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WeiYu Ma, RuoNan Zhen, XiaYou Tan, YiNan He, JinWei Zhang, ShiHao Tang & Zhi Wang

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Self-Control and Social Support in the Link Between Academic Pressure Anxiety Depression and Social Media Addiction in College Students

WeiYu Ma¹

¹Guangzhou No.12 Hospital, Guangzhou, Guangdong, 510620, China

RuoNan Zhen²

²Guangzhou Center For Disease Control And Prevention, Guangzhou, Guangdong, 510440, China

XiaYou Tan¹

¹Guangzhou No.12 Hospital, Guangzhou, Guangdong, 510620, China

YiNan He¹

¹Guangzhou No.12 Hospital, Guangzhou, Guangdong, 510620, China

JinWei Zhang¹

¹Guangzhou No.12 Hospital, Guangzhou, Guangdong, 510620, China

ShiHao Tang¹

¹Guangzhou No.12 Hospital, Guangzhou, Guangdong, 510620, China

Zhi Wang^{1*}

^{1*}Guangzhou No.12 Hospital, Guangzhou, Guangdong, 510620, China

Corresponding Author □ Zhi Wang

Corresponding Author E-mail: wangzhi202502@126.com

Abstract

The deep integration of social media into daily routines has intensified concerns about problematic social media use among students, adversely affecting both educational outcomes and psychological well-being. Drawing on Social Cognitive Theory and Cognitive-behavioral Theory, this study investigates the roles of academic pressure, anxiety, and depression in the development of social media addiction, with particular attention to the mediating effect of self-control and the moderating role of social support. A survey of 900 college students collected data on these key variables. Structural equation modeling revealed that: academic pressure, anxiety, and depression directly increase social media addiction while also reducing self-control, which mediates the associations. Social support weakens the relationship between academic pressure and social media addiction, yet it fails to significantly moderate the link between anxiety and social media addiction. These findings reveal a multi-layered mechanism underlying social media addiction and provide valuable guidance for intervention strategies in higher education contexts.

Keywords: Academic Pressure, Anxiety, Depression, Self-control, Social Support, Social Media Addiction

1. Introduction

Social media has become an indispensable part of college students' academic and personal lives, functioning as a key channel for obtaining information, maintaining social connections, and entertainment. However, excessive use has

significantly increased the risk of social media addiction (SMA) among college students ¹. SMA denotes an uncontrollable overuse of social platforms, where engagement becomes excessive to the point of disrupting daily routines, hindering real-world social interactions, and diminishing overall functioning ². As a pathological manifestation of digital behaviors, SMA is a critical early warning indicator for assessing the digital health risks of university students ³. In China, 70.4% of respondents reported that social media use was eroding their academic effectiveness, and over half (50.10%) explicitly acknowledged symptoms of SMA among contemporary students ⁴. Data from the Bergen Social Media Addiction Scale show that 34% of American college students meet the criteria for SMA ⁵. SMA has been found to significantly impair academic performance ⁶⁻⁸, hinder real life social competence ⁹, and elevate mental health risks among students ^{3,10}. Therefore, exploring the mechanisms underlying SMA in college students is essential for understanding the formation of mental health issues in the digital era and for providing theoretical foundations for psychological interventions.

Existing scholarship has linked academic pressure (AP), anxiety (ANX), and depression (DEP) to SMA, yet most studies consider each correlate separately, focusing on the association between a single psychological factor and SMA ^{1,11-13}. These associations are unlikely to be purely linear. They may depend on both personal psychological resources, e.g. self-control (SC), and contextual conditions, e.g. social support (SS) ¹⁴. This study is grounded in the principles of Social Cognitive Theory (SCT) and Cognitive-Behavioral Theory (CBT) to examine how SMA develops among college students. CBT specifies how internal states, including AP, ANX, and DEP, guide appraisal processes that foster observable behaviors, such as excessive engagement with social media, and how these patterns become maintained through negative reinforcement cycles ¹⁵. SCT emphasizes person-environment transactions and indicates that contextual resources, including SS, can buffer the formation of SMA in college students ¹⁶. Considered together, the two perspectives are complementary: one illuminates micro-level cognitive and behavioral pathways, and the other highlights macro-level environmental influences. Their integration provides a coherent account of how internal drives and external contexts are jointly associated with SMA.

Guided by these theories and the identified gap, this study specifies a moderated mediation model. AP, ANX, and DEP are proposed to be associated with SMA through the mediating role of SC, whereas SS is expected to moderate the links among these factors with SMA. Clarifying this moderated mediation process advances understanding of the multilevel formation of SMA among college students. Understanding this mechanism offers direct insights for developing

targeted interventions, ultimately supporting students' mental health and academic success.

2. Literature Review

2.1 Theoretical Foundations

SCT holds that people acquire and sustain behavior through core processes such as observational learning, self-efficacy, and self-regulation. It stresses reciprocal interactions among personal factors, behavior, and environmental conditions^{17,18}. In recent years, this framework has seen extensive use in health behavior programs (including physical exercise), research on educational technology, and studies of addictive behaviors¹⁹⁻²². CBT maintains that emotional and behavioral difficulties arise from the interplay between maladaptive cognitive patterns, such as overgeneralization and catastrophizing, and reinforcement processes^{23,24}. Distorted appraisals tend to elicit maladaptive actions, and the resulting outcomes further strengthen negative beliefs, creating a self-perpetuating cycle²³. This approach is widely applied in psychotherapy for DEP and ANX, in interventions targeting behavioral addictions, in stress management, and in educational psychology²⁵⁻²⁸.

