measure covers general confidence, self-regulation, and perceived task difficulty rather than academic tasks alone. Research on university learners nevertheless provides a useful interpretive background (Greco et al., 2022). Higher confidence and persistence may co-occur with more favorable academic evaluations, whereas greater pressure may be associated with lower perceived capability.

Although academic stress, self-efficacy, and satisfaction have been studied in general university populations, their joint relationship remains underexplored among university calligraphy majors. This context is distinctive because students simultaneously face technical, artistic, evaluative, and cultural learning demands. Existing calligraphy research has focused more heavily on aesthetic value, curriculum development, positive affect, or broad educational outcomes than on the psychological mechanisms linking stress to broader academic satisfaction (Wu et al., 2021; Kong, 2023; Chen et al., 2024). The present study therefore examines whether self-efficacy statistically mediates the association between learning stress and academic satisfaction among Chinese university calligraphy majors.

Hypotheses and conceptual model: Based on the literature and the study's original research model, four hypotheses were tested:

H1: Learning stress is negatively associated with academic satisfaction.

H2: Learning stress is negatively associated with self-efficacy.

H3: Self-efficacy is positively associated with academic satisfaction.

H4: Self-efficacy mediates the association between learning stress and academic satisfaction.

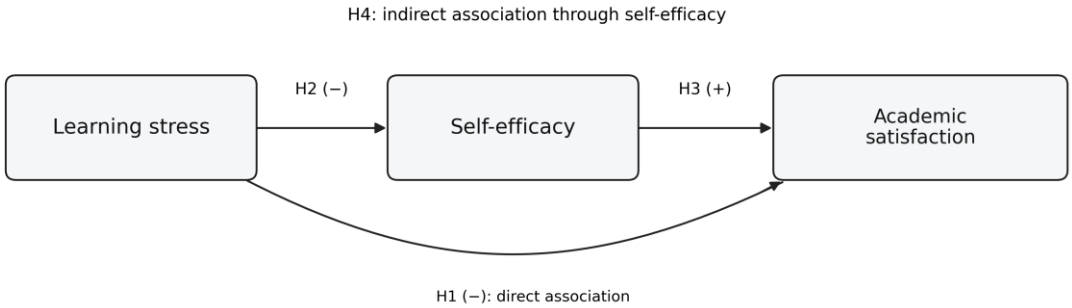


Figure 1. *Conceptual Mediation Model*

B. Methods

Research Design and Participants

A quantitative cross-sectional survey design was used. The main study involved first-year students enrolled in calligraphy programs at three universities in Henan Province, China. A total of 600 questionnaires were distributed, 595 were returned, and 583 were retained as valid responses, corresponding to 97.98% of returned questionnaires. Twelve returned questionnaires were excluded according to the study's reported screening rules: completion in less than one minute and/or selection of the same response option across all items. The final sample included 299 men (51.3%) and 284 women (48.7%). With respect to prior calligraphy learning experience, 266 students (45.6%) reported less than three years and 317 (54.4%) reported three to ten years. In terms of place of origin, 397 students (68.1%) were from urban areas, and 186 (31.9%) were from rural areas. The main survey was administered from November 15 to November 29, 2024. The original study reports a 100-student pilot to assess the instrument's preliminary performance. According to the corresponding author, participants were informed that the survey was for academic research, that responses would be treated confidentially, and that participation was voluntary.

Table 1. *Participant Characteristics*

Characteristic	Category	n	%
Gender	Male	299	51.3
Gender	Female	284	48.7
Prior calligraphy learning	< 3 years	266	45.6
Prior calligraphy learning	3–10 years	317	54.4
Place of origin	Urban	397	68.1
Place of origin	Rural	186	31.9

Measures

Learning stress was represented by nine survey variables, scored and organized into concerns about future prospects, academic competition, and academic workload (three indicators

per domain). This measure was described in the original study as adapted from the student learning-stress instrument discussed by Tian and Deng (2007). Higher analytic scores were associated with greater perceived learning stress. Overall Cronbach's alpha was .891; the three domain alphas were .915, .885, and .889.

