Psychometric Properties of the Self-Efficacy Subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) among Chinese Undergraduates

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Abstract
This study investigated the psychometric properties and measurement invariance of the self-efficacy subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) in a Chinese undergraduate context. The sample comprised 589 undergraduate students (69.4% female; Mage = 19.21 years, SD = 1.06) from Chinese universities. Psychometric analyses revealed robust properties of the self-efficacy subscale. Multi-group confirmatory factor analysis demonstrated strong evidence supporting configural, metric, scalar, and strict measurement invariance across gender groups, validating the scale's capability to assess academic self-efficacy constructs equivalently among female and male Chinese undergraduate students. Analysis of participants' responses indicated moderate levels of academic self-efficacy. This validation study provides researchers and educational practitioners in China with a psychometrically sound instrument for assessing academic self-efficacy, thereby enabling more precise and culturally appropriate investigations in this domain. Implications for future research directions and practical applications are discussed.
Keywords: Self-Efficacy, Chinese Undergraduates, Psychometric Validation, Measurement Invariance, MSLQ

Introduction
Self-efficacy, a core construct in social cognitive theory, refers to an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments (Bandura, 1977). In the context of academic settings, self-efficacy has been consistently linked to various positive outcomes, including enhanced motivation, improved academic

performance, and increased persistence in the face of challenges (Honicke & Broadbent, 2016; Pajares, 1996; Zimmerman, 2000). It plays an important role in sustainable lifelong learning in the digital era (Guo et al., 2021; Shahzad et al., 2022). Given its significance in educational psychology, accurate measurement of academic self-efficacy is crucial for both researchers and practitioners.

The Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich et al. (Pintrich et al., 1991, 1993; Pintrich & DE Groot, 1990), has emerged as one of the most widely used instruments for assessing various motivational and learning strategy constructs, including academic self-efficacy. The MSLQ consists of several subscales, with the Self-Efficacy Subscale (SES) specifically designed to measure students' judgments about their ability to accomplish academic tasks. Since its inception, the SES has been extensively utilized in diverse educational contexts and has undergone numerous adaptations and translations to suit various cultural and linguistic backgrounds (Credé & Phillips, 2011; Duncan & McKeachie, 2005; Holland et al., 2018).

While the psychometric properties of the MSLQ and its Self-Efficacy subscale have been well-established in Western contexts (Credé & Phillips, 2011; Pintrich et al., 1993), there is a growing need to examine its validity and reliability in non-Western settings, particularly in China, where the educational landscape and cultural norms may differ significantly from those in which the instrument was originally developed. China's higher education system has undergone rapid expansion and transformation in recent decades (Jiang & Ke, 2021), necessitating culturally appropriate and psychometrically sound instruments to assess key psychological constructs such as academic self-efficacy among Chinese undergraduates.

Several studies have attempted to validate the MSLQ or its subscales in Chinese contexts. For instance, Rao & Sachs (1999) examined the factor structure of the MSLQ among Hong Kong students, while Lee et al. (2010) investigated its psychometric properties in Taiwanese samples. However, these studies have yielded mixed results, with some suggesting that the original factor structure may not fully apply to Chinese populations. Moreover, most of these validation efforts have focused on the entire MSLQ rather than specifically examining the Self-Efficacy subscale, which warrants particular attention given its theoretical and practical importance. Hence, while previous studies have examined the MSLQ in Chinese contexts, a thorough investigation of the psychometric properties specifically of the Self-Efficacy subscale among mainland Chinese undergraduates is lacking.

The cultural differences between Western and Chinese societies may influence the conceptualization and measurement of academic self-efficacy. For example, the emphasis on collective achievement in Chinese culture (Li, 2002) might affect how students perceive and report their academic self-efficacy. Additionally, the highly competitive nature of the Chinese education system (Tan & Yates, 2011) could potentially impact the distribution and interpretation of self-efficacy scores. These cultural nuances underscore the importance of rigorously examining the psychometric properties of the Self-Efficacy subscale within the Chinese context.

Despite the widespread use of the MSLQ Self-Efficacy subscale in Chinese educational research (Rao & Sachs, 1999; Wang et al., 2013; Wang et al., 2021, 2023; Zhang et al., 2018),

there remains a paucity of comprehensive psychometric evaluations of this instrument among mainland Chinese undergraduates. This gap in the literature is particularly concerning given the increasing internationalization of higher education and the growing number of Chinese students pursuing studies abroad (Gu & Schweisfurth, 2015; Yang, 2020; Zheng & Kapoor, 2021). A thorough understanding of the psychometric properties of the Self-Efficacy subscale in this population is essential for ensuring the validity of cross-cultural comparisons and the accurate interpretation of research findings.

Furthermore, previous studies on the MSLQ in Chinese contexts have often focused on adolescents or students from comprehensive universities. However, there is a notable gap in research specifically examining the psychometric properties of the Self-Efficacy subscale among students in normal universities. These institutions, which primarily focus on teacher education, play a crucial role in China's educational system (Dong et al., 2024). Given the unique characteristics of normal university students, who are typically preparing for careers in education, their conceptualization and experience of academic self-efficacy may differ from those of students in other types of institutions. This study aims to address this gap by focusing specifically on undergraduate students from Chinese normal universities, thereby contributing to our understanding of academic self-efficacy in this important yet understudied population.

Moreover, the rapid technological advancements and the increasing prevalence of online learning environments in Chinese higher education (Huang et al., 2023; Li et al., 2023; Niu et al., 2023) raise questions about the applicability of traditional self-efficacy measures in these new educational contexts. The Self-Efficacy subscale of the MSLQ, originally developed for face-to-face learning environments, may require adaptation or supplementation to fully capture the nuances of academic self-efficacy in digital learning spaces. Assessing the psychometric properties of the Self-Efficacy subscale of the MSLQ under this context could provide valuable insights into its cross-cultural validity and potential areas for refinement.

Self-efficacy theory posits that heightened academic self-efficacy is associated with increased confidence in academic success and reduced susceptibility to academic burnout (Bandura, 1977). Empirical evidence consistently demonstrates the negative correlation between academic self-efficacy and academic burnout among undergraduate students (Chen et al., 2022; Lau et al., 2021; Ma, 2024; Tang et al., 2021; Yang et al., 2022; Zhou et al., 2022). To assess the criterion validity of the SES, its relationship with academic burnout was tested. In addition, the Academic Self-Efficacy Scale (ASS) developed by Liang (2004) is a widely utilized self-report instrument in China for measuring academic self-efficacy. The concurrent validity of the SES was examined using its correlation with ASS.

Empirical findings regarding gender disparities in academic self-efficacy have yielded inconsistent results in the extant literature. While several investigations have reported non-significant gender differences in self-efficacy (Credé & Phillips, 2011; Rao & Sachs, 1999; Tejani et al., 2021), other scholars have documented statistically significant variations between males and females (Pintrich & DE Groot, 1990; Revishvili et al., 2022; Wang et al., 2013). Notably, there remains a paucity of research examining the measurement invariance of academic self-efficacy across gender groups within the context of undergraduate students in Mainland China. Therefore, it is imperative to establish measurement invariance across

gender subgroups to ensure valid and meaningful comparisons. Subsequently, this study investigated potential gender differences in academic self-efficacy between male and female students.

