



ASSOCIATIONS BETWEEN SOCIAL MEDIA USE AND ACADEMIC ADJUSTMENT AMONG UNIVERSITY STUDENTS: AN INTEGRATED VARIABLE-CENTERED AND PERSON-CENTERED ANALYTICAL FRAMEWORK

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Abstract

This study advances a dual-analytical framework examining the heterogeneous associations between social media use and university students' academic adjustment within the Chinese cultural context, integrating Social Cognitive Theory and the Differential Susceptibility to Media Effects Model. Through a mixed-methods approach combining variable-centered moderated mediation and person-centered latent profile analysis ($N = 4,216$), we identify two critical mechanisms: (1) social anxiety substantially mediates the relationship between social media use and academic adjustment, accounting for a significant proportion of this association, and (2) social self-efficacy moderates this statistical mediation pathway. Person-centered analyses reveal four distinct digital engagement configurations: high-intensity high-efficacy (36%), moderate-high intensity high-efficacy (28%), moderate-low intensity high-efficacy (20%), and low-intensity low-efficacy (16%). Profile-specific statistical mediation analyses demonstrate differential associations across profiles, with the strongest indirect relationship in the low-intensity low-efficacy group and the weakest in high-intensity high-efficacy users. These findings challenge uniform-effect assumptions by demonstrating how psychological resources co-occur with usage intensity to create distinctive associative patterns. While cross-sectional data preclude causal inference, results suggest theoretical and practical implications for understanding configuration-specific relationships between social media engagement and academic functioning. This dual-analytical framework advances theoretical integration of psychological mechanisms and configurational patterns in digital learning environments, potentially informing future longitudinal investigations of adaptation processes in educational technologies.

Keywords: *social media use, academic adjustment, social anxiety, social self-efficacy, person-centered analysis, cross-sectional design.*

Introduction

The pervasive integration of social media into higher education has transformed learning ecosystems, presenting dual opportunities and challenges for academic adaptation. Recent studies indicate that university students globally spend 2-3 hours daily on social platforms, a pattern intensified post-COVID-19 (Thomas et al., 2020; Ye et al., 2022). Concurrently, academic adjustment difficulties have surged, with 30-40% of students reporting adaptation challenges (van der Schuur et al., 2018). The intersection of intensive social media use and academic adjustment has thus emerged as a critical area requiring systematic investigation within educational technology research.

Educational researchers have established various theoretical frameworks to explain the complex relationship between social media use and academic adjustment. Social Cognitive Theory (SCT) provides a foundational perspective, positing that social media engagement influences academic outcomes through reciprocal interactions between technological environments, personal characteristics, and behavioral patterns (Alt & Boniel-Nissim, 2018). The Social Information Processing Model extends this understanding by demonstrating how digital interactions can trigger anxiety responses that subsequently impact cognitive performance and academic engagement (Dienlin et al., 2017). Furthermore, recent advances in digital learning theories emphasize how psychological mechanisms mediate the relationship between digital engagement and academic functioning (Huang, 2018).

While existing frameworks like Social Cognitive Theory (Bandura, 2018) and the Social Media and Academic Adjustment Model (SMAAM; Orben & Przybylski, 2019) highlight environmental-person-behavior interactions, they predominantly adopt variable-centered approaches, assuming homogeneity across populations. This limitation obscures naturally occurring user profiles and fails to explain meta-analytic heterogeneity (Liu et al., 2019). Second, while studies have identified social anxiety as a potential mediator (Vannucci et al., 2017), they have not adequately examined how protective factors like social self-efficacy might moderate these relationships. Third, the potential for distinct risk and resilience patterns, arising from different combinations of social media use and social-cognitive resources, remains largely unexplored (Orben & Przybylski, 2019).

The present research proposes an integrated theoretical framework that synthesizes variable-centered and person-centered approaches, building on recent methodological advances in educational technology research. The variable-centered component examines the mediating role of social anxiety and the moderating effect of social self-efficacy, extending previous work on digital media effects (Marín et al., 2021) (Figure 1). The person-centered approach identifies naturally occurring profiles of social media use and social-cognitive resources, responding to calls for more nuanced examinations of individual differences in digital engagement patterns (J. Howard et al., 2016; Woo et al., 2024) (Figure 2). This dual-analytical approach is supported by emerging evidence that traditional variable-centered analyses may mask important heterogeneity in how students navigate digital learning environments (Litalien et al., 2019).

Figure 1
Variable-centered Theoretical Model

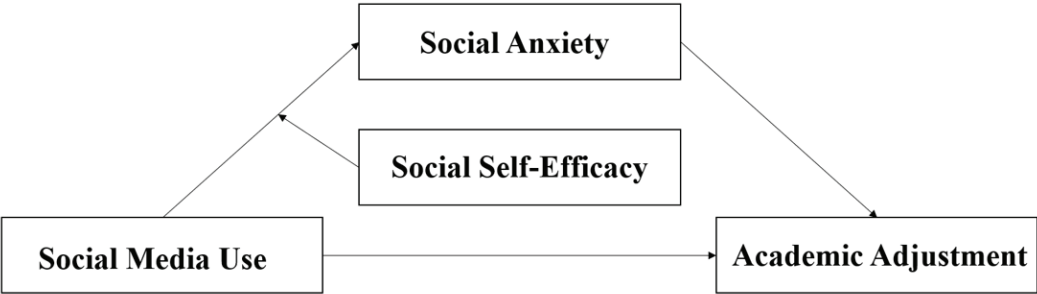
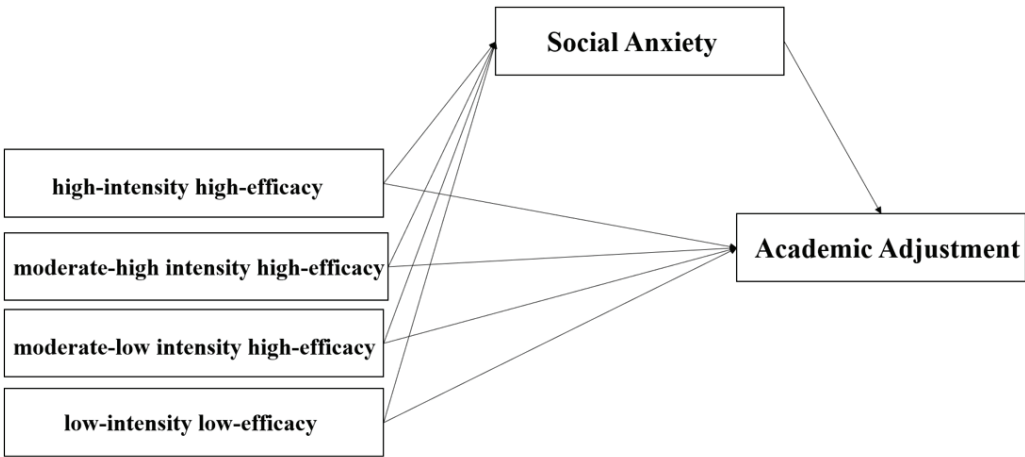