Academic satisfaction was represented by nine scored survey variables covering learning experiences, teaching, and institutional resources/arrangements (three indicators per domain). The source instrument was attributed in the original study to Li and Wang (2009). Higher analytic scores were associated with more favorable satisfaction evaluations. This construct pertains to students' broader academic experience and should not be interpreted as satisfaction with a specific calligraphy-aesthetics course. Overall Cronbach's alpha was .861; the domain alphas were .845, .846, and .838.

Self-efficacy was represented by nine scored variables organized into confidence, self-regulation, and perceived task difficulty (three indicators per domain), with the instrument attributed in the original study to Bian (2003). Higher scores in the retained analytic dataset were interpreted as indicating stronger self-efficacy. Overall Cronbach's alpha computed from the retained analysis variables was .854; the domain alphas were .872, .769, and .819.

The present analysis uses the 27 scored survey variables representing these three constructs in the retained SPSS file. The original study also considered other constructs during development, but they were not included in this three-construct model. Internal consistency and factorability were assessed using the archived dataset. Principal component analyses with varimax rotation yielded three-component solutions for each measure. The cumulative variance explained was 82.92% for learning stress, 76.25% for academic satisfaction, and 74.05% for self-efficacy. These PCA results describe the dimensionality of the variables analyzed and should not be treated as definitive evidence of construct validity.

Table 2. *Measurement Quality of The Study Variables*

Construct	Items	α	KMO	Variance explained
Learning stress	9	.891	.855	82.92%
Academic satisfaction	9	.861	.846	76.25%
Self-efficacy	9	.854	.846	74.05%

Note. α = Cronbach's alpha. Bartlett's tests of sphericity were significant for all three instruments ($p < .001$).

Data analysis

Data were analyzed using SPSS 25.0 and AMOS 27.0. First, descriptive statistics, skewness, kurtosis, reliability coefficients, and principal component analyses were examined. Reported absolute skewness values were below 3, and absolute kurtosis values were below 10 for all reported variables; these univariate checks do not establish multivariate normality. Pearson correlations were then calculated among the three focal constructs. For the structural equation model, each latent construct was represented by its three domain-level indicators. The model estimated paths from learning stress to academic satisfaction and self-efficacy, and from self-efficacy to academic satisfaction. Model fit was evaluated with χ^2/df, GFI, SRMR, RMSEA, NFI, TLI, CFI, and IFI. Finally, the indirect effect of learning stress on academic satisfaction through self-efficacy was evaluated using bootstrap estimation; the indirect effect was considered significant when its 95% confidence interval did not include zero.

C. Results and Discussion

Descriptive statistics and correlations

The mean score for learning stress was 3.33 (SD = 1.03). Academic satisfaction averaged 3.65 (SD = 0.88), while self-efficacy averaged 3.69 (SD = 0.87). The three variables were significantly related in the expected directions. Learning stress was negatively correlated with academic satisfaction ($r = -.514$, $p < .01$) and self-efficacy ($r = -.532$, $p < .01$). Self-efficacy was positively correlated with academic satisfaction ($r = .497$, $p < .01$). These correlations provide preliminary support for H1–H3.

Table 3. *Descriptive Statistics and Correlations Among Focal Variables*

Variable	M	SD	1	2	3
1. Learning stress	3.33	1.03	1		
2. Academic satisfaction	3.65	.88	-.514**	1	
3. Self-efficacy	3.69	.87	-.532**	.497**	1

Note. ** $p < .01$.

Structural Model and Hypothesis Testing

The structural model demonstrated good fit to the data. The chi-square to degrees-of-freedom ratio was 1.55, GFI was .986, SRMR was .025, RMSEA was .031, NFI was .974, TLI was .986, CFI was .991, and IFI was .991. All indices met the fit criteria adopted in the original analysis, indicating that the proposed three-construct mediation model adequately represented the observed covariance structure.

Table 4. *Structural Model Fit Indices*

Index	Criterion	Model
χ^2/df	< 3	1.55
GFI	> .90	0.986
SRMR	< .10	0.025
RMSEA	< .08	0.031
NFI	> .90	0.974
TLI	> .90	0.986
CFI	> .90	0.991
IFI	> .90	0.991

All three standardized structural paths were significant. Learning stress showed a negative path to academic satisfaction ($\beta = -.453$, $p < .001$), supporting H1, and a negative path to self-efficacy ($\beta = -.742$, $p < .001$), supporting H2. Self-efficacy showed a positive path to academic satisfaction ($\beta = .380$, $p < .001$), supporting H3. Critical ratio statistics are reported in Table 5 based on the corresponding AMOS estimates.