By addressing these gaps, this study aims to contribute to the validation of the Self-Efficacy subscale of the MSLQ for use among Chinese undergraduates. Such efforts are crucial for advancing cross-cultural research on academic self-efficacy and informing evidence-based educational practices in Chinese higher education institutions. Furthermore, this research may provide valuable insights into the potential adaptation or development of culturally sensitive measures of academic self-efficacy, thereby enhancing the accuracy and utility of self-efficacy assessment in diverse educational contexts.

To be more specific, the objectives of the present study include: (1) investigate the cultural equivalence of the Self-Efficacy subscale items and explore potential adaptations to enhance its relevance and validity within the Chinese undergraduate context; (2) conduct a comprehensive psychometric evaluation of the Self-Efficacy subscale, including reliability, validity, and factor structure analyses; (3) examine measurement invariance across gender, to ensure equitable and meaningful comparisons; and (4) test the gender difference and assess the academic self-efficacy levels of normal undergraduate students in H province, China, utilizing the Chinese version of the Self-Efficacy scale.

Materials and Methods

Participants

The study employed a stratified random sampling method to select participants from three normal universities in Hebei province, China. The research was conducted in two phases. The pilot study comprised 218 participants (66.4% female) with a mean age of 19.14 years (SD = 1.02). For the main study, 596 undergraduate students were recruited (69.4% female), a sample size that satisfies the requirements for Confirmatory Factor Analysis (CFA) and aligns with recommended sample sizes for validation studies in the literature (Wolf et al., 2013). This robust sample ensures adequate statistical power and representativeness for the psychometric analyses conducted in this investigation.

Procedure

This study was conducted in accordance with ethical guidelines and received approval from the Ethics Committee for Research involving Human Subjects at University Putra Malaysia (JKEUPM-2023-137).
The Self-Efficacy subscale (SES) underwent a rigorous translation and adaptation process following the International Test Commission guidelines (International Test Commission, 2018). Three independent bilingual psychologists performed forward and backward translations. A committee approach was employed to adapt the items to the academic context of Chinese universities. The adapted items are presented in Table 2. Subsequently, three independent psychology professors assessed the face and content validity of the translated scale. Expert feedback indicated good face and content validity of SES.

A pilot study (n = 218) was conducted to assess item comprehension and initial psychometric properties. Informed consent was obtained from all participants prior to data collection. Results indicated a clear understanding of all items with no ambiguous expressions identified.

The scale demonstrated excellent internal consistency (Cronbach's α = 0.934). Test-retest reliability was evaluated after a two-week interval using the same sample (n = 218).

For the main study, the electronic version of the questionnaires was disseminated via the Questionnaire Star platform under standardized conditions to ensure data integrity and consistency. A total of 596 respondents participated in the actual study, providing a robust sample for subsequent psychometric analyses.

Instruments

Self-Efficacy subscale (SES) of the Motivated Strategies for Learning Questionnaire (MSLQ). The present study utilized the Self-Efficacy subscale from the Motivated Strategies for Learning Questionnaire (MSLQ), originally developed by Pintrich et al. (Pintrich et al., 1991, 1993; Pintrich & DE Groot, 1990). This subscale comprises 8 items, each rated on a 7-point Likert-type scale ranging from 1 (not at all true of me) to 7 (very true of me). The subscale is designed to assess students' beliefs about their capability to perform academic tasks. In the current investigation, the SES demonstrated high internal consistency reliability (Cronbach's α = 0.894), indicating strong psychometric properties in this sample.

Academic Self-Efficacy Scale (ASS). The Academic Self-Efficacy Scale (ASS), developed by Liang (2004), was employed to assess participants' academic self-efficacy. This instrument comprises two dimensions: Learning Ability Self-Efficacy (LAS) and Learning Behavior Self-Efficacy (LBS). The LAS dimension evaluates an individual's confidence in their capacity to successfully complete academic tasks, achieve satisfactory outcomes, and avoid academic failure. The LBS dimension assesses an individual's confidence in their ability to employ effective learning strategies to attain academic goals. The ASS consists of 22 items rated on a 5-point Likert-type scale ranging from 1 (completely inconsistent) to 5 (completely consistent). Both the LAS and LBS subscales contain 11 items each. The total academic self-efficacy score is derived from the sum of the two dimensional scores, with higher scores indicating greater academic self-efficacy. In the present study, the ASS demonstrated excellent internal consistency reliability for the overall scale (Cronbach's α = 0.925), as well as for the LAS (α = 0.894) and LBS (α = 0.856) subscales.

Academic Burnout Scale (ABS). Academic burnout was assessed using the Academic Burnout Scale (ABS) developed by Lian et al. (2005). This 20-item instrument measures three dimensions of academic burnout: Low Mood (LM), Inappropriate Behavior (IB), and Low Sense of Accomplishment (LSA). Items are rated on a 5-point Likert-type scale ranging from 1 (Not at all like me) to 5 (Very much like me), yielding a total score range of 20 to 100. Higher scores indicate greater levels of academic burnout. Sample items include: "I felt exhausted after learning for a whole day" and "I have this ability to get my bachelor's degree." The ABS demonstrated good internal consistency reliability in the current study, with Cronbach's alpha coefficients of 0.854 for the overall scale, and 0.792, 0.752, and 0.738 for the LM, IB, and LSA subscales, respectively. These reliability coefficients suggest that the ABS is a psychometrically sound instrument for assessing academic burnout in the present sample.

Statistical Analysis

Statistical analyses were conducted using SPSS 26.0 and AMOS 24.0 software packages. Initial data screening, descriptive statistics, and reliability analyses were performed using SPSS. Subsequently, CFA was conducted using AMOS to assess the psychometric properties of the

Self-Efficacy subscale (SES). Scale reliability was examined using Cronbach's alpha (threshold > 0.70) and Composite Reliability (CR) (threshold ≥ 0.60) (Nunnally, 1978). Maximum Likelihood Estimation was employed for the CFA, as the data met the statistical assumptions for parametric tests.

Convergent validity was assessed through the examination of standardized factor loadings (threshold ≥ 0.50, positive, and ≤ 1.0) and Average Variance Extracted (AVE) for the construct (threshold > 0.50) (Hair et al., 2010). Construct validity was determined by the overall model fit indices. Discriminant validity was evaluated using correlation coefficients between the constructs, which should be below 0.85 to demonstrate discriminant validity (Kline, 2015).

Model fit was assessed using multiple indices: Root Mean Square Error of Approximation (RMSEA; acceptable < 0.10, preferred < 0.08), Comparative Fit Index (CFI; threshold > 0.90), Tucker-Lewis Index (TLI; threshold > 0.90), and chi-square/degrees of freedom ratio (χ^2/df; threshold < 5.0) (Hu & Bentler, 1999; Kline, 2015). Additionally, the Standardized Root Mean Square Residual (SRMR; threshold ≤ 0.08) was examined (Hu & Bentler, 1999).