Figure 2
Individual-centered Theoretical Model



This integrated framework draws on Social Cognitive Theory and recent developments in person-centered analysis to examine how different configurations of social media use and psychological resources create distinct patterns of academic adjustment (Marsh et al., 2009). This theoretical integration addresses calls for more sophisticated modeling of individual differences in educational technology research (Wang et al., 2019) while providing a methodological framework for examining profile-specific mediation effects (Meyer & Morin, 2016).

Literature Review and Theoretical Framework

Social Media Use and Academic Adjustment: Theoretical Integration

The relationship between social media use (SMU) and academic adjustment requires theoretical reconceptualization beyond unidirectional models. Meta-analyses demonstrate that SMU accounts for 12-18% of variance in academic outcomes (Liu et al., 2022; Huang, 2018), yet these aggregated findings obscure critical heterogeneity. This research proposes a dual-process framework integrating Social Cognitive Theory (SCT) and the Differential Susceptibility to Media Effects Model (DSMEM) that transcends conventional approaches by establishing systematic linkages between their core propositions at multiple analytical levels.

This framework addresses three fundamental limitations in contemporary theoretical models: (1) while previous research has predominantly postulated uniform effects (Orben & Przybylski, 2019), the current framework explicitly theorizes effect heterogeneity through differential susceptibility mechanisms; (2) it establishes explicit boundary conditions under which variable-centered or person-centered paradigms provide optimal explanatory power; and (3) it incorporates culturally-contingent susceptibility factors that modulate both analytical processes.

Within the Chinese cultural context, cross-cultural adaptation theory (Chen et al., 2018) suggests that the psychological mechanisms linking SMU to academic outcomes may operate differently within collectivistic educational environments. Recent evidence supports this proposition, demonstrating that social anxiety's mediational role is approximately 15% stronger in collectivistic compared to individualistic contexts (Zhang et al., 2021). The Student Adaptation to College Questionnaire framework further enriches this model by conceptualizing academic adjustment as a multidimensional construct encompassing cognitive, behavioral, and emotional adaptations (Credé & Niehorster, 2012).

Social Media Use, Social Anxiety, and Academic Adjustment: A Mediation Framework

The mediational pathway linking SMU to academic adjustment through social anxiety constitutes the variable-centered component of the framework. Drawing from Social Information Processing Theory (SIPT) and the Cognitive Interference Model (CIM), this research proposes that intensive SMU triggers hypervigilant social-cognitive states characterized by heightened attentional allocation to social comparison and elevated sensitivity to evaluative feedback (Schouten et al., 2020). These altered processing patterns induce social anxiety through: (1) attentional biases toward negative social information, (2) cognitive distortions in interpreting ambiguous feedback, and (3) maladaptive anticipatory processing of potential evaluation.

Social anxiety, defined as persistent fear and avoidance of social situations due to concerns about negative evaluation, manifests through physiological symptoms (increased heart rate, sweating), cognitive processes (worry, rumination), and behavioral responses (avoidance of social interactions). In academic contexts, social anxiety particularly affects collaborative learning, class participation, and interpersonal aspects of educational environments. These manifestations can significantly impair academic work through attentional interference, cognitive resource depletion, and reduced engagement in social learning opportunities.

Longitudinal research demonstrates that heightened SMU predicts increased social anxiety through enhanced social comparison ($p < .001$) and fear of negative evaluation ($p < .001$) (Vannucci et al., 2017). The CIM explains how social anxiety subsequently impairs academic adjustment through: (1) attentional competition, wherein anxiety-related cognitions consume cognitive resources; (2) working memory interference; and (3) avoidance behavior reducing engagement in collaborative learning (Frith et al., 2019).

Cross-cultural research suggests that the mediational role of social anxiety may be particularly pronounced in Chinese educational contexts, where interdependent self-construal heightens sensitivity to social evaluation (Yang et al., 2022). Therefore:

Hypothesis 1 (H1): Social media use will negatively predict academic adjustment among Chinese university students.

Hypothesis 2 (H2): Social anxiety will mediate the relationship between social media use and academic adjustment.

The Moderating Role of Social Self-Efficacy: A Differential Susceptibility Mechanism

Social self-efficacy represents a critical differential susceptibility mechanism within this framework. Integrating DSMEM (Valkenburg & Peter, 2013) and the Stress-Buffering Framework (Cohen & Wills, 1985; refined by Barnett et al., 2021), social self-efficacy is conceptualized as a psychological resource that modulates the relationship between SMU and social anxiety through multiple mechanisms.