Table 5. *Standardized Structural Path Estimates*

Path	Std. β	C.R.	p
Learning stress → Academic satisfaction	-.453	-4.549	< .001
Learning stress → Self-efficacy	-.742	-10.792	< .001
Self-efficacy → Academic satisfaction	.380	3.851	< .001

Note. C.R. values are based on the corresponding unstandardized AMOS estimates; β values are standardized coefficients.

Mediating effect of self-efficacy

Bootstrap analysis showed a significant indirect effect of learning stress on academic satisfaction through self-efficacy. The indirect effect was -.282 (SE = .086), with a 95%

confidence interval from -.461 to -.119 and p = .003. Because the confidence interval excluded zero, H4 was supported. The direct path from learning stress to academic satisfaction remained significant in the structural model, indicating partial rather than complete mediation.

Table 6. *Bootstrap Test of The Indirect Effect*

Mediating path	Est.	SE	95% CI	p
Learning stress → Self-efficacy → Academic satisfaction	-.282	.086	[-.461, -.119]	.003

Note. The indirect effect is significant because the 95% confidence interval does not include zero.

The first finding is that greater learning stress was associated with lower academic satisfaction. This pattern is consistent with broader research in higher education showing that academic stress can undermine students' positive evaluations of their learning experience. Zhao (2024), for example, found that patterns of academic stress, coping, and self-efficacy differentiated student satisfaction among Chinese university students. The present findings examine this relationship among university calligraphy majors, in which stress may arise from repeated technical practice, performance comparisons, creative evaluation, and uncertainty about future development. In a course intended to cultivate aesthetic experience, excessive pressure may reduce students' sense of accomplishment and satisfaction, even when they remain academically engaged.

The second finding is that learning stress was negatively associated with self-efficacy. This finding is consistent with research linking stress and self-efficacy or identifying self-efficacy as a psychological resource for managing academic demands (Ye et al., 2018; Freire et al., 2020; Kristensen et al., 2023; Liu et al., 2024). For calligraphy majors, this mechanism is plausible because progress is often visible and comparative: students repeatedly encounter models of expert performance, public or instructor evaluation of written work, and technical standards that may make perceived gaps in competence salient. When stress is interpreted as evidence that course demands exceed personal capability, efficacy beliefs may decline.

The third finding is that self-efficacy was positively associated with academic satisfaction. This is consistent with evidence that students who feel capable of managing academic tasks tend to evaluate their learning experiences more positively (Shehadeh et al., 2020; Aldhahi et al., 2022). In calligraphy education, self-efficacy may be especially important because improvement depends on sustained deliberate practice. Students who believe they can solve technical problems, regulate practice, and cope with difficult assignments are more likely to interpret incremental progress as meaningful, which can support satisfaction even when the course remains demanding.

Most importantly, self-efficacy partially mediated the relationship between learning stress and academic satisfaction. The result suggests a two-part pathway: learning stress is directly associated with lower satisfaction, and it is also associated with lower satisfaction indirectly through lower perceived capability. This finding is conceptually consistent with recent work treating self-efficacy as a psychological resource embedded in the stress process rather than merely as an outcome (Greco et al., 2022; Kristensen et al., 2023). The partial mediation also indicates that self-efficacy is not the only mechanism involved. Other processes, such as academic emotions, coping strategies, teacher feedback, peer comparison, and learning engagement, may account for additional variance and should be examined in future research.

At a conceptual level, the findings extend research on academic stress and self-efficacy into a form of higher education in which technical performance, aesthetic judgment, and cultural learning are closely intertwined. The partial mediation pattern is especially informative. It indicates that students' broader academic evaluations as calligraphy majors are related not only

to the amount of pressure they report, but also to how capable they feel of meeting the course demands. In this sense, self-efficacy provides a psychologically plausible link between perceived demands and academic satisfaction. At the same time, the remaining direct path from learning stress to satisfaction shows that self-efficacy does not exhaust the relationship. Other processes, including academic emotions, perceived fairness of assessment, coping, feedback, and peer comparison, may also shape how stress is translated into students' evaluations of the learning experience.