To ensure measurement invariance across subgroups, multigroup CFA was conducted, examining invariance across genders. The assessment of measurement invariance for the SES was conducted through a systematic evaluation of overall model fit and comparisons between nested models. Measurement invariance was considered supported when fit indices demonstrated acceptable values and nested model comparisons met the following predetermined criteria: (1) a change in the RMSEA (ΔRMSEA) less than 0.015; (2) a change in the SRMR (ΔSRMR) below 0.03; (3) a change in the CFI (ΔCFI) not exceeding 0.01; (4) a change in the $\hat{\gamma}$ (Δ$\hat{\gamma}$) no more than 0.008; and (5) McDonald's Noncentrality Index (McNCI) change below 0.02 (Chen, 2007; Cheung & Rensvold, 2002; Kang et al., 2016; Rutkowski & Svetina, 2017). It is noteworthy that the chi-square difference test was not employed as a criterion for assessing measurement invariance due to its well-documented sensitivity to sample size and limited discriminatory power in distinguishing between invariant and non-invariant models (Kline, 2015; Meade et al., 2008; Putnick & Bornstein, 2016). This approach aligns with contemporary best practices in psychometric evaluation, emphasizing the use of multiple fit indices to provide a comprehensive assessment of measurement invariance across different subgroups or time points.

The differences in mean scores between male and female groups were compared using the independent t-test. Bivariate correlations were computed to examine the relationships between the SES, Academic Self-Efficacy Scale (ASS), and Academic Burnout Scale (ABS).

Results
Preliminary Analyses
The data were screened and examined to ensure the absence of missing values or outliers, as well as to verify the fulfilment of the CFA assumptions, such as normality. After data cleaning, 7 questionnaires were dropped, and the questionnaire validity rate was 98.83%. According to the literature, when the skewness falls within the range of -2.58 to +2.58 (Tabachnick et al., 2013) and the kurtosis is between -10 and +10 (Collier, 2020), the data can be considered normally distributed and suitable for further analysis. In the present study (n=589), the normality examination revealed that the skewness coefficients ranged from 0.041 to 0.230,

and the kurtosis coefficients were between -0.190 and 0.176, indicating that the data met the criterion for normal distribution (Table 2). Therefore, it can be concluded that the data were normally distributed and appropriate for subsequent analyses.

The Demographic Information of Respondents
The study sample comprised 589 participants (69.4% female) with ages ranging from 18 to 24 years (M = 19.21, SD = 1.06). Descriptive statistics were computed to elucidate the demographic characteristics of the respondents (Table 1). The sample was drawn from three universities, with distributions of 37.0% (n = 218), 29.9% (n = 176), and 33.1% (n = 195), respectively. Academic year representation was as follows: 30.4% (n = 179) first-year students, 25.1% (n = 148) second-year, 23.3% (n = 137) third-year, and 21.2% (n = 125) fourth-year undergraduates. Regarding academic disciplines, 50.8% (n = 299) of participants were enrolled in humanities programs, 31.4% (n = 185) in science and engineering fields, and 17.8% (n = 105) in arts-related majors.

Table 1
Demographic Characteristics of Participants (n=589)

Demographic Variables	Category	Frequency (n)	Percentage (%)
University	1	218	37.0
	2	176	29.9
	3	195	33.1
Gender	Male	180	30.6
	Female	409	69.4
Academic Year	First Year	179	30.4
	Second Year	148	25.1
	Third Year	137	23.3
	Fourth Year	125	21.2
Major	Humanities	299	50.8
	Science and Engineering	185	31.4
	Arts	105	17.8

Reliability Analysis
The internal consistency reliability of the SES was assessed using Cronbach's alpha coefficient, a widely accepted measure for Likert-type scales. The SES demonstrated robust internal consistency (Cronbach α = 0.894), exceeding the established threshold of 0.7.

To evaluate temporal stability, test-retest reliability was examined using a subset of participants (n = 218) who completed the SES at two-time points separated by a two-week interval. Intraclass correlation coefficients (ICCs) were computed, revealing good test-retest reliability for the SES (ICC = 0.804, 95% CI [0.751, 0.846]).

As Table 2 presents item analysis indicated that all corrected item-total correlations surpassed 0.60, and the "Alpha if item deleted" values ranged from 0.871 to 0.884, which were all below the internal consistency reliability of 0.894, suggesting that scale reliability would not be improved by item removal. Collectively, these psychometric properties provide evidence for

the SES as a reliable instrument for assessing academic self-efficacy in undergraduate populations, demonstrating both internal consistency and temporal stability.

Table 2
Reliability Analysis for the SES (n=589)

Items	M (SD)	Skewness	Kurtosis	Corrected item-total correlation	Alpha if item deleted
1. I believe I will receive an excellent grade in my college courses.	4.95 (0.90)	0.150	-0.164	0.640	0.883
2. I'm certain I can understand the most difficult material presented in the readings for courses.	5.21 (0.83)	0.230	-0.184	0.637	0.882
3. I'm confident I can understand the basic concepts taught in courses.	5.03 (0.90)	0.117	-0.190	0.698	0.877
4. I'm confident I can understand the most complex material presented by the instructor in courses.	5.14 (0.79)	0.143	0.115	0.615	0.884
5. I'm confident I can do an excellent job on the assignments and tests in my college courses.	5.01 (0.81)	0.101	-0.108	0.713	0.875
6. I expect to do well in my academic area.	5.16 (0.76)	0.212	0.176	0.762	0.871
7. I'm certain I can master the skills being taught in the courses.	4.92 (0.83)	0.168	-0.161	0.673	0.879
8. Considering the difficulty of the courses, the teachers, and my skills, I think I will do well in the class.	5.05 (0.80)	0.041	0.068	0.637	0.882

Factor Structure of the SES
CFA was conducted to evaluate the hypothesized factor structure of the SES utilizing data from a sample of 589 participants in the actual study. The one-factor model exhibited factor loadings ranging from 0.66 to 0.81, surpassing the threshold of 0.50 and thus meeting acceptability criteria. Table 3 presents a summary of key model fit indices of this initial model. The SRMR value of 0.044 was below the established upper limit of 0.08, while the CFI of 0.928 exceeded the conventional cutoff value of 0.90. However, several indices indicated suboptimal model fit: the χ^2/df of 9.172 exceeded the recommended threshold of 5, the RMSEA of 0.118 surpassed the critical value of 0.08, and the TLI of 0.899 fell below the established criterion of 0.9.

Examination of Modification Indices revealed values exceeding 15 for the error terms associated with items 5 and 7. Consequently, the error covariances of these items were correlated, as both assess participants' perceived confidence in mastering class assignments and skills. Similarly, error covariances of items 2 and 4 were correlated due to their shared focus on measuring participants' self-efficacy regarding comprehension of class materials.

Following model re-specification, factor loadings ranged from 0.64 to 0.85, with key fit indices summarized in a re-specified model of Table 3. The revised model demonstrated satisfactory fit indices for the one-factor measurement model of the SES (χ^2/df = 3.578 < 5.0, RMSEA = 0.066 < 0.08, CFI = 0.981 > 0.90, TLI = 0.968 > 0.9). The SRMR value of 0.027 remained below the 0.080 threshold, while the Akaike Information Criterion (AIC) of 98.827 represented a reduction compared to the initial model's AIC of 215.446. This final one-factor measurement model of the SES was subsequently employed in further analyses to investigate its relationships with other study variables.