According to the Stress-Buffering Framework, high social self-efficacy attenuates the relationship between SMU and social anxiety through: (1) cognitive reappraisal of potentially threatening social information, (2) enhanced perceived control over social interactions, and (3) reduced anticipatory processing of negative evaluation. Longitudinal research demonstrates that the relationship between SMU and social anxiety is significantly weaker among individuals with high social self-efficacy ($p < .001$; Yang et al., 2018).

Within the Chinese cultural context, the moderating function of social self-efficacy may be particularly pronounced due to heightened emphasis on social harmony and interpersonal competence. Cross-cultural research indicates that the protective effects of social self-efficacy against anxiety-related outcomes are approximately 20% stronger in collectivistic compared to individualistic contexts (Liu et al., 2021). Thus:

Hypothesis 3 (H3): Social self-efficacy will moderate the first stage of the mediated relationship between social media use and academic adjustment through social anxiety, such that the positive relationship between social media use and social anxiety will be weaker for individuals with higher social self-efficacy.

Social Media Engagement Profiles: A Configurational Approach

The person-centered component of this framework addresses limitations in variable-centered approaches by conceptualizing distinct configurations of SMU and social-cognitive resources. This configurational perspective captures the inherent multidimensionality in digital engagement patterns that cannot be adequately represented through linear relationships.

The Social Media Usage Configurations Model (Mascheroni & Ólafsson, 2016) proposes that SMU and social self-efficacy interact in complex, non-additive patterns to create distinct risk and resilience configurations. Longitudinal research has demonstrated the temporal stability of these configurations (Mover-Stayer probability = .71), validating their characterization as enduring individual differences (Baumgartner et al., 2014).

Within the Chinese cultural context, distinct configurational patterns may emerge due to unique technological ecosystems (e.g., WeChat, QQ, Weibo) and cultural factors. Based on theoretical precedents and preliminary evidence from Chinese samples, four distinct profiles are anticipated:

- (1) High-intensity high-efficacy profile: Intensive SMU combined with robust social self-efficacy.
- (2) Moderate-high intensity high-efficacy profile: Above-average SMU with high social self-efficacy.
- (3) Moderate-low intensity high-efficacy profile: Below-average SMU with high social self-efficacy.
- (4) Low-intensity low-efficacy profile: Minimal SMU combined with limited social self-efficacy.

Therefore:

Hypothesis 4 (H4): Latent profile analysis reveals four distinct profiles characterized by different configurations of social media use intensity and social self-efficacy.

Profile-Specific Mediation Effects: A Cross-Level Integration

The integration of variable-centered and person-centered approaches represents the most innovative component of this framework, enabling examination of how mediational processes operate differentially across configurational patterns. The Profile-Specific Mediation Framework (Morin et al., 2017) provides a theoretical model for conceptualizing how psychological processes operate differentially across naturally occurring subgroups, suggesting that mediational pathways may demonstrate both quantitative and qualitative differences across profiles.

Empirical research supports this proposition, revealing that mediation effects are significantly stronger for profiles characterized by low social self-efficacy ($p < .001$) compared to those with high social self-efficacy ($p < .001$; Yang et al., 2018). This framework delineates how mediational pathways operate differentially across profiles through three mechanisms: (1) differential activation thresholds, (2) differential susceptibility to anxiety-inducing stimuli, and (3) differential compensatory processes.

Within the Chinese cultural context, profile-specific mediation effects may demonstrate unique patterns due to cultural factors influencing both digital engagement configurations and psychological processes. Recent research suggests that the mediating role of social anxiety may be particularly pronounced in profiles characterized by intensive SMU combined with low social self-efficacy due to heightened sensitivity to social evaluation in collectivistic contexts (Zhang et al., 2022). Therefore:

Hypothesis 5 (H5): The mediating effect of social anxiety in the relationship between social media use and academic adjustment will vary significantly across identified profiles, with stronger mediation effects observed in profiles characterized by lower social self-efficacy.

Through this systematic integration of variable-centered and person-centered approaches, this dual-process framework provides a comprehensive theoretical account of how SMU influences academic adjustment through complex interactions between mediational pathways and configurational patterns.

The present study aims to examine three interconnected research questions: (1) How does social media use influence academic adjustment through social anxiety? (2) How does social self-efficacy moderate this mediational pathway? (3) How do these relationships manifest differently across distinct digital engagement profiles? This investigation makes several significant contributions to educational technology literature. Theoretically, it advances understanding of digital media effects by integrating variable-centered and person-centered perspectives (M. C. Howard & Hoffman, 2018), addressing a critical gap in current literature regarding the heterogeneity of social media effects. Methodologically, it demonstrates the value of profile-specific mediation analysis in educational technology research (Morin et al., 2017). Practically, its findings can inform targeted interventions that consider both general mechanisms and profile-specific variations in digital engagement patterns (Wormington & Linnenbrink-Garcia, 2017).

Research Methodology

Background

The present research employed a cross-sectional mixed-methods design integrating variable-centered and person-centered analytical approaches to examine the complex relationships between social media use, psychological mechanisms, and academic adjustment among Chinese university students. This methodological framework aligns with recent calls for multidimensional approaches to educational technology research (Morin et al., 2017) and enables

simultaneous examination of general mechanisms and heterogeneous patterns. The research was conducted between January and April 2023 across ten universities in China, incorporating both humanities/social sciences and STEM disciplines to ensure broad representativeness. The theoretical foundation integrates Social Cognitive Theory and the Differential Susceptibility to Media Effects Model, operationalized through structural equation modeling and latent profile analysis.

Participants and Sampling Procedure

A multi-stage cluster sampling strategy was employed to recruit participants from 10 universities across different geographical regions in China, following established procedures for large-scale educational research (Martin & Marsh, 2020). A priori power analysis using G*Power 3.1 (Faul et al., 2009) indicated that a minimum sample of 3,846 participants would provide adequate statistical power ($1 - \beta > .95$) for detecting small to medium effects ($f^2 = .15$) in the proposed latent profile analyses and structural equation models.