In this study, combining SCT with CBT offers complementary lenses for understanding psychological and behavioral difficulties among college students. Together, they form an integrated explanatory scheme. SCT clarifies how SS, as an environmental resource, can strengthen SC and thereby mitigate the adverse associations of AP, ANX, and DEP. CBT explains how these psychological difficulties may erode SC and are associated with greater SMA. This integrated perspective specifies how contextual and cognitive mechanisms jointly shape behavioral outcomes and provides a sound basis for comprehensive interventions: enhance SS systems to improve external conditions and employ cognitive-behavioral training to strengthen SC. Such efforts can help college students manage AP, ANX, and DEP, as well as related behavioral problems.

2.2 Relationships Between Variables

2.2.1 Academic Pressure and Social Media Addiction

AP refers to the psychological and physiological responses individuals experience when they perceive academic demands to exceed their coping capabilities. Core features of AP include cognitive overload, time constraints, and achievement related ANX²⁹. Many studies have demonstrated a positive relationship between AP and SMA among college students^{1,11,27}. Under high AP, students may turn to social media as an emotional regulation tool, using it as an avoidance based coping mechanism to seek temporary relief through instant gratification. However, excessive reliance reinforces usage behavior, eventually

leading to addiction⁸. Moreover, AP consumes sustained attentional resources, while the fragmented and novel content offered by social media fulfills the need for “low cognitive load to high novelty”⁸. The rapid content switching and instant feedback features on social media platforms hinder attentional focus, gradually reducing concentration and fostering dependency²⁷. For instance, He and Zhu¹ identified a notable positive association between AP and SMA in doctoral candidates, highlighting how specific academic stressors can exacerbate addictive behaviors. In this study, undergraduate students’ unique academic stressors (such as coursework, thesis writing, and laboratory experiments) may similarly contribute to an elevated risk.

2.2.2 Anxiety and Social Media Addiction

ANX refers to a negative emotional state characterized by tension, worry, and unease in response to perceived threats or uncertainty³⁰. Existing research has identified there is a robust positive association between ANX and SMA^{12,28,31}. According to CBT, ANX prompts college students to turn to social media for emotional soothing. Brief interactions and content consumption provide short-term relief. Yet this largely passive pattern can consolidate into habitual reliance and become SMA³². In a study of 375 young adults, Arikan, et al.³³ reported that attachment ANX significantly and positively predicted SMA. Anxious college students may also fixate on possible negative feedback online and engage in repeated checking to reduce uncertainty, a cycle that reinforces compulsive, addictive use³⁴.

2.2.3 Depression and Social Media Addiction

DEP is a persistent condition marked by low mood, diminished interest, and cognitive difficulties³⁵. Evidence shows that DEP is significantly and positively associated with SMA^{13,15,33,36}. In digital settings, college students with depressive symptoms often avoid deep, face-to-face interaction and prefer controlled, surface-level online exchanges such as liking or using emojis¹³. This shift can limit the development of offline social skills and foster a loop in which greater DEP corresponds to heavier social media use, raising the likelihood of addiction³. DEP was positively linked to SMA in college students during the COVID-19 period³⁶.

2.2.4 The Mediating Role of Self-Control

SC is the ability to suppress impulses, regulate emotions, and act purposefully to achieve long-term goals³⁷. Consistent evidence indicates that SC is negatively associated with SMA³⁸⁻⁴¹. Based on SCT, college students with depleted SC resources are more likely to be influenced by environmental cues, imitate others’ excessive media use, and have trouble in monitoring and regulating their online activities^{38,42}. Conversely, those with higher SC can better resist impulses for

immediate gratification⁴⁰. Blachnio, et al.³⁸ examined adults across seven countries and found that SC was negatively related to multiple forms of digital media overuse, including Internet, smartphone, and Facebook addiction. These findings demonstrate that SC plays an essential role in protecting college students from SMA.

Furthermore, evidence suggests that AP, ANX, and DEP significantly undermine individuals' SC^{6,43-46}. From the standpoint of CBT, AP may impose a heavy cognitive load, continuously consuming mental resources and diminishing self-regulation capacity⁴⁴. For instance, Zhang, et al.⁴¹ found a significant negative link between perceived stress and SC in college students. From a physiological viewpoint, AP impairs prefrontal cortex functioning, reducing executive control efficiency⁶. ANX also directs attention toward negative stimuli, increases social comparison, and depletes cognitive resources, thereby weakening SC^{14,43}. For example, Blachhart, et al.⁴³ found that adults with higher social ANX displayed poorer SC after social interactions. DEP further drains psychological energy, making it difficult for students to engage inhibitory mechanisms when tempted by social media⁴⁷. Vally, et al.³⁶ demonstrated that DEP had a negative association with sense of control, which was related to higher levels of SMA. Overall, AP, ANX, and DEP jointly reduce SC and impair decision-making and executive functioning. This depletion of psychological resources weakens emotional regulation and impulse inhibition, creating a reinforcing cycle.