Table 3
Comparison of Model Fit Indices (n=589)

Models	χ^2/df	RMSEA (90 % CI)	CFI	TLI	SRMR	AIC
Initial Model	9.172	0.118 [0.103-0.134]	0.928	0.899	0.044	215.446
Re-specified Model	3.578	0.066 [0.049-0.085]	0.981	0.968	0.027	98.827

Psychometric Properties of the SES
Construct Validity of the SES
The construct validity of the measurement model was evaluated through the examination of fit indices against recommended thresholds. As presented in Table 3, the final measurement model of the SES demonstrated satisfactory construct validity. The RMSEA, an indicator of Absolute Fit, was 0.066, falling below the critical value of 0.08. The CFI, representing Incremental Fit, was 0.981, exceeding the conventional threshold of 0.90. The χ^2/df, a measure of Parsimonious Fit, was 3.578, below the upper limit of 5.0. These fit indices collectively support the construct validity of the final measurement model for the Chinese version of the SES.

Convergent Validity and Composite Reliability of the SES
Convergent validity was assessed using Average Variance Extracted (AVE), while composite reliability was evaluated using the Composite Reliability (CR) coefficient. As shown in Table 4, the AVE (0.51) and CR (0.89) values exceeded their respective threshold values of 0.5 and 0.7, indicating satisfactory convergent validity and composite reliability for the SES.

Table 4
AVE and CR for the SES (n=589)

Construct	Items	Loadings	AVE	CR
SES	1	0.69	0.51	0.89
	2	0.70		
	3	0.71		
	4	0.64		
	5	0.72		
	6	0.85		
	7	0.70		
	8	0.68		

Discriminant Validity Assessment

Discriminant validity was established by examining correlation coefficients between constructs, with values below 0.85 considered indicative of distinct constructs. Table 5 displays the correlation coefficients between the SES and the academic burnout scale (ABS), including its respective sub-constructs. Analysis revealed significant negative correlations, with coefficients ranging from -0.312 (SES and Low Mood [LM]) to -0.507 (SES and Low Sense of Accomplishment [ISA]), all below the 0.85 threshold. These results provide evidence for good discriminant validity of the SES in the present study.

Table 5
The Correlations between the SES and the ABS and its Sub-Constructs (n=589)

Constructs	M(SD)	SES	LM	IB	ISA	ABS
SES	5.06 (0.63)	1				
LM	2.87 (0.64)	-0.312**	1			
IB	2.97 (0.61)	-0.428**	0.655**	1		
ISA	2.77 (0.55)	-0.507**	0.348**	0.449**	1	
ABS	2.87 (0.49)	-0.489**	0.877**	0.859**	0.680**	1

Note: ** P < 0.01

Criterion Validity of the SES

The correlation analysis, as illustrated in Table 5, revealed significant negative associations between the Self-Efficacy Scale (SES) and Academic Burnout Scale (ABS), including its three sub-dimensions: Low Mood (LM) (r = -0.312, p < 0.01), Inappropriate Behavior (IB) (r = -0.428, p < 0.01), and Low Sense of Accomplishment (LSA) (r = -0.507, p < 0.01). The overall correlation coefficient between SES and ABS was -0.489 (p < 0.01). These statistically significant inverse relationships provide robust evidence for the criterion-related validity of the SES.

Concurrent Validity of the SES

To assess the concurrent validity of the Chinese version of the SES, its correlation with the Academic Self-Efficacy Scale (ASS) and its subscales was examined, given the ASS's widespread use in China. As illustrated in Table 6, the correlation coefficients between the SES and the ASS, as well as its subscales Learning Ability Self-efficacy (LAS) and Learning Behavior Self-efficacy (LBS), were 0.729, 0.698, and 0.571, respectively. These moderate to strong positive correlations provide evidence for good concurrent validity of the adapted scale in the Chinese cultural context, supporting its utility as a more concise measure of academic self-efficacy.

Table 6
The Correlations between the SES and the ASS and its Sub-Constructs (n=589)

Constructs	M(SD)	SES	LAS	LBS	ASS
SES	5.06 (0.63)	1			
LAS	3.04 (0.60)	0.698**	1		
LBS	3.10 (0.62)	0.571**	0.568**	1	
ASS	3.06 (0.54)	0.729**	0.943**	0.809**	1

Note: ** P < 0.01

Measurement Invariance across Gender
A multigroup CFA was conducted to assess the measurement invariance of the SES across gender. The results, presented in Table 7, support configural, metric, scalar, and residual invariance, indicating equivalence of the SES's structure, factor loadings, item intercepts, and residuals across male and female groups.

Without using equality constraints, configural invariance was assessed. The model fit indices suggested a good fit to the data: χ^2/df = 2.733, RMSEA = 0.054, SRMR = 0.036, CFI = 0.974. The $\hat{\gamma}$ and McNCI values were 0.974 and 0.950, respectively. These results suggested that the configural invariance of SES across genders was supported.

Metric invariance was evaluated by constraining factor loadings to be equivalent between male and female groups. The model fit indices exhibit well with the χ^2/df of 2.762, RMSEA of 0.055, SRMR of 0.048, and CFI of 0.969. The values of ΔRMSEA, ΔSRMR, ΔCFI, Δ$\hat{\gamma}$, and ΔMcNCI were 0.001, 0.012, -0.005, -0.005, and -0.011, respectively, and all are within the cutoff values. Thus, the metric invariance of SES across gender was supported.

By constraining factor loadings and item intercepts to be the same for both male and female groups, the scalar invariance was evaluated. Results revealed that the model exhibited good fit: χ^2/df = 2.753, RMSEA = 0.055, SRMR = 0.063, CFI = 0.968. The values of ΔRMSEA (0.000), ΔSRMR (0.015), ΔCFI (-0.001), Δ$\hat{\gamma}$ (-0.001), and ΔMcNCI (-0.001) were all within the recommended criteria. Therefore, the scalar invariance of SES across genders was confirmed. Residual invariance was evaluated by constraining factor loadings, intercepts, and residual item variance to be equal across gender groups. The model demonstrated good fit: χ^2/df = 2.674, RMSEA = 0.053, SRMR = 0.069, CFI = 0.962. Changes in fit indices (ΔRMSEA = -0.002, ΔSRMR = 0.006, ΔCFI = -0.006, Δ$\hat{\gamma}$ = -0.006, ΔMcNCI = -0.012) were within acceptable thresholds, supporting residual invariance.

These findings collectively demonstrate the measurement invariance of the SES across gender, supporting its utility for gender comparisons in academic self-efficacy research.