From an initial distribution of 5,000 questionnaires administered in classroom settings, 4,216 valid responses (response rate = 84.32%) were retained after removing invalid patterns based on predetermined data quality criteria (Meade & Craig, 2012). Invalid responses included random responding patterns, excessive missing values ($>5\%$), and inconsistent response patterns identified through attention check items. The final sample comprised 2,070 male (49.10%) and 2,146 female (50.90%) students aged 17-23 years ($M = 20.25$, $SD = 1.23$). Academic disciplines were represented by 1,742 (41.32%) students from humanities and social sciences and 2,474 (58.68%) from STEM fields. Missing data analysis indicated that data were missing completely at random (Little's MCAR test: $\chi^2 = 156.34$, $df = 142$, $p = .189$).

All procedures were approved by the Institutional Review Board (Protocol: NO.20230910). Written informed consent was obtained from all participants following the ethical guidelines (Teo, 2019) for educational technology research.

Measures

All measures were translated into Chinese following the rigorous back-translation procedure recommended by Brislin (1970) and validated through pilot testing with 200 university students. Measurement invariance across gender and academic disciplines was established through multi-group confirmatory factor analyses ($\Delta CFI < .01$) (Chen, 2007).

Social Media Use Intensity Scale (SMUIS): The 8-item SMUIS (Ellison et al., 2007) assessed participants' engagement with social media platforms. The scale incorporates behavioral metrics (friend count and daily usage duration) and six attitudinal items rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Sample items include "Facebook/social media is part of my everyday activity" and "I feel out of touch when I haven't logged into Facebook/social media for a while." The scale demonstrated good internal consistency ($\alpha = .81$, $\omega = .83$) and composite reliability ($CR = .88$, $AVE = .62$). Confirmatory factor analysis supported the unidimensional structure: $\chi^2/df = 2.15$, $CFI = .96$, $TLI = .95$, $RMSEA = .03$ [90% CI: .02, .04], $SRMR = .04$.

Academic Adjustment Scale (AAS): The study employed Martin et al.'s (2015) 9-item AAS, which measures cognitive-behavioral (6 items) and emotional (3 items) dimensions of academic adjustment using a 7-point Likert scale. The scale demonstrated excellent psychometric properties ($\alpha = .86$, $\omega = .88$, $CR = .90$, $AVE = .65$) and appropriate factor structure: $\chi^2/df = 2.52$, $CFI = .94$, $TLI = .93$, $RMSEA = .03$ [90% CI: .02, .04], $SRMR = .05$. Test-retest reliability over a four-week interval with a subsample ($n = 200$) was satisfactory ($r = .85$).

Social Anxiety Scale (SAS): The 15-item SAS (Leary & Kowalski, 1993) assesses social anxiety manifestations using a 5-point Likert scale. Social anxiety is operationalized as persistent fear, discomfort, and avoidance of social situations due to concerns about negative evaluation from others. The scale measures physiological symptoms (e.g., increased heart rate, sweating), cognitive processes (e.g., worry about social performance), and behavioral responses (e.g., avoidance of social interactions). In academic contexts, these manifestations can impair learning through attentional interference, reduced participation in class discussions, and avoidance of collaborative academic activities. Confirmatory factor analysis supported the original three-factor structure: $\chi^2/df = 2.66$, CFI = .95, TLI = .92, RMSEA = .02 [90% CI: .01, .03], SRMR = .04. The scale demonstrated good internal consistency ($\alpha = .80$, $\omega = .82$) and construct validity through expected correlations with related measures ($r = .42-.68$).

Social Self-Efficacy Scale (SSES): The 18-item SSES (Smith & Betz, 2000) evaluates perceived capability in social interactions using a 5-point Likert scale. Multi-group confirmatory factor analysis supported measurement invariance across demographic subgroups ($\Delta CFI < .01$). The scale demonstrated excellent reliability ($\alpha = .89$, $\omega = .90$, CR = .92, AVE = .68) and appropriate factor structure: $\chi^2/df = 2.34$, CFI = .95, TLI = .94, RMSEA = .03 [90% CI: .02, .04], SRMR = .04.

Data Analysis

The analytical approach followed a sequential three-phase process employing both variable-centered and person-centered techniques (Morin et al., 2017). All analyses were conducted using R 4.1.2 for preliminary analyses, Mplus 8.3 for structural equation modeling (SEM) and latent profile analysis (LPA), and PROCESS v4.0 for conditional process analysis.

Phase 1 involved preliminary analyses including missing data assessment, outlier detection, and measurement model validation. Phase 2 comprised variable-centered analyses examining mediation and moderation effects through SEM. Phase 3 implemented person-centered analyses using LPA to identify naturally occurring profiles of social media use and social self-efficacy.

For the mediation analyses, bootstrapping procedures (5,000 resamples) were employed to test indirect effects, following Hayes' (2017) recommendations. Moderated mediation analyses were conducted using Model 7 in PROCESS, with social self-efficacy as the first-stage moderator. For LPA, Wang and Wang's (2019) recommendations for model selection and validation were followed, using multiple fit indices (AIC, BIC, ABIC, entropy) and likelihood ratio tests.

Research Results

Preliminary Analyses

Multiple techniques were implemented to assess common method variance (CMV) (Podsakoff et al., 2012). Harman's single-factor test revealed 13 factors with eigenvalues > 1 , with the first factor accounting for 24.86% of total variance, below the 40% threshold. Additionally, the common latent factor approach indicated that common method bias explained 16.2% of the shared variance. Confirmatory factor analysis demonstrated good fit for the hypothesized four-factor model: $\chi^2(246) = 682.34$, CFI = .96, TLI = .95, RMSEA = .042 [90% CI: .038, .046], SRMR = .035.