Moreover, prior research indicates that SC may partially mediate the associations among AP, ANX, DEP, and SMA^{34,36,41}. Under prolonged AP, college students' limited SC resources are easily exhausted, leading to maladaptive social media use or loss of control. Jiang, et al.⁶ found that SC was a mediator between AP and problem behaviors among adolescents. Because college students are in a transitional stage of psychological development, their emotion regulation and behavioral control skills are not yet mature. When trapped in ANX or DEP, they struggle to cope adaptively⁴⁸. These negative emotions reduce executive functioning, making students more susceptible to the instant feedback of social media⁴⁰. Failures in SC may thus evolve into habitual overuse patterns characterized by extended screen time and withdrawal symptoms⁴⁹. Zhang, et al.³⁴ and Vally, et al.³⁶ both demonstrated that SC mediates the relationship between negative states (ANX/DEP) and SMA. Therefore, enhancing college students' SC may buffer the adverse effects of AP, ANX, and DEP on SMA.

2.2.5 The Moderating Role of Social Support

SS is the emotional and practical assistance individuals obtain from their social networks⁵⁰. It functions mainly through two pathways. First, by providing

emotional, informational, and instrumental support, it strengthens individuals' ability to adapt psychologically. Second, in stressful contexts, it helps buffer the adverse effects of pressure and negative events ⁵¹. SS may moderate the associations among AP, ANX, DEP, and SMA ^{9,12,46,52-54}. College students are in a transitional phase of psychological development, moving from dependence toward autonomy. They often desire independence while still needing emotional connection. When real-life social resources such as teacher guidance or peer companionship are insufficient, students tend to rely on social media to relieve AP, ANX, and DEP ^{46,55}. From the SCT perspective, adequate SS allows individuals to reinterpret AP and emotional distress as manageable challenges. It provides alternative experiences and emotional affirmation that enhance self-efficacy and reduce avoidance-oriented reliance on social media ¹⁷. For instance, Sun, et al. ⁴⁶ found that SS moderated the link between perceived stress and addictive behaviors among adults, while Qi, et al. ⁵⁶ reported that peer support significantly moderated the associations between negative emotions and SMA in Chinese college students.

In addition, SS may also serve as a moderator between SC and SMA ^{21,57}. During this developmental period, college students are particularly sensitive to peer approval and emotional support. When SS is lacking, their SC capacity tends to weaken ^{37,58}. Meng, et al. ⁵⁷ found that SS, particularly from family and significant others, served a buffering function in the relationship between low SC and online gaming addiction, diminishing the probability of addictive behaviors. Therefore, this study proposes that sufficient SS may relieve AP, ANX, and DEP, enhance SC resources, and decrease compensatory use of social media. This moderating process constitutes an essential protective pathway linking AP, ANX, DEP, SC, and addictive behaviors.

The specific research hypotheses and conceptual model of this study are presented below (see Table 1 and Figure 1).

Table 1 List of Research Hypotheses

Hypothesis No.	Research Hypothesis
H1	AP significantly and positively correlates with SMA among college students.
H2	ANX significantly and positively correlates with SMA among college students.
H3	DEP significantly and positively correlates with SMA among college students.
H4	SC significantly and negatively correlates with SMA among college students.
H5	AP significantly and negatively correlates with SMA among college

	students.
H6	ANX significantly and negatively correlates with SC among college students.
H7	DEP significantly and negatively correlates with SC among college students.
H8	College students' SC mediates the relationship between AP and SMA.
H9	College students' SC mediates the relationship between ANX and SMA.
H10	College students' SC mediates the relationship between DEP and SMA.
H11	SS moderates the relationship between AP and SMA among college students.
H12	SS moderates the relationship between ANX and SMA among college students.
H13	SS moderates the relationship between DEP and SMA among college students.
H14	SS moderates the relationship between AP and SMA among college students.

Note: AP: Academic Pressure; ANX: Anxiety; DEP: Depression; SC: Self-Control; SS: Social Support; SMA: Social Media Addiction.

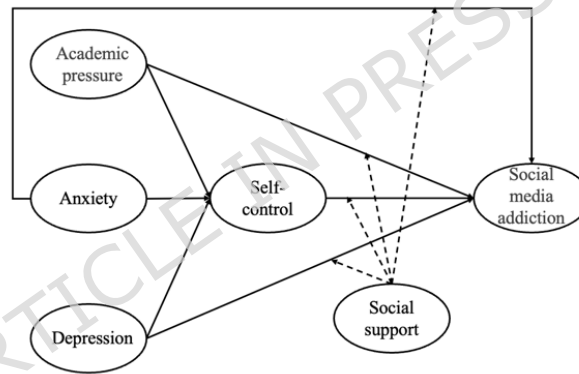


Figure 1 Research model

3. Methodology

3.1 Sample and Data Collection

This study was approved by the Ethics Committee of Guangzhou No.12 Hospital and was conducted across multiple universities in China. The research strictly adhered to the ethical guidelines outlined in the Declaration of Helsinki, covering all procedures including participant recruitment, data collection, and analysis. Based on the diversity of university types, the wide regional distribution, and the participating institutions' willingness to support research on students' mental health, this study identified the initial cooperating universities. In addition, students were invited to complete the questionnaire through coordination with course instructors and the university-level student affairs system. Data were collected from May to June 2025, with the assistance of faculty members from partner institutions. The survey was administered through "Wenjuanxing," a

professional online survey platform. A non-probability sampling method, specifically convenience sampling, was employed. All participants provided written consent after receiving full details about the study. It is important to acknowledge that convenience sampling may introduce self-selection bias, which could affect the external validity of the findings. However, considering practical constraints such as feasibility and resource availability, this method was deemed the most appropriate under the current research conditions.