Table 7
Model fit indices for measurement invariance across gender (n=589)

Model	Invariance	χ^2 (df)	χ^2/df	RMSEA (ΔRMSEA)	SRMR (ΔSRMR)	Δχ^2 (Δdf)	CFI (ΔCFI)	$\hat{\gamma}$ (Δ$\hat{\gamma}$)	McNCI (ΔMcNCI)
Gender									
1	Configural	92.915** (34)	2.733	0.054 (—)	0.036 (—)	— (—)	0.974 (—)	0.974 (—)	0.950 (—)
2	Metric	113.230** (41)	2.762	0.055 (0.001)	0.048 (0.012)	20.315* (7)	0.969 (-	0.969 (-	0.939 (-0.011)
3	Scalar	115.633** (42)	2.753	0.055 (0.000)	0.063 (0.015)	2.403 (1)	0.968 (-	0.968 (-	0.938 (-0.001)
4	Residual	141.698** (53)	2.674	0.053 (-0.002)	0.069 (0.006)	26.065 (11)	0.962 (-	0.962 (-	0.926 (-0.012)

Gender Difference in Academic Self-Efficacy
Independent samples t-tests were conducted to examine gender differences in self-efficacy measures. The analyses revealed no statistically significant gender differences across all scales (Table 8). Specifically, males (M = 5.05, SD = 0.68) and females (M = 5.07, SD = 0.60) showed comparable scores on the SES (t = -0.357, p = 0.722). Similarly, no significant differences were found between males (M = 3.07, SD = 0.63) and females (M = 3.03, SD = 0.59) on the Learning Ability Self-Efficacy (LAS) (t = 0.828, p = 0.408), or between males (M = 3.09, SD = 0.67) and females (M = 3.10, SD = 0.59) on the Learning Behavior Self-Efficacy (LBS) (t = -0.337, p = 0.736). The overall Academic Self-efficacy Scale (ASS) also showed no significant gender difference between males (M = 3.08, SD = 0.59) and females (M = 3.06, SD = 0.53; t = 0.454, p = 0.650).

Table 8
Independent t test of the SES, ASS and its sub-constructs (n=589)

Constructs/Sub-constructs	Male	Female	t	p
SES	5.05 (0.68)	5.07 (0.60)	-0.357	0.722
LAS	3.07 (0.63)	3.03 (0.59)	0.828	0.408
LBS	3.09 (0.67)	3.10 (0.59)	-0.337	0.736
ASS	3.08 (0.59)	3.06 (0.53)	0.454	0.650

Assessment of Academic Self-Efficacy Levels
This study evaluated academic self-efficacy levels among normal undergraduate students utilizing two instruments: the SES and the ASS. Descriptive statistics, including means (M) and standard deviations (SD), for the SES, ASS, and its sub-constructs are presented in Table 6. The SES yielded a mean score of 5.06 (SD = 0.63), while the ASS demonstrated a mean of 3.06 (SD = 0.54). The sub-constructs of the ASS, LAS and LBS, exhibited mean scores of 3.04 (SD = 0.60) and 3.10 (SD = 0.62), respectively.

Given that the SES employs a 7-point Likert-type scale (ranging from 1 to 7) and ASS adopts a 5-point Likert-type scale (ranging from 1 to 5), these observed mean scores, all surpassing the scale midpoint of 4 and 3, respectively, indicate moderate levels of academic self-efficacy among the participants. The relatively small standard deviations, ranging from 0.54 to 0.63, suggest a narrow dispersion of scores around the mean, thus enhancing the precision and reliability of the findings (Cohen, 2013).

Discussion
The present study aimed to evaluate the psychometric properties of the Self-Efficacy subscale (SES) of the MSLQ among Chinese undergraduate students. The findings provide robust evidence supporting the reliability, validity, and measurement invariance of the SES in this cultural context, offering valuable insights into its applicability for assessing academic self-efficacy in Chinese higher education settings.

Scale Adaptation and Factor Structure
The successful adaptation of the SES to the Chinese context demonstrates the cross-cultural applicability of the self-efficacy construct as conceptualized by Bandura (1977) and

operationalized in the MSLQ (Pintrich et al., 1991, 1993; Pintrich & DE Groot, 1990). The good model fit of the one-factor structure aligns with previous research on the MSLQ in Western contexts (Cook et al., 2011; Credé & Phillips, 2011; Pintrich et al., 1993; Tejani et al., 2021; Valentín et al., 2013) and Hong Kong adolescents (Lee et al., 2010; Rao & Sachs, 1999). This consistency suggests that the underlying construct of academic self-efficacy, as measured by the SES, maintains its structural integrity across cultural boundaries. The SES can effectively capture the essence of academic self-efficacy among Chinese students, despite potential cultural differences in educational practices and self-construal (Li, 2002; Tan & Yates, 2011). To enhance the model's goodness-of-fit indices, error covariances between items 5 and 7, as well as items 2 and 4, were allowed to correlate based on Modification Indices (MI). This modification was theoretically justified due to the semantic redundancy between these item pairs, an approach that aligns with previous psychometric validation studies of the MSLQ (Dayel et al., 2018). However, the necessity for error correlation suggests potential item redundancy, indicating that these items may require linguistic refinement to enhance their discriminant validity and reduce semantic overlap in future iterations of the instrument.

Psychometric Properties of the SES
The comprehensive analytical approach was adopted for a rigorous examination of the psychometric properties of the SES in the context of Chinese normal undergraduate students, providing insights into its reliability, validity, and measurement invariance across gender. The SES demonstrated excellent psychometric properties in the sample of Chinese undergraduate students.

The high internal consistency reliability (Cronbach's α = 0.894) indicates that the items consistently measure the same underlying construct, supporting the homogeneity of the scale (Nunnally, 1978). This reliability coefficient is comparable to those reported in Western samples (Duncan & McKeachie, 2005; Pintrich et al., 1993), supporting the robust internal consistency of the SES across various educational contexts.

The present investigation demonstrated robust test-retest reliability of the Self-Efficacy subscale (SES) over a two-week interval, corroborating findings from previous research. This temporal stability across diverse cultural contexts provides compelling evidence for the scale's reliability in cross-cultural investigations, supporting its utility as a consistent measure of academic self-efficacy (Holland et al., 2018; Honicke & Broadbent, 2016; Pintrich et al., 1993). The congruence of the results with extant literature underscores the SES's psychometric integrity and its potential for yielding comparable data across different cultural milieus, thereby enhancing its value in international comparative studies of academic self-efficacy.

The construct validity of the SES was supported by its good model fit indices, indicating that the theoretical structure of academic self-efficacy is well-represented by the scale items in the studied sample. The strong convergent validity, evidenced by high factor loadings and adequate AVE, further corroborates that the items effectively capture the intended construct (Hair et al., 2010).

The composite reliability of the SES exceeded the recommended threshold, providing additional evidence of the scale's internal consistency and suggesting that the items reliably represent the latent construct of academic self-efficacy (Fornell & Larcker, 1981).

Discriminant validity was established through the moderate negative correlations between the SES and the Academic Burnout Scale (ABS), with all correlations below the 0.85 threshold (Kline, 2023). This finding aligns with theoretical expectations and previous research indicating an inverse relationship between academic self-efficacy and burnout (Chen et al., 2022; Lau et al., 2021; Ma, 2024; Rahmati, 2015; Tang et al., 2021; Ventura et al., 2015; Yang et al., 2022; Zhou et al., 2022). The distinct yet related nature of these constructs supports the unique contribution of the SES in assessing academic self-efficacy within the broader nomological network of educational psychology constructs.