The domain context also matters for interpreting these associations. In calligraphy education, progress is often visible in the quality of written work and is developed through repeated practice, correction, and comparison with exemplars. Such conditions can make competence judgments salient. A student who finds demanding practice manageable may interpret correction as evidence of progress, whereas a student who doubts personal capability may find the same demands discouraging. This remains a pedagogical interpretation rather than a directly measured classroom mechanism: the study did not assess specific feedback encounters, and its cross-sectional design cannot establish temporal sequence. Accordingly, mediation here denotes a statistical indirect association, not proof of a causal psychological process.

Research on university aesthetic education suggests that course quality should not be evaluated solely in terms of technical attainment or cultural content. Students' psychological experience of the learning process is also relevant. Future studies could test the present model longitudinally across different stages of calligraphy training, compare novice and more experienced learners, and examine whether mastery-oriented feedback or structured opportunities for revision strengthen self-efficacy while reducing avoidable stress. Such work would clarify whether the associations observed here are stable across institutions and whether instructional changes can produce corresponding changes in students' satisfaction.

The results have potential implications for teaching in university calligraphy programs. First, instructors can reduce avoidable stress by clarifying assessment criteria, sequencing technical tasks from attainable to more complex levels, and balancing evaluative comparison with mastery-oriented feedback. Second, self-efficacy can be supported through achievable short-term goals, visible progress documentation, structured opportunities for revision, and feedback that links improvement to controllable strategies rather than fixed talent. Third, because calligraphy education is intended to foster aesthetic engagement as well as technical competence, course design should protect opportunities for exploration, interpretation, and personal expression. This is compatible with recent calls to strengthen the aesthetic and humanistic functions of university calligraphy curricula (Wu et al., 2021; Kong, 2023) and with evidence linking calligraphy practice to positive affect and academic emotions (Wang et al., 2023; Chen et al., 2024).

Several limitations should be considered. First, the sample was drawn from three universities in Henan Province and therefore cannot be assumed to represent all calligraphy majors in China. Multi-region and multi-institution replication would improve generalizability. Second, the cross-sectional design does not establish temporal or causal ordering among learning stress, self-efficacy, and satisfaction. Longitudinal or intervention designs are needed to test whether changes in stress precede changes in self-efficacy and satisfaction. Third, all focal variables were measured via student self-reports, which may introduce common-method variance. Future studies could combine self-report data with instructor ratings, behavioral indicators of practice, or course performance. Fourth, the present model focused on a single mediator. Future research could examine academic emotions, coping, learning engagement, teacher support, or peer climate as additional mediators or moderators.

Fifth, all three constructs were measured with relatively brief nine-item scales. Although the scales showed satisfactory internal consistency in this sample, subsequent research could strengthen construct validation through independent replication, more detailed item-level confirmatory analyses, and tests of measurement equivalence across student groups. Academic satisfaction was operationalized broadly at the university-experience level rather than as satisfaction with one specific calligraphy course. Future work could include course-specific indicators and the comparison of students' questionnaire responses with observed learning behaviors or course outcomes.

Sixth, all participants were first-year calligraphy majors. This improves comparability of training stage within the sample, but it also limits inference about students at later stages of professional study, when technical demands, assessment practices, and confidence may differ. Longitudinal follow-up across academic years would be particularly useful for determining whether the relationships among learning stress, self-efficacy, and satisfaction remain stable as students accumulate calligraphy experience and encounter more advanced creative and evaluative tasks.

D. Conclusion

This study examined learning stress, self-efficacy, and academic satisfaction among 583 Chinese university calligraphy majors. Learning stress was negatively associated with both academic satisfaction and self-efficacy, whereas self-efficacy was positively associated with academic satisfaction. Structural equation modeling further showed that self-efficacy partially mediated the association between learning stress and academic satisfaction. The findings suggest that improving the academic experience of university calligraphy majors requires attention not only to the amount of academic pressure students experience but also to the beliefs they develop about their capacity to manage challenges. A teaching environment that calibrates difficulty, provides mastery-oriented feedback, and makes progress visible may help protect self-efficacy and sustain satisfaction while preserving the rigor required for technical and aesthetic development.

Ethics statement

Institutional approval was obtained for this questionnaire study. The approving university is withheld for double-blind review, and no approval reference number was issued. The corresponding author reports that participants were informed of the academic research purpose and the confidential treatment of responses, and that participation was voluntary.

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