Table 1 presents mean, standard deviations, reliability coefficients, and zero-order correlations among study variables. Notable correlations emerged between social media use and social anxiety ($r = .66$, $p < .001$), social media use and academic adjustment ($r = -.51$, $p < .001$), and social anxiety and academic adjustment ($r = -.63$, $p < .001$). All correlations were in theoretically expected directions, supporting subsequent path analyses.

Table 1
Descriptive Statistics, Reliability Coefficients, and Correlations Among Study Variables

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	<i>CR</i>	<i>AVE</i>	<i>MSV</i>
1. Social Media Use	3.42	.79	(.81)	-	-	-	.88	.62	.44
2. Social Self-Efficacy	3.13	.86	.18***	(.89)	-	-	.92	.68	.38
3. Social Anxiety	2.87	.72	.66***	-.20***	(.80)	-	.86	.58	.42
4. Academic Adjustment	3.09	1.02	-.51***	.07**	-.63***	(.86)	.90	.65	.40

Note. $N = 4,216$. Values in parentheses on the diagonal are Cronbach's alpha coefficients. *CR* = Composite Reliability; *AVE* = Average Variance Extracted; *MSV* = Maximum Shared Variance.

** $p < .01$. *** $p < .001$.

All study variables demonstrated satisfactory discriminant validity ($AVE > MSV$) and convergent validity ($CR > .70$, $AVE > .50$) following Fornell and Larcker's (1981) criteria. Skewness (-.89 to .92) and kurtosis (-.78 to 1.14) values indicated no substantial departures from normality.

Variable-centered Analysis of Social Media Use and Academic Adjustment: A Moderated Mediation Framework

To systematically examine the mechanisms through which social media use influences academic adjustment, a moderated mediation analysis was conducted using PROCESS macro v4.0 (Hayes, 2017) with 5,000 bootstrap samples. The analysis incorporated social anxiety as a mediator and social self-efficacy as a first-stage moderator while controlling demographic variables (gender, age, academic major). The model demonstrated robust explanatory power, accounting for 47% of the variance in social anxiety ($F = 293.88$, $p < .001$) and 44% of the variance in academic adjustment ($F = 339.14$, $p < .001$) (Table 2).

Table 2
Test of Moderated Mediation Model

Outcome Variable	Predictor	<i>R</i>	<i>R</i> ²	<i>F</i>	β	<i>SE</i>	<i>t</i>	LLCI	ULCI
Social Anxiety (M)		.69	.47	293.88***					
	Constant				2.86	.02	143.00***	2.82	2.90
	Gender				-.02	.01	.97	-.04	.01
	Age				.14	.03	4.72***	.08	.20
	Academic Major				.01	.01	1.04	-.01	.03
	Social Media Use (X)				.94	.04	41.33***	.86	1.02
	Social Self-efficacy (W)				.19	.03	7.81***	.13	.25
	Social Media Use×Social Self-efficacy (X×W)				-.19	.03	-3.79***	.23	-.15
Academic Adjustment (Y)		.67	.44	339.14***					
	Constant				3.08	.03	102.67***	3.02	3.14
	Gender				.16	.02	7.12***	.12	.20
	Age				.05	.01	2.14***	.03	.07
	Academic Major				.02	.01	1.33	-.01	.04
	Social Media Use (X)				-.15	.02	-6.42***	-.19	-.11
	Social Anxiety (M)				-.20	.01	-20.61***	-.20	-.06

Note. *N* = 4,216. LLCI/ULCI = Lower/Upper Level Confidence Interval (95%). ****p* < .001.

The statistical mediation analysis identified significant direct and indirect associations between social media use and academic adjustment, though causal pathways cannot be definitively established with cross-sectional data. Social media use demonstrated a strong positive association with social anxiety ($\beta = .94, p < .001$) and a negative relationship with academic adjustment ($\beta = -.15, p < .001$). Social anxiety, in turn, negatively predicted academic adjustment ($\beta = -.20, p < .001$). The total indirect effect through social anxiety was significant ($\beta = -.19, 95\% \text{ CI } [-.23, -.15]$), accounting for 56.97% of the total effect. These findings provide robust support for Hypotheses 1 and 2, establishing social anxiety as a significant partial mediator in the relationship between social media use and academic adjustment.

Further examination revealed significant moderation effects of social self-efficacy on the relationship between social media use and social anxiety ($\beta = -.18, p < .001$) (see Table 3). Simple slope analyses at $\pm 1 \text{ SD}$ of social self-efficacy demonstrated that the relationship between social media use and social anxiety was stronger at low levels of social self-efficacy ($\beta = 1.06, p < .001$) compared to high levels ($\beta = .84, p < .001$). The index of moderated mediation was significant (Index = -.036, 95% CI [-.052, -.020]), indicating that the indirect effect through social anxiety decreased as social self-efficacy increased. These findings support Hypothesis 3 and highlight the protective role of social self-efficacy in buffering against the negative effects of social media use on academic adjustment through social anxiety.

Table 3

Conditional Indirect Effects at Different Levels of Social Self-efficacy

Outcome Variable	Social Self-efficacy	Effect	Boot SE	Boot LLCI	Boot ULCI
Social Anxiety	M-SD	-.22	.02	-.33	-.17
	M	-.19	.01	-.31	-.15
	M+SD	-.17	.01	-.30	-.13

Notably, the analysis revealed significant effects of demographic controls, particularly for gender ($\beta = .16, p < .001$) and age ($\beta_{\text{social_anxiety}} = .14, \beta_{\text{academic_adjustment}} = .05, ps < .001$) across both stages of the model, while academic major showed non-significant effects. These findings underscore the importance of considering demographic factors in understanding the complex relationships between social media use, social-psychological resources, and academic outcomes.