A minimum of 10 participants per survey item is advised, following Kline⁵⁹ guidelines on sample size calculation. To determine the appropriate sample size, a calculation was performed accounting for the 72-item questionnaire and an estimated 20% participant dropout rate. This yielded a minimum target of 864 participants (72 items \times 10 respondents, plus 20% buffer). In practice, 950 questionnaires were administered, with 923 completed surveys returned. During preliminary data screening, 23 responses were eliminated due to either: incomplete responses ($>20\%$ missing items), or evidence of response bias, as indicated by extreme response patterns (e.g., $\geq 80\%$ answers clustered at scale endpoints like "strongly agree"). Such patterns may reflect ceiling/floor effects and threaten data validity⁶⁰. Consequently, the final analytical sample consisted of 900 validated responses (Figure 2).

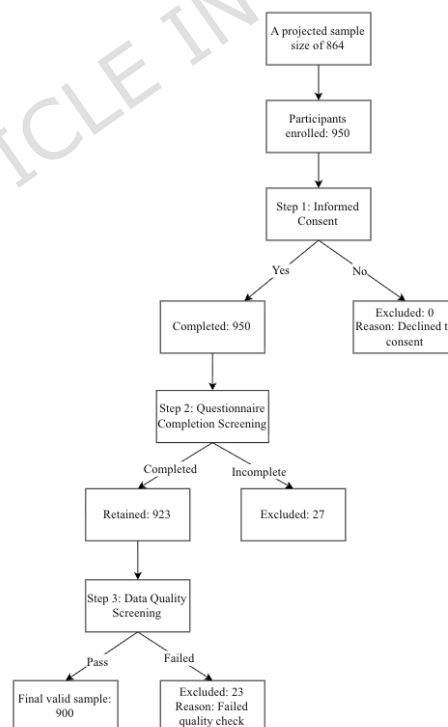


Figure 2 Flowchart of Participant Recruitment and Retention

Sample demographics are displayed in Table 2. Of the respondents, male: 496 (55.10%) and female: 404 (44.90%). 54.20% were aged between 20 and 22 years. Most were junior year students ($n = 464$, 51.60%). A total of 607 participants

(67.40%) were non-only children. Regarding parental education, 555 students (61.70%) reported that their parents' highest education level was high school. No significant differences were found between demographic variables and the dependent variables ($p > 0.05$).

Table 2 Demographic Characteristics of the Sample

Variables	Options	N	Percentage (%)	SMA (p)
Gender	Man	496	55.10%	0.894
	Woman	404	44.90%	
Age	Under 18 years old	54	6.00	0.196
	18-20 years old	279	31.00	
	20-22 years old	488	54.20	
	Over 22 years old	79	8.80	
Grade	Freshman year	89	9.90	0.056
	Sophomore year	228	25.30	
	Junior year	464	51.60	
	Senior year	119	13.20	
Singleton	Yes	293	32.60	0.571
	No	607	67.40	
Parental education level	Primary school	39	4.30	0.149
	Junior high school	243	27.00	
	High school	555	61.70	
	University	63	7.00	

Note: SMA: Social Media Addiction.

3.2 Measurement Instruments

The first section of this questionnaire gathered demographic information from participants, while the second contained the constructs under investigation. All constructs were assessed using validated scales, adapted to align with the research context and objectives. Following the recommendations of Hair ⁶¹, to ensure scale reliability and validity (loadings > 0.70 , average variance extracted (AVE) > 0.50), items with low loadings were removed. This improved the measurement model and secured the study's findings.

3.2.1 Academic Pressure

AP was evaluated with the Educational Stress Scale for Adolescents (ESSA) ⁶², 16-item instrument measuring five domains: AP, study burden, grade-related ANX, personal expectations, and emotional distress. Participants rated their agreement with statements like "I am dissatisfied with my academic performance" on a 5-

point scale (1=strongly disagree, 5=strongly agree). The ESSA, validated in Chinese contexts ⁶³, showed excellent reliability (Cronbach's $\alpha=0.980$) in this study.

3.2.2 Anxiety

Generalized Anxiety Disorder scale (GAD-7), originally developed by Spitzer, et al. ⁶⁴, was employed to assess ANX. This instrument consists of seven Likert-type items (e.g., "I experience dryness of mouth"), each scored on a 4-point scale ranging from 0 ("not at all") to 3 ("nearly every day"). Previous validation studies have demonstrated robust psychometric characteristics of the GAD-7 in Chinese student populations ⁶⁵. Following the elimination of one item with an outer loading below the recommended threshold of 0.708, the final scale comprised 6 items, Cronbach's $\alpha = 0.798$, which falls within the acceptable range for internal consistency reliability.

3.2.3 Depression

DEP was evaluated with the 7-item Patient Health Questionnaire-9 (PHQ-9), an instrument originally created by Spitzer, et al. ⁶⁴. The scale incorporated statements such as "Nothing brings me pleasure or happiness anymore," with responses recorded on a 4-point Likert-type scale ranging from 0 ("never") to 3 ("almost daily"). Previous psychometric analyses have confirmed the tool's strong reliability and validity among Chinese collegiate samples ⁶⁶. Following the removal of one item with suboptimal factor loading (<0.708), 6 items were ultimately included in the analysis, and Cronbach's $\alpha = 0.799$.