The significant positive correlations between the SES and the ASS provide strong evidence of concurrent validity. This relationship demonstrates that the SES effectively measures the same underlying construct as the widely used ASS in China, supporting its validity in the Chinese educational context. The moderate to strong correlations suggest that while both scales assess academic self-efficacy, they may capture slightly different aspects of the construct, potentially reflecting nuances in their theoretical foundations or item content.

The establishment of measurement invariance (configural, metric, scalar, and residual) across gender is a particularly noteworthy finding. This invariance indicates that the SES measures academic self-efficacy equivalently for male and female Chinese undergraduate students, which is in line with previous studies conducted in Western culture (Alkharusi et al., 2012; Nielsen et al., 2017), allowing for meaningful comparisons between these groups (Vandenberg & Lance, 2000). Such invariance is crucial for ensuring fair and accurate assessments in diverse student populations and supports the use of SES in research examining gender differences in academic self-efficacy within Chinese higher education.

Gender Difference in Academic Self-Efficacy
The absence of significant gender differences in self-efficacy measures aligns with several previous studies in the literature. These findings support the work of Huang (Huang, 2013), who conducted a meta-analysis of gender differences in academic self-efficacy and found minimal overall effects. Similarly, our results corroborate studies by Rao & Sachs (1999), Credé & Phillips (2011), and Tejani et al. (2021), which reported no substantial gender disparities in academic self-efficacy among university students.

These findings suggest that male and female students demonstrate comparable levels of academic self-efficacy in contemporary educational settings. This pattern may reflect the increasing equity in educational opportunities and societal expectations for academic achievement across genders. Additionally, the results challenge traditional gender stereotypes about academic capabilities and suggest that both male and female students develop similar levels of confidence in their academic abilities.

However, it is important to note that these findings should be interpreted within the specific cultural and educational context of the study, as they are inconsistent with some previous studies (Pintrich & DE Groot, 1990; Revishvili et al., 2022; Wang et al., 2013). Future research

might benefit from examining potential moderating factors such as academic discipline, cultural background, or educational level that could influence the relationship between gender and academic self-efficacy (Bandura, 2012; Usher & Pajares, 2008).

Levels of Academic Self-Efficacy
The moderate levels of academic self-efficacy observed among participants in this study provide interesting insights into the self-perceptions of Chinese undergraduate students. These results provide empirical evidence for the academic self-efficacy levels of the studied undergraduate population, offering valuable insights into their perceived self-efficacy in academic contexts. The consistency in mean scores across both scales and sub-constructs further corroborates the reliability of the measurements and strengthens the internal validity of the study (Tabachnick et al., 2013).

These findings may reflect the unique characteristics of the Chinese educational system, which is often characterized by high levels of competition and pressure (Tan & Yates, 2011). The moderate self-efficacy levels could be interpreted as a realistic self-assessment in the face of challenging academic demands, or they might indicate areas where interventions to boost students' confidence in their academic abilities could be beneficial.

The obtained findings demonstrate substantial concordance with extant literature spanning diverse cultural contexts (Cook et al., 2011; Mazumder, 2014; Pintrich & DE Groot, 1990; Vaculíkova, 2016; Wang et al., 2013). The robust cross-cultural replication of these psychometric properties not only substantiates the construct validity of the SES as a culturally invariant measurement instrument but also suggests the presence of potentially universal underlying mechanisms in academic self-efficacy constructs among tertiary education students. This cross-cultural convergence of findings provides empirical support for the generalizability of the scale's factor structure and reinforces its utility as a viable assessment tool across different cultural and educational settings.

It is important to consider these results in light of cultural factors that may influence self-efficacy beliefs. For instance, the emphasis on modesty and self-criticism in Chinese culture (Li, 2002) might lead students to report more moderate levels of self-efficacy compared to their Western counterparts. Future research could explore how cultural values and educational practices in China interact with academic self-efficacy beliefs and their measurement.

Implications, Limitations and Recommendations
The validation of the SES for use with Chinese undergraduate students has several important implications. First, it provides researchers and educators in China with a psychometrically sound tool for assessing academic self-efficacy, facilitating more accurate and culturally relevant research in this area. Second, the availability of a valid measure of academic self-efficacy can support the development and evaluation of interventions aimed at enhancing students' belief in their academic capabilities, potentially leading to improved educational outcomes.

For policymakers and educational administrators, the findings underscore the importance of considering academic self-efficacy in curriculum design and student support services. The

moderate levels of self-efficacy observed in our sample suggest that there may be room for interventions to bolster students' confidence in their academic abilities, which could have positive ripple effects on motivation, persistence, and achievement.

Despite its strengths, this study has several limitations that should be addressed in future research. First, our sample was limited to undergraduate students from normal universities in one province of China. Future studies should examine the psychometric properties of the SES across a broader range of Chinese higher education institutions and geographical regions to ensure its generalizability. Additionally, while we established measurement invariance across gender, future research should investigate invariance across other important subgroups, such as academic disciplines and years of study.

Another limitation is the cross-sectional nature of the data, which precludes conclusions about the predictive validity of the SES over time. Longitudinal studies examining the relationship between academic self-efficacy, as measured by the SES, and important educational outcomes (e.g., academic performance, persistence) would provide valuable insights into the scale's predictive utility in the Chinese context.

Future research should also explore the potential need for cultural adaptations of the SES items to enhance their relevance and validity in the Chinese educational context. While our study demonstrated good psychometric properties of the adapted scale, there may be unique aspects of academic self-efficacy in Chinese culture that are not fully captured by the current items.

Conclusions
In conclusion, this study provides strong evidence for the reliability, validity, and measurement invariance of the Self-Efficacy subscale of the MSLQ among Chinese undergraduate students. The successful adaptation and validation of this instrument fill an important gap in the literature and provide researchers and educators with a valuable tool for assessing academic self-efficacy in the Chinese higher education context. The moderate levels of academic self-efficacy observed in our sample highlight the need for further research into the factors influencing students' beliefs in their academic capabilities and potential interventions to enhance these beliefs. As China continues to expand and transform its higher education system, the availability of psychometrically sound instruments like the SES will be crucial for understanding and supporting students' motivational beliefs and academic success. The research represents a significant contribution to the field of educational psychology and cross-cultural assessment of academic self-efficacy. By validating this instrument within the specific cultural context of Chinese higher education, the study bridges a critical gap in understanding academic self-efficacy measurement across diverse educational environments. Theoretically, the research extends Bandura's social cognitive theory by providing empirical evidence of how self-efficacy constructs manifest among Chinese undergraduate students, offering nuanced insights into the cultural variations of academic self-efficacy. The validation of the SES not only enhances methodological rigor in educational research but also contributes to a more comprehensive understanding of student motivation, suggesting that contextually adapted psychological measurement tools are essential for developing targeted educational interventions that can effectively support student learning and academic development.