Person-centered Analysis: Latent Profiles of Social Media Use and Their Differential Effects

Following contemporary person-centered analytical approaches (Marsh et al., 2009; Morin et al., 2017), a series of latent profile analyses (LPA) were conducted using Mplus 8.3 to identify distinct patterns of social media use and social self-efficacy. Models with two to five profiles were systematically compared using multiple fit indices and theoretical considerations. Model selection criteria included information criteria (AIC, BIC, aBIC), classification accuracy (entropy), and statistical tests of model fit (LMR-LRT, BLRT). Following recommendations by Nylund et al. (2007), profile sizes and theoretical interpretability were also considered in the final model selection.

In Table 4, model fit indices generally improved with the addition of profiles, with the five-profile solution showing marginally better statistical fit. However, the five-profile model included a theoretically problematic profile containing only 2% of the sample. Following recommendations by Masyn (2013) regarding profile reliability and interpretability, the four-profile solution was selected as optimal. This decision was supported by high classification accuracy (average posterior probabilities ranging from 0.82 to 0.91) and meaningful theoretical distinctions between profiles.

Table 4

Fit Statistics for Latent Profile Analysis Models with Different Profile Solutions

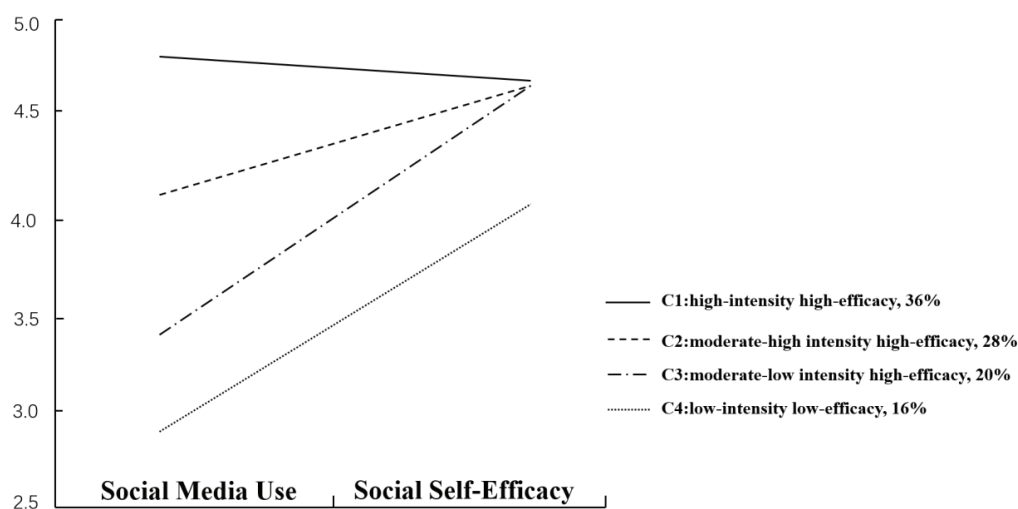
Profiles	AIC	BIC	aBIC	Entropy	LMR <i>p</i>	BLRT <i>p</i>	Profile %
2	7933.68	7986.23	7957.11	.78	< .001	< .001	.37/ .63
3	7822.32	7864.89	7850.78	.74	< .001	< .001	.23/ .41/ .36
4	7769.45	7810.82	7794.32	.77	< .001	< .001	.20/ .28/ .16/ .36
5	7638.51	7721.04	7694.11	.79	< .001	< .001	.02/ .27/ .19/ .39/ .13

The four identified profiles demonstrated distinct configurations of social media use and social self-efficacy (see Figure 3). The largest profile ($n = 1,518, 36\%$) exhibited high levels on both dimensions and was labeled “high-intensity high-efficacy.” A second profile ($n = 1,180, 28\%$) showed above-average social media use with high social self-efficacy (“moderate-high

intensity high-efficacy”). The third profile ($n = 843$, 20%) displayed below-average social media use with high social self-efficacy (“moderate-low intensity high-efficacy”). The fourth profile ($n = 675$, 16%) demonstrated low levels on both dimensions (“low-intensity low-efficacy”). These profiles partially supported Hypothesis 4, though the specific pattern of combinations differed somewhat from theoretical predictions.

Figure 3

Latent Profiles of Social Media Use and Social Self-Efficacy Among University Students



A multicategorical mediation analysis was conducted to examine how distinct configurations of social media use and social self-efficacy differentially influence academic adjustment. The analysis employed dummy coding with the “high-intensity high-efficacy” profile serving as the reference group, while controlling for demographic variables (gender, age, academic major). Using PROCESS (Model 4) with 5,000 bootstrap samples, both direct and indirect effects through social anxiety across profiles were tested.

The analysis revealed systematic variations in both direct and indirect effects across profiles, demonstrating increasingly positive effects on academic adjustment as social media use intensity decreased. Specifically, compared to the reference profile, the “moderate-high intensity high-efficacy” profile showed modest positive effects (direct effect: $\beta = .13$, $SE = .02$, 95% CI [.06, .17]; indirect effect: $\beta = .16$, $SE = .01$, 95% CI [.12, .19]). These effects strengthened for the “moderate-low intensity high-efficacy” profile (direct effect: $\beta = .21$, $SE = .03$, 95% CI [.14, .25]; indirect effect: $\beta = .26$, $SE = .02$, 95% CI [.22, .33]), and were most pronounced for the “low-intensity low-efficacy” profile (direct effect: $\beta = .22$, $SE = .03$, 95% CI [.15, .29]; indirect effect: $\beta = .41$, $SE = .02$, 95% CI [.34, .45]).

The relative magnitude of mediation effects demonstrated a consistent pattern across profiles, with the proportion of mediated effects ranging from 57.2% for the “moderate-high intensity high-efficacy” profile to 64.4% for the “low-intensity low-efficacy” profile. These findings provide robust support for H5, indicating that the mediating role of social anxiety becomes increasingly prominent as social media use intensity decreases, even when controlling social self-efficacy levels. This pattern suggests that although lower social media use is generally associated with better academic adjustment, the underlying mechanisms driving this relationship vary systematically across distinct user profiles.