3.2.4 Self-Control

SC was assessed by the 19-item Self-Control Scale (SCS) originally designed by Tan and Guo ⁶⁷. This instrument measures an individual's ability to exercise cognitive and behavioral regulation, including impulse control, resistance to short-term gratification, and persistence toward long-term objectives. Participants responded to statements such as "I can effectively resist temptations" on a 5-point Likert scale (1= "strongly disagree", 5 = "strongly agree"). Follow-up validation research with Chinese university students has demonstrated the scale's sound psychometric properties ⁶⁸. In the current investigation, following the removal of items with outer loadings <0.708 during psychometric evaluation, a refined 12-item version was retained (Cronbach's $\alpha = 0.943$).

3.2.5 Social Support

The Multidimensional Scale of Perceived Social Support (MSPSS) was used to assess SS ⁶⁹, measuring perceived support across three domains: family, friends, and significant others. This 12-item scale (e.g., "My family genuinely tries to help me") adopts a 7-point Likert response format (1 = strongly disagree, 7 = strongly

agree). Prior research has demonstrated its validity among Chinese adolescents⁷⁰. After removing items with outer loadings below 0.708, 9 items were retained, showing excellent internal consistency (Cronbach's $\alpha = 0.965$).

3.2.6 Social Media Addiction

The Bergen Social Media Addiction Scale (BSMAS) was employed to assess SMA⁷¹. This 6-item instrument (e.g., "I frequently think about or plan my social media use") utilizes a 5-point Likert scale (1 = very rarely to 5 = very often). Studies demonstrated its robust psychometric properties among Chinese university populations⁷². The scale had high internal consistency (Cronbach's $\alpha = 0.945$).

The instruments employed in this research underwent a standardized double-translation and back-translation protocol. Two qualified bilingual professionals independently executed the forward translation: a subject-matter specialist proficient in English and Chinese, alongside a linguistics expert with native-level Chinese competency. Following this, two distinct reviewers, one specializing in content accuracy and another in linguistic precision, performed blind back-translation into English. Divergences between translations were systematically examined and harmonized to establish a consensus Chinese adaptation. Prior to formal deployment, the translated instruments were pilot tested with 20 Chinese tertiary students to verify item comprehensibility and cultural relevance. Identified issues including ambiguous expressions, unidiomatic phrasing, or conceptual deviations from the source version were addressed during final proofreading to produce the validated Chinese adaptation.

3.3 Data Analysis

Data were analyzed sequentially using SPSS 27.0 and Smart-PLS 4.0. SPSS handled descriptive statistics and tests for common method bias (CMB), while Smart-PLS 4.0 assessed the measurement model and examined structural relationships through Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the hypotheses.

4. Results

4.1 Descriptive Statistical Analysis

The study conducted correlation analyses among AP, ANX, DEP, SC, SS, and SMA. Table 3 presents the descriptive statistics for each variable, including sample size (N), mean (M), standard deviation (SD), kurtosis (Kur), and skewness (SK). The absolute values of skewness were below 2 and those of kurtosis were below 7, indicating that the data met the assumptions of normality.

Table 3 Means, Standard deviation, SK, Kur and Sample size

N	M	SD	Sk	Kur
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AP	900	48.00	15.094	0.367	-0.895
ANX	900	13.95	4.269	0.137	-1.235
DEP	900	13.78	4.296	0.042	-1.327
SC	900	40.95	12.003	-0.485	-1.094
SS	900	29.42	11.380	-0.423	-1.101
SMA	900	15.77	7.069	0.333	-1.294

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

4.2 Common Method Bias

To address potential common method bias (CMB) inherent in self-reported data within structural equation modeling, Harman's single-factor test was initially performed. The analysis extracted six factors with eigenvalues greater than 1, with the largest factor explaining 46.687% of the total variance—below the 50% threshold recommended in prior literature⁷³, preliminarily suggesting that CMB was not a major concern. To further validate these findings and concurrently assess measurement model validity, confirmatory factor analysis (CFA) was conducted using AMOS 26.0. The baseline CFA model demonstrated satisfactory fit across all standard indices, confirming robust construct validity. Subsequently, the unmeasured latent method factor (ULMC) approach was implemented by introducing a common method factor into the baseline model. Comparative analysis revealed negligible changes in model fit indices (ΔGFI , ΔAGFI , ΔCFI , ΔIFI , $\Delta\text{TLI} < 0.01$; $\Delta\text{RMSEA} < 0.05$) after incorporating the method factor. Consistent with established methodological criteria⁷⁴, these minimal improvements confirm that common method bias does not substantially compromise the measurement model or study findings (Table 4).

Table 4 Results of Common Method Bias Tests

	CMIN/D F	RMSEA	SRMR	GFI	AGFI	CFI	IFI	TLI
Reference value	<5	<0.080	<0.08	>0.80	>0.80	>0.80	>0.80	>0.80
			0	0	0	0	0	0
Baseline model	3.989	0.058	0.035	0.828	0.802	0.925	0.925	0.916
Method factor model	3.254	0.056	0.034	0.830	0.803	0.925	0.925	0.918
Model Fit Difference		ΔRMSEA A	ΔSRMR R	ΔGFI	ΔAGFI	ΔCFI	ΔIFI	ΔTLI
		0.002	0.001	0.002	0.001	0.000	0.000	0.002
Evaluation criterion		<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01

Note: CMIN: chi-square value, DF: degree of freedom, RMSEA: root mean square error of approximation, SRMR: Standardized Root Mean Square Residual, GFI: goodness-of-fit index, AGFI: adjusted goodness-of-fit index, CFI: comparative fit index, IFI: incremental fit index, TLI: tucker-lewis index.