References

Alkharusi, H., Neisler, O., Al-Barwani, T., Clayton, D., Al-Sulaimani, H., Khan, M., Al-Yahmadi, H., & Al-Kalbani, M. (2012). Psychometric properties of the Motivated Strategies for Learning Questionnaire for Sultan Qaboos university students. *College Student Journal*, *46*(3), 567–580.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295x.84.2.191

Bandura, A. (2012). On the functional properties of perceived self-efficacy revisited. *Journal of Management*, *38*(1), 9–44. https://doi.org/10.1177/0149206311410606

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling*, *14*(3), 464–504. https://doi.org/10.1080/10705510701301834

Chen, K., Liu, F., Mou, L., Zhao, P., & Guo, L. (2022). How physical exercise impacts academic burnout in college students: The mediating effects of self-efficacy and resilience. *Frontiers in Psychology*, *13*, 964169. https://doi.org/10.3389/fpsyg.2022.964169

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Cohen, J. (2013). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Routledge. https://doi.org/10.4324/9780203771587

Collier, J. E. (2020). *Applied structural equation modeling using AMOS: Basic to advanced techniques* (1st ed.). Routledge. https://doi.org/10.4324/9781003018414

Cook, D. A., Thompson, W. G., & Thomas, K. G. (2011). The Motivated Strategies for Learning Questionnaire: Score validity among medicine residents. *Medical Education*, *45*(12), 1230–1240. https://doi.org/10.1111/j.1365-2923.2011.04077.x

Credé, M., & Phillips, L. A. (2011). A meta-analytic review of the Motivated Strategies for Learning Questionnaire. *Learning and Individual Differences*, *21*(4), 337–346. https://doi.org/10.1016/j.lindif.2011.03.002

Dayel, S. B., Diab, A. A., Abdelaziz, A., Farghaly, A., & Ansari, A. A. (2018). Validity of the motivated strategies for learning questionnaire in Saudi Arabia. *International Journal of Medical Education*, *9*, 309–315. https://doi.org/10.5116/ijme.5bec.81cf

Dong, J., Hassan, N. C., Hassan, A. Bin, Chen, D., & Guo, W. (2024). Effect of achievement motivation and self-efficacy on general well-being among students at normal universities in Ningxia: The mediating role of time management. *Behavioral Sciences*, *14*(1), 15. https://doi.org/10.3390/bs14010015

Duncan, T. G., & McKeachie, W. J. (2005). The making of the Motivated Strategies for Learning Questionnaire. *Educational Psychologist*, *40*(2), 117–128. https://doi.org/10.1207/s15326985ep4002_6

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.2307/3151312

Gu, Q., & Schweisfurth, M. (2015). Transnational connections, competences and identities: Experiences of Chinese international students after their return 'home.' *British Educational Research Journal*, *41*(6), 947–970. https://doi.org/10.1002/berj.3175

Guo, H., Tong, F., Wang, Z., Tang, S., Yoon, M., Ying, M., & Yu, X. (2021). Examining self-regulated learning strategy model: A measurement invariance analysis of MSLQ-CAL

among college students in China. *Sustainability*, *13*(18), 10133. https://doi.org/10.3390/su131810133

Hair, J. F. J., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Prentice Hall.

Holland, D. F., Kraha, A., Zientek, L. R., Nimon, K., Fulmore, J. A., Johnson, U. Y., Ponce, H. F., Aguilar, M. G., & Henson, R. K. (2018). Reliability generalization of the motivated strategies for learning questionnaire: A meta-analytic view of reliability estimates. *Sage Open*, *8*(3), 1–29. https://doi.org/10.1177/2158244018802334

Honicke, T., & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review*, *17*, 63–84. https://doi.org/10.1016/j.edurev.2015.11.002

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Huang, C. (2013). Gender differences in academic self-efficacy: A meta-analysis. *European Journal of Psychology of Education*, *28*(1), 1–35. https://doi.org/10.1007/s10212-011-0097-y

Huang, C., Tu, Y., Han, Z., Jiang, F., Wu, F., & Jiang, Y. (2023). Examining the relationship between peer feedback classified by deep learning and online learning burnout. *Computers and Education*, *207*, 104910. https://doi.org/10.1016/j.compedu.2023.104910

International Test Commission. (2018). ITC Guidelines for Translating and Adapting Tests (Second Edition). *International Journal of Testing*, *18*(2), 101–134. https://doi.org/10.1080/15305058.2017.1398166

Jiang, J., & Ke, G. (2021). China's move to mass higher education since 1998: Analysis of higher education expansion policies. *Higher Education Quarterly*, *75*(3), 418–437. https://doi.org/10.1111/hequ.12313

Kang, Y., McNeish, D. M., & Hancock, G. R. (2016). The role of measurement quality on practical guidelines for assessing measurement and structural invariance. *Educational and Psychological Measurement*, *76*(4), 533–561. https://doi.org/10.1177/0013164415603764

Kline, P. (2015). *A handbook of test construction (psychology revivals): Introduction to psychometric design*. Routledge. https://doi.org/10.4324/9781315695990

Kline, R. B. (2023). *Principles and practice of structural equation modeling* (5th ed.). Guilford publications.

Lau, S. C., Chow, H. J., Wong, S. C., & Lim, C. S. (2021). An empirical study of the influence of individual-related factors on undergraduates' academic burnout: Malaysian context. *Journal of Applied Research in Higher Education*, *13*(4), 1181–1197. https://doi.org/10.1108/JARHE-02-2020-0037

Lee, J. C.-K., Zhang, Z., & Yin, H. (2010). Using multidimensional Rasch analysis to validate the Chinese version of the Motivated Strategies for Learning Questionnaire (MSLQ-CV). *European Journal of Psychology of Education*, *25*(1), 141–155. https://doi.org/10.1007/s10212-009-0009-6

Li, J. (2002). A Cultural Model of Learning: Chinese "heart and mind for wanting to learn." *Journal of Cross-Cultural Psychology*, *33*(3), 248–269. https://doi.org/10.1177/0022022102033003003

Li, M., Zhao, M., Sun, X., Qiu, H., & Deng, A. (2023). Which combination of teaching methods lead to high level of effectiveness in offline-online mixed teaching? A configuration analysis based on fsQCA. *Journal of Hospitality, Leisure, Sport and Tourism Education*, *33*, 100459. https://doi.org/10.1016/j.jhlste.2023.100459

Lian, R., Yang, L., & Wu, L. (2005). Relationship between professional commitment and learning burnout of undergraduates and scales developing. *Acta Psychologica Sinica*, *37*(5), 632–636.

Liang, Y. (2004). Correlation between self-efficacy to school work and mental health of university students. *Chinese Journal of Clinical Rehabilitation*, *8*(24), 4962–4963.

Ma, Y. (2024). The impact of academic self-efficacy and academic motivation on Chinese EFL students' academic burnout. *Learning and Motivation*, *85*, 101959. https://doi.org/10.1016/j.lmot.2024.101959

Mazumder, Q. (2014). Student motivation and learning strategies of students from USA, China and Bangladesh. *International Journal of Evaluation and Research in Education (IJERE)*, *3*(4), 205–210.