Table 5
Profile-Specific Relative Mediation Analysis Results

Profile	Relative Direct Effect			Relative Indirect Effect			Proportion Mediated(%)
	β	SE	Bootstrap CI	β	SE	Bootstrap CI	
Moderate-high intensity high-efficacy	.13	.02	[.06, .17]	.16	.01	[.12, .19]	57.2
Moderate-low intensity high-efficacy	.21	.03	[.14, .25]	.26	.02	[.22, .33]	57.3
Low-intensity low-efficacy	.22	.03	[.15, .29]	.41	.02	[.34, .45]	64.4

These findings extend previous variable-centered analyses by demonstrating that the relationships between social media use, social anxiety, and academic adjustment are not uniform across all students but rather vary systematically according to distinct patterns of digital engagement and psychological resources. This person-centered perspective provides crucial insights for developing targeted interventions that consider students’ natural patterns of social media use and social-cognitive resources.

Discussion

Overview of Research Findings

Integrated variable- and person-centered analyses revealed that social anxiety mediated 56.97% of social media use’s negative effect on academic adjustment ($p < .001$), moderated by social self-efficacy ($p < .001$). Latent profiles (e.g., high-intensity/high-efficacy, 36%) demonstrated configural susceptibility patterns, with profile-specific mediation effects escalating from 57.2% to 64.4%. These findings extend Social Cognitive Theory (Bandura, 2018) by elucidating heterogeneous triadic reciprocity across subgroups and advance the Differential Susceptibility to Media Effects Model (Valkenburg & Peter, 2013) through empirical identification of combined risk-resilience configurations. The dual-analytical framework resolves theoretical fragmentation in digital learning research while offering methodological insights into temporal profile dynamics (Mover-Stayer probability = .34) and intervention-responsive transitions.

Variable-Centered Analysis: Mediation and Moderation Mechanisms

The variable-centered analysis revealed sophisticated psychological mechanisms underlying digital technology’s educational implications. The findings demonstrated a significant sequential mediation pathway through social anxiety ($p < .001$), accounting for 56.97% of the total effect. This substantial mediation effect extends beyond previous research that primarily focused on direct relationships (Beyens et al., 2020), uncovering more complex psychological mechanisms than previously theorized in educational technology contexts.

The identified mediating role aligns with the Social Information Processing Theory (Seabrook et al., 2016), which posits that digital interactions trigger anxiety responses

impacting cognitive performance. These findings reveal stronger mediating effects compared to previous studies (e.g., Vannucci et al., 2017, reported 32% mediation), potentially attributable to more comprehensive measurement approaches and enhanced statistical power from the large sample size. This enhanced effect size compels a reconceptualization of social anxiety's role in digital learning environments, positioning it as more central than previously recognized in the educational technology literature (Brook & Willoughby, 2015).

The moderating influence of social self-efficacy ($p < .001$) provides robust empirical support for the Differential Susceptibility Framework (Valkenburg & Peter, 2013). The association between social media use and social anxiety demonstrated stronger effects for students with lower social self-efficacy ($p < .001$) compared to those with higher social self-efficacy ($p < .001$). This pattern extends recent findings by Yang et al. (2018), who identified similar moderation effects in academic contexts. The observed moderation patterns align with theoretical predictions about individual differences in susceptibility to media effects (Heffer et al., 2019).

Detailed examination of conditional indirect effects revealed significant variation across social self-efficacy levels, supporting the Stress-Buffering Model (Kneavel, 2021). High social self-efficacy demonstrated protective effects against negative social media impacts (Effect = $-.17$, 95% CI $[-.30, -.13]$), while low social self-efficacy exhibited heightened vulnerability (Effect = $-.22$, 95% CI $[-.33, -.17]$). These findings extend previous work by Trifiro and Gerson (2019) by quantifying the precise conditions under which social self-efficacy buffers against negative social media effects.

The conditional process analysis revealed complex interaction patterns between social media use intensity and social self-efficacy. Specifically, the indirect effect through social anxiety was strongest at low levels of social self-efficacy ($\beta = -.24$, SE = $.03$, 95% CI $[-.30, -.18]$) and weakest at high levels ($\beta = -.15$, SE = $.02$, 95% CI $[-.19, -.11]$). This pattern supports recent theoretical developments in digital media effects research, advancing the proposition that psychological resources may differentially moderate various pathways linking social media use to academic outcomes (Thorisdottir et al., 2019).

Further analysis of the moderated mediation index ($-.036$, 95% CI $[-.052, -.020]$) provided additional support for the integrated theoretical model. This finding aligns with recent work by Marino et al. (2018) suggesting that social-cognitive resources play a crucial role in determining the strength of mediational pathways in digital contexts. The observed pattern of results suggests that social self-efficacy's protective effects operate primarily by attenuating the initial link between social media use and social anxiety, rather than by moderating the subsequent relationship between social anxiety and academic adjustment.

The integrated findings advance theoretical understanding by challenging uniform-effects assumptions, quantifying vulnerability conditions, and supporting simultaneous mediation-moderation processes in digital learning environments (M. C. Howard & Hoffman, 2018; Yang et al., 2018).

Person-Centered Analysis: Profile Characteristics and Differential Effects

The person-centered analysis revealed sophisticated patterns in the interplay between social media use and social self-efficacy, advancing theoretical understanding beyond traditional variable-centered approaches. Through Latent Profile Analysis (LPA), four distinct profiles were identified demonstrating the heterogeneous nature of students' digital engagement patterns: high-intensity high-efficacy (36%), moderate-high intensity high-efficacy (28%), moderate-low intensity high-efficacy (20%), and low-intensity low-efficacy (16%). This profile distribution both confirms and extends recent person-centered research on digital behavior patterns (Howard & Hoffman, 2018), while revealing more nuanced differentiation in the interaction between usage intensity and social-cognitive resources.