4.3 SEM Analysis

4.3.1 Measurement Model

Following the recommendations of Hair ⁶¹, the measurement model was evaluated for reliability and validity. Reliability was examined through item outer loadings and composite reliability. In accordance with established criteria, outer loadings should exceed 0.708; however, items with loadings between 0.4 and 0.7 may be retained provided the construct's average variance extracted (AVE) and CR surpass their respective thresholds ⁶¹. Accordingly, items with loadings lower than 0.708 were excluded, and only acceptable items were preserved (see Table 5). Internal consistency was verified using CR, and all values were above 0.708, suggesting satisfactory reliability ⁶¹. As shown in Table 5, all item loadings and CR values met the recommended standards, indicating strong internal reliability. Convergent validity requires the AVE to exceed 0.50. The Heterotrait-monotrait ratio (HTMT) (<0.85 , Table 6) and Fornell-Larcker criterion ⁶¹ (see Table 7) were used to test discriminant validity, confirming satisfactory discriminant validity under both criteria.

To further ensure adequate convergent and discriminant validity, a strict item-screening procedure was applied prior to analysis. The appendix lists the original factor loadings. In the initial model, several constructs had AVE values below 0.50 (e.g., DEP = 0.428, ANX = 0.430, SC = 0.390), which did not reach the recommended level ⁶¹. Additional checks revealed several items with low loadings and overlapping meanings with other items, indicating conceptual redundancy. These items were removed in accordance with theoretical and statistical standards. After removal, all constructs achieved AVE values above 0.50, while Cronbach's α and CR remained high. These results demonstrate that item deletion improved the coherence and explanatory quality of the measurement model without compromising reliability.

Table 5 Reliability and Validity

Constructs	Items	Outer Loadings	Cronbach' α	CR	AVE
AP	AP1	0.860	0.980	0.982	0.773
	AP2	0.883			
	AP3	0.866			
	AP4	0.880			
	AP5	0.890			
	AP6	0.880			

	AP7	0.899			
	AP8	0.894			
	AP9	0.896			
	AP10	0.897			
	AP11	0.885			
	AP12	0.870			
	AP13	0.839			
	AP14	0.882			
	AP15	0.861			
	AP16	0.884			
	ANX1	0.712			
	ANX2	0.705			
ANX	ANX3	0.700	0.798	0.856	0.519
	ANX4	0.705			
	ANX5	0.702			
	ANX6	0.710			
	DEP1	0.709			
	DEP2	0.713			
DEP	DEP3	0.713	0.799	0.857	0.507
	DEP4	0.706			
	DEP5	0.703			
	DEP6	0.705			
	SC1	0.754			
	SC2	0.756			
	SC3	0.766			
	SC4	0.751			
	SC5	0.778			
SC	SC6	0.800	0.943	0.950	0.616
	SC7	0.834			
	SC8	0.821			
	SC9	0.814			
	SC10	0.836			
	SC11	0.794			
	SC12	0.704			
	SS1	0.863			
	SS2	0.911			
	SS3	0.782			
	SS4	0.891			
SS	SS5	0.909	0.965	0.970	0.782
	SS6	0.908			
	SS7	0.902			
	SS8	0.918			
	SS9	0.776			
SMA	SMA1	0.886	0.945	0.956	0.784

SMA2	0.856
SMA3	0.887
SMA4	0.881
SMA5	0.906
SMA6	0.896

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

Table 6 Discriminant Validity (HTMT Criterion)

	AP	DEP	ANX	SMA	SS	SC
AP						
DEP	0.796					
ANX	0.787	0.793				
SMA	0.800	0.792	0.762			
SS	0.337	0.449	0.423	0.469		
SC	0.799	0.711	0.791	0.842	0.316	

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

Table 7 Discriminative Validity (Fornell-Larker criteria)

	AP	DEP	ANX	SMA	SS	SC
AP	0.879					
DEP	0.706	0.807				
ANX	0.785	0.705	0.874			
SMA	0.770	0.794	0.805	0.885		
SS	0.328	0.393	0.371	0.449	0.884	
SC	-0.738	-0.792	-0.773	-0.796	-0.302	0.785

Note: According to the Fornell-Larcker criterion, to assess discriminant validity, the correlations between constructs should be lower than the square root of the Average Variance Extracted (AVE), which is represented by the diagonal elements in the matrix. AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

4.3.2 Structural Model

To verify the validity of the structural model, the study used critical metrics such as multicollinearity analysis, path coefficients, and R^2 values. These measures evaluate the model's robustness and predictive accuracy. Multicollinearity diagnostics were conducted to identify potential predictor redundancy⁷⁵. All constructs had Variance Inflation Factor (VIF) values below the 3.3 threshold, indicating no significant multicollinearity. Table 8 displays VIF results spanning 1.449–2.987, verifying the absence of substantial collinearity.

Table 8 Multicollinearity Diagnostics

	AP	DEP	ANX	SMA	SS	SC
AP				2.368		2.987
DEP				2.493		2.848
ANX				2.964		2.661
SMA						
SS				1.449		
SC				2.336		

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

To evaluate the magnitude and significance of the model path coefficients, this study incorporated control variables such as gender, age, grade, and whether the participant was an only child, and employed the PLS bootstrap method with 5,000 subsamples for testing. Table 9 summarizes the test results. Within SEM, this approach helps ascertain the extent to which predictor variables affect outcome variables. Results show that: AP ($\beta=0.162$, $t=5.248$, $p=0.000$), ANX ($\beta=0.212$, $t=5.009$, $p=0.000$), DEP ($\beta=0.134$, $t=3.266$, $p=0.001$), and SC ($\beta=-0.367$, $t=11.884$, $p=0.000$) demonstrate significant associations with college students' SMA, supporting H1, H2, H3, and H4. Moreover, AP ($\beta=-0.236$, $t=5.986$, $p=0.000$), ANX ($\beta=-0.245$, $t=5.767$, $p=0.000$), and DEP ($\beta=-0.392$, $t=8.634$, $p=0.000$) indicates significant associations with SC, thereby supporting H5, H6, and H7.

Table 9 Path Hypothesis Testing

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	<i>t</i>	<i>p</i>	Results
AP → SMA	0.162	0.162	0.031	5.248	0.000	Supported
AP → SC	-0.236	-0.235	0.039	5.986	0.000	Supported
DEP → SMA	0.134	0.136	0.041	3.266	0.001	Supported
DEP → SC	-0.392	-0.391	0.045	8.634	0.000	Supported
ANX → SMA	0.212	0.210	0.042	5.009	0.000	Supported
ANX → SC	-0.245	-0.248	0.042	5.767	0.000	Supported
SC → SMA	-0.367	-0.367	0.031	11.884	0.000	Supported

Note: This section presents the model estimates, including *t*-statistics, *p*-values, and confidence intervals. A *t*-value > 1.96 and a *p*-value < 0.05 denote statistical significance. AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

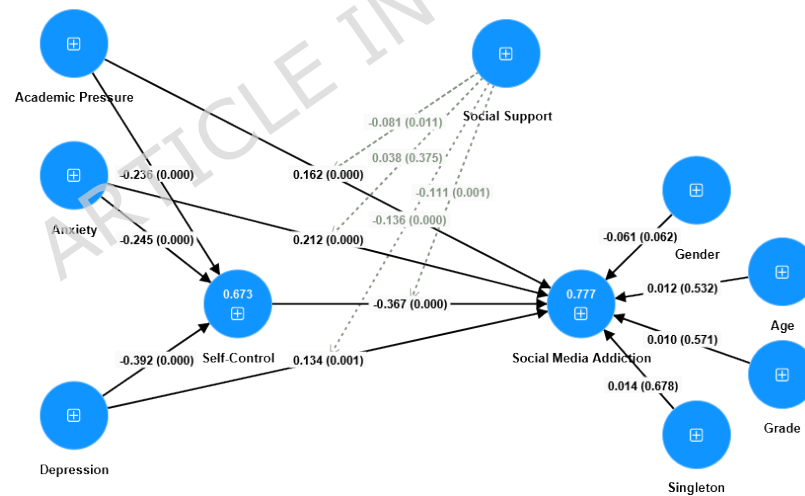


Figure 3 Path Coefficients of the Research Model

To facilitate practical interpretation, standardized path coefficients were converted into unstandardized effects using the ratio of standard deviations⁶¹. Given that the standard deviation of BSMAS was 7.07, a one-standard deviation increase in academic stress, anxiety, and depression was associated with an increase of approximately 1.14, 1.50, and 0.95 points in BSMAS, respectively, whereas a one-standard deviation increase in self-control predicted a 2.59-point decrease. These values provide a clearer sense of the magnitude of the effects in real-world terms (Figure 3).

The R^2 and Q^2 metrics indicate the explanatory capacity and out-of-sample predictive capability of the endogenous constructs, respectively ⁶¹. As shown in Table 10, the R^2 values suggest that the model demonstrates satisfactory explanatory capability, with the predictors accounting for 77.70% of the variance in SMA and 67.30% of the variance in SC. Moreover, all Q^2 values are greater than zero, indicating moderate predictive relevance of the model. Finally, the SRMR value is 0.043 and the NFI value is 0.806, both of which suggest a good model fit.

Table 10 Explanatory Power and Predictive Relevance

	R^2	R^2_{adjust}	Q^2	Model fit
SMA	0.777	0.775	0.601	SRMR: 0.043
SC	0.673	0.672	0.409	NFI: 0.806

Note: “ R^2 ”: explanatory power; “ Q^2 ”: predictive relevance; “SRMR”: Standardized Root Mean Square Residual; “NFI”: Normed Fit Index. *SMA: Social media addiction, SC: Self-control.*

4.4 Mediation Analysis

To evaluate whether SC mediated the associations among AP, ANX, DEP, and SMA, gender, age, grade, and only-child status were included as control variables. The Bootstrapping approach was employed with 5,000 resamples to estimate indirect and direct effects along with their confidence intervals, allowing for the assessment of mediation significance and type ⁷⁶. Bootstrapping analysis demonstrated significant indirect effects for all three pathways, with 95% CIs excluding zero. Specifically, the AP → SC → SMA path (indirect effect = 0.087, 95% CI [0.057, 0.120]) supported H8; the ANX → SC → SMA path (indirect effect = 0.090, 95% CI [0.057, 0.130]) supported H9; and the DEP → SC → SMA path (indirect effect = 0.144, 95% CI [0.107, 0.182]) supported H10. Detailed mediation outcomes are displayed in Table 11.

Table 11 Mediation Analysis

Relationship	Indirect Effect	2.5%	97.5%	t	p	Direct Effect	t	p	Type of Mediation
AP → SC → SMA	0.087	0.057	0.120	5.289	0.000	0.1628	5.248	0.000	CPM
ANX → SC → SMA	0.090	0.057	0.130	4.787	0.000	0.2129	5.009	0.000	CPM
DEP → SC → SMA	0.144	0.107	0.182	7.606	0.000	0.1346	3.261	0.001	CPM

Note: t refers to the two-tailed t -test value; p indicates the significance level; CPM denotes a partial mediation effect; *AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.*

4.5 Moderating Effect Analysis

A moderating effect arises when the link between two variables is contingent upon a third variable (the moderator). The presence of this moderator may amplify, diminish, or even flip the direction of the primary relationship⁶¹. After controlling for variables such as gender, age, grade, and whether one is an only child, this study employed the two-stage approach in Smart-PLS to examine the moderating role of SS in the relationships between AP, ANX, DEP, and SC with SMA⁷⁷. As shown in Table 12, for college students, SS significantly moderated the relationships between AP ($\beta=-0.081$, $t=2.558$, $p=0.011$), DEP ($\beta=-0.136$, $t=3.544$, $p=0.000$), and SC ($\beta=-0.111$, $t=3.455$, $p=0.001$) with SMA, supporting H11, H13, and H14. However, SS did not significantly moderate the relationship between ANX and SMA ($\beta=0.038$, $t=0.886$, $p=0.375$), and thus H12 was not supported.

Table 12 Analysis of Moderating Effects

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	<i>t</i>	<i>p</i>	Results
SS × AP → SMA	-0.081	-0.080	0.032	2.558	0.011	Supported
SS × ANX → SMA	0.038	0.040	0.043	0.886	0.375	Not supported
SS × DEP → SMA	-0.136	-0.136	0.038	3.544	0.000	Supported
SS × SC → SMA	-0.111	-0.109	0.032	3.455	0.001	Supported

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

To better illustrate the moderating role of SS, a simple slope analysis was performed (see Table 13 and Figures 4–6). As shown in Figure 4, SS significantly buffered the positive association between AP and SMA. When SS was low (-1 SD), AP showed a stronger positive link with SMA ($\beta = 0.301$, $p < 0.001$). Under high SS conditions ($+1$ SD), this association significantly weakened ($\beta = 0.118$, $p < 0.05$), demonstrating that stronger SS effectively buffers against the risk of SMA linked to AP.

As displayed in Figure 5, SS also moderated the association between DEP and SMA. Under low SS conditions, DEP was strongly and positively associated with SMA ($\beta = 0.459$, $p < 0.001$). At the mean level, this relationship weakened ($\beta = 0.233$, $p < 0.001$), and at high SS, it was no longer significant ($\beta = 0.007$, $p = 0.930$). These results imply that higher levels of SS can protect individuals from

the addictive tendency linked to DEP.

Furthermore, as illustrated in Figure 6, SS significantly moderated the link between SC and SMA. When SS was low, the negative association between SC and SMA was relatively weak ($\beta = -0.298, p < 0.001$). When SS was high, this negative relationship became stronger ($\beta = -0.548, p < 0.001$). This suggests that high SS strengthens the protective function of SC, enabling college students to better resist SMA.

In sum, SS demonstrated two distinct moderating patterns. For negative emotional factors such as AP and DEP, it exerted a buffering role by weakening their positive associations with SMA. For self-regulatory variables such as SC, it showed an enhancement effect by reinforcing its negative association with SMA.

Table13 Simple Slope Analysis

Relationships		Effect Size	Boot SE	Boot LLCI	Boot ULCI
SS \times AP \rightarrow SMA	M - SD	0.301	0.301	0.202	0.405
	M	0.210	0.210	0.136	0.284
	M + SD	0.118	0.119	0.010	0.231
SS \times DEP \rightarrow SMA	M - SD	0.459	0.462	0.264	0.666
	M	0.233	0.236	0.107	0.369
	M + SD	0.007	0.010	-0.142	0.170
SS \times SC \rightarrow SMA	M - SD	-0.298	-0.300	-0.4	-0.205
	M	-0.423	-0.423	-0.492	-0.355
	M + SD	-0.548	-0.546	-0.647	-0.440

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.

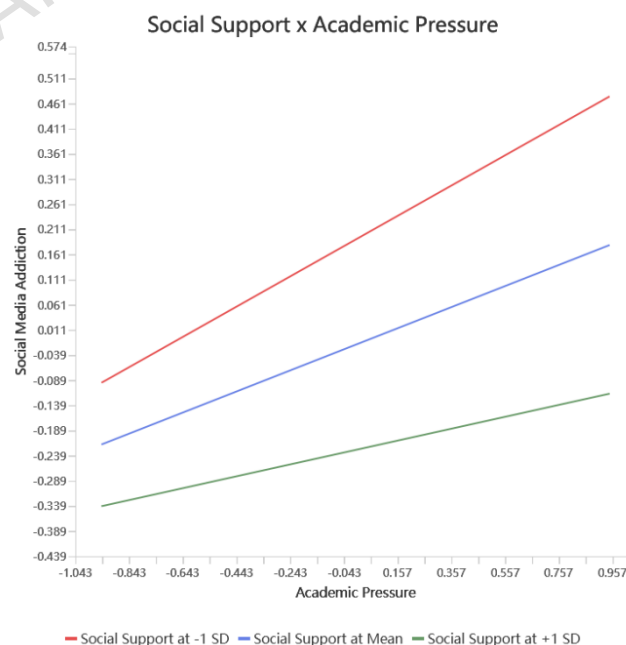


Figure 4 Moderating effect of SS on the relationship between AP and SMA