Meade, A. W., Johnson, E. C., & Braddy, P. W. (2008). Power and sensitivity of alternative fit indices in tests of measurement invariance. *Journal of Applied Psychology*, *93*(3), 568–592. https://doi.org/10.1037/0021-9010.93.3.568

Nielsen, T., Makransky, G., Vang, M. L., & Dammeyer, J. (2017). How specific is specific self-efficacy? A construct validity study using Rasch measurement models. *Studies in Educational Evaluation*, *53*, 87–97. https://doi.org/10.1016/j.stueduc.2017.04.003

Niu, H., Wang, S., Tao, Y., Tang, Q., Zhang, L., & Liu, X. (2023). The association between online learning, parents' marital status, and internet addiction among adolescents during the COVID-19 pandemic period: A cross-lagged panel network approach. *Journal of Affective Disorders*, *333*, 553–561. https://doi.org/10.1016/j.jad.2023.04.096

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). McGraw-Hill.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, *66*(4), 543–578. https://doi.org/10.3102/00346543066004543

Pintrich, P. R., & DE Groot, E. V. (1990). Motivational and Self-Regulated Learning Components of Classroom Academic Performance. *Journal of Educational Psychology*, *82*(1), 33–40. https://doi.org/10.13140/RG.2.1.1714.1201

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ)*. Ann Arbor: University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & Mckeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement*, *53*(3), 801–813. https://doi.org/10.1177/0013164493053003024

Putnick, D. L., & Bornstein, M. H. (2016). Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental Review*, *41*, 71–90. https://doi.org/10.1016/j.dr.2016.06.004

Rahmati, Z. (2015). The study of academic burnout in students with high and low level of self-efficacy. *Procedia - Social and Behavioral Sciences*, *171*, 49–55. https://doi.org/10.1016/j.sbspro.2015.01.087

Rao, N., & Sachs, J. (1999). Confirmatory factor analysis of the Chinese Version of the Motivated Strategies for Learning Questionnaire. *Educational and Psychological Measurement*, *59*(6), 1016–1029. https://doi.org/10.1177/00131649921970206

Revishvili, M., Tsereteli, M., & Aptarashvili, I. (2022). Psychometric properties of the Georgian version of Motivated Strategies for Learning Questionnaire (MSLQ). *Georgian Psychological Journal*, *4*. https://doi.org/10.52340/gpj.2022.08.01

Rutkowski, L., & Svetina, D. (2017). Measurement Invariance in International Surveys: Categorical Indicators and Fit Measure Performance. *Applied Measurement in Education*, *30*(1), 39–51. https://doi.org/10.1080/08957347.2016.1243540

Shahzad, K., Javed, Y., Khan, S. A., Iqbal, A., Hussain, I., & Jaweed, M. V. (2022). Relationship between IT self-efficacy and personal knowledge and information management for sustainable lifelong learning and organizational performance: A systematic review from 2000 to 2022. *Sustainability*, *15*(1), 5. https://doi.org/10.3390/su15010005

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.

Tan, J. B., & Yates, S. (2011). Academic expectations as sources of stress in Asian students. *Social Psychology of Education*, *14*(3), 389–407. https://doi.org/10.1007/s11218-010-9146-7

Tang, L., Zhang, F., Yin, R., & Fan, Z. (2021). Effect of interventions on learning burnout: A systematic review and meta-analysis. *Frontiers in Psychology*, *12*, 645662. https://doi.org/10.3389/fpsyg.2021.645662

Tejani, S. B. A., Khan, N. U. N., Ejaz, S., & Shamsy, S. (2021). Psychometric features of Motivated Strategies for Learning Questionnaire (MSLQ) among the students of higher education sector in Karachi-Pakistan. *Reviews of Management Sciences*, *3*(2), 85–100. https://doi.org/10.53909/rms.03.02.090

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research*, *78*(4), 751–796. https://doi.org/10.3102/0034654308321456

Vaculíkova, J. (2016). The third round of the Czech validation of the Motivated Strategies for Learning Questionnaire (MSLQ). *International Education Studies*, *9*(7), 35–46. https://doi.org/10.5539/ies.v9n7p35

Valentín, A., Mateos, P. M., González-Tablas, M. M., Pérez, L., López, E., & García, I. (2013). Motivation and learning strategies in the use of ICTs among university students. *Computers and Education*, *61*, 52–58. https://doi.org/10.1016/j.compedu.2012.09.008

Vandenberg, R. J., & Lance, C. E. (2000). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. *Organizational Research Methods*, *3*(1), 4–70. https://doi.org/10.1177/109442810031002

Ventura, M., Salanova, M., & Llorens, S. (2015). Professional self-efficacy as a predictor of burnout and engagement: The role of challenge and hindrance demands. *Journal of Psychology: Interdisciplinary and Applied*, *149*(3), 277–302. https://doi.org/10.1080/00223980.2013.876380

Wang, C., Schwab, G., Fenn, P., & Chang, M. (2013). Self-efficacy and self-regulated learning strategies for English language learners: Comparison between Chinese and German college students. *Journal of Educational and Developmental Psychology*, *3*(1), 173. https://doi.org/10.5539/jedp.v3n1p173

Wang, F., Jiang, C., King, R. B., & Leung, S. O. (2023). Motivated Strategies for Learning Questionnaire (MSLQ): Adaptation, validation, and development of a short form in the Chinese context for mathematics. *Psychology in the Schools*, *60*(6), 2018–2040. https://doi.org/10.1002/pits.22845

Wang, F., Leung, S. O., & Jiang, C. (2021). Psychometric properties of cognitive and metacognitive learning strategies scale among Chinese senior secondary school students. *Journal of Psychoeducational Assessment*, *39*(6), 761–771. https://doi.org/10.1177/07342829211011806

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement*, *73*(6), 913–934. https://doi.org/10.1177/0013164413495237

Yang, G., Sun, W., & Jiang, R. (2022). Interrelationship amongst university student perceived learning burnout, academic self-efficacy, and teacher emotional support in China's English online learning context. *Frontiers in Psychology*, *13*, 829193. https://doi.org/10.3389/fpsyg.2022.829193

Yang, R. (2020). Internationalization of Higher Education, China. In *The International Encyclopedia of Higher Education Systems and Institutions* (pp. 1901–1904). Springer Netherlands. https://doi.org/10.1007/978-94-017-8905-9_228

Zhang, Y., Dong, S., Fang, W., Chai, X., Mei, J., & Fan, X. (2018). Self-efficacy for self-regulation and fear of failure as mediators between self-esteem and academic procrastination among undergraduates in health professions. *Advances in Health Sciences Education*, *23*, 817–830. https://doi.org/10.1007/s10459-018-9832-3

Zheng, J., & Kapoor, D. (2021). State formation and higher education (HE) policy: An analytical review of policy shifts and the internationalization of higher education (IHE) in China between 1949 and 2019. *Higher Education*, *81*(2), 179–195. https://doi.org/10.1007/s10734-020-00517-2

Zhou, Z., Liu, H., Zhang, D., Wei, H., Zhang, M., & Huang, A. (2022). Mediating effects of academic self-efficacy and smartphone addiction on the relationship between professional attitude and academic burnout in nursing students: A cross-sectional study. *Nurse Education Today*, *116*, 105471. https://doi.org/10.1016/j.nedt.2022.105471

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, *25*(1), 82–91. https://doi.org/10.1006/ceps.1999.1016