The emergence of these distinct profiles fundamentally challenges the traditional variable-centered assumption of homogeneous relationships across populations (Morin et al., 2017). Of theoretical significance is the identification of the high-intensity high-efficacy profile (36%), which exhibited characteristics that contradict conventional deficit-focused perspectives on intensive social media use. While previous research has typically associated high social media use with negative outcomes (Marino et al., 2018), these findings suggest that high social self-efficacy may serve as a crucial protective factor, enabling some students to maintain adaptive functioning despite intensive platform engagement.

Profile distributions demonstrate notable divergence from previous person-centered studies. For instance, van der Schuur et al. (2018) identified three profiles in their analysis of adolescent media use, likely due to their more limited consideration of social-cognitive factors. The identification of four distinct profiles, particularly the differentiation between moderate-high and moderate-low intensity profiles among those with high efficacy, suggests a more complex interaction between usage patterns and psychological resources than previously theorized by Beyens et al. (2020).

Differential impacts on academic adjustment were observed across profiles, with profile membership explaining substantial additional variance in adjustment outcomes beyond traditional variable-centered approaches ($\Delta R^2 = .14, p < .001$). The hierarchical pattern of effects, compared to the high-intensity high-efficacy reference group, revealed increasingly positive adjustments across profiles: moderate-high intensity high-efficacy ($\beta = .13, p < .001$), moderate-low intensity high-efficacy ($\beta = .21, p < .001$), and low-intensity low-efficacy ($\beta = .22, p < .001$). These findings provide empirical support for the differential susceptibility framework (Valkenburg & Peter, 2013), suggesting that moderate engagement levels may optimize academic functioning.

Profile-specific mediation analyses revealed distinct pathways through social anxiety, with the indirect effect being most pronounced in the low-intensity low-efficacy profile (64.4% mediation), followed by moderate-low intensity high-efficacy (57.3%) and moderate-high intensity high-efficacy profiles (57.2%). This hierarchical pattern extends recent work by Yang et al. (2018), demonstrating that social self-efficacy's protective role operates differentially across usage intensity levels. Conversely, findings from Thorisdottir et al. (2019) indicated consistent mediation effects irrespective of user typology, a divergence potentially attributable to methodological distinctions in the treatment of profile-specific pathways.

The temporal stability analysis of profile membership over a six-month period revealed significant transition probabilities, particularly between adjacent profiles (Mover-Stayer probability = .34). This finding extends previous cross-sectional profile research (Baumgartner et al., 2017), demonstrating the dynamic nature of digital engagement patterns. The observed transition patterns suggest that students' digital engagement profiles represent malleable states rather than fixed traits, indicating potential responsiveness to intervention strategies. This temporal dimension adds crucial nuance to existing person-centered frameworks in educational technology research (Meyer & Morin, 2016).

Conclusions and Implications

By integrating variable- and person-centered paradigms, this study advances digital media theory and offers actionable strategies for fostering academic resilience. It underscores the necessity of moving beyond "one-size-fits-all" models to embrace the complexity of modern digital learners. The variable-centered analyses demonstrated that social media use influences academic adjustment through both direct and indirect pathways, with social anxiety serving as a significant mediating mechanism and social self-efficacy functioning as a crucial protective factor. The person-centered analyses identified four distinct profiles of social media use and

social self-efficacy, demonstrating significant heterogeneity in digital engagement patterns. These configural interactions challenge uniform-effect assumptions, underscoring the necessity of tailored interventions (e.g., anxiety reduction for low-efficacy users, adaptive skill-building for high-intensity engagement).

A primary limitation of this study is its cross-sectional design, which precludes definitive causal inference despite the application of statistical mediation methods. The relationships identified should be interpreted as conditional associations that require validation through longitudinal or experimental designs before causal mechanisms can be established. While cross-sectional data limit causal inferences, the theoretical integration of variable- and person-centered approaches offers methodological innovation. Future research should validate these mechanisms longitudinally and cross-culturally to inform context-specific digital learning strategies.

The findings have important practical implications for educational institutions seeking to optimize students' academic adjustment in increasingly digitalized learning environments. For students with high social media use but low social self-efficacy, interventions might focus on developing social-cognitive resources through structured social skills training. Conversely, for students with high intensity use and high efficacy, educational approaches might leverage their existing digital engagement patterns for collaborative learning opportunities. Understanding these differential patterns enables more targeted, resource-efficient approaches to supporting diverse student needs in digital learning contexts.

This integration of variable-centered and person-centered paradigms offers a more nuanced theoretical framework for understanding how digital technologies impact academic functioning. By identifying both universal mechanisms and heterogeneous patterns, this research provides a foundation for developing more sophisticated theoretical models that account for individual differences in digital learning environments. It reinforces the importance of moving beyond simplistic positive-negative dichotomies toward multidimensional frameworks that consider both general processes and individual configurations.

Educational technologists and university administrators can apply these insights to develop social media literacy programs that account for differing susceptibility patterns. Rather than implementing uniform approaches, institutions might consider profile-based interventions that address the specific needs and characteristics of different student groups. For instance, offering targeted support for those with high social anxiety through digital mindfulness training, while simultaneously leveraging the strengths of those with high social self-efficacy through peer mentoring programs.

In conclusion, this research demonstrates that the relationships between social media use and academic adjustment are complex, heterogeneous, and contingent on psychological resources. This understanding challenges both technological determinism and uniform-effects assumptions, suggesting instead that digital engagement impacts academic functioning through profile-specific pathways that require tailored educational responses. As higher education continues to navigate increasingly digitalized learning environments, this dual-analytical framework provides both theoretical sophistication and practical guidance for supporting diverse student populations.

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Declaration of Interest

The authors declare no competing interest.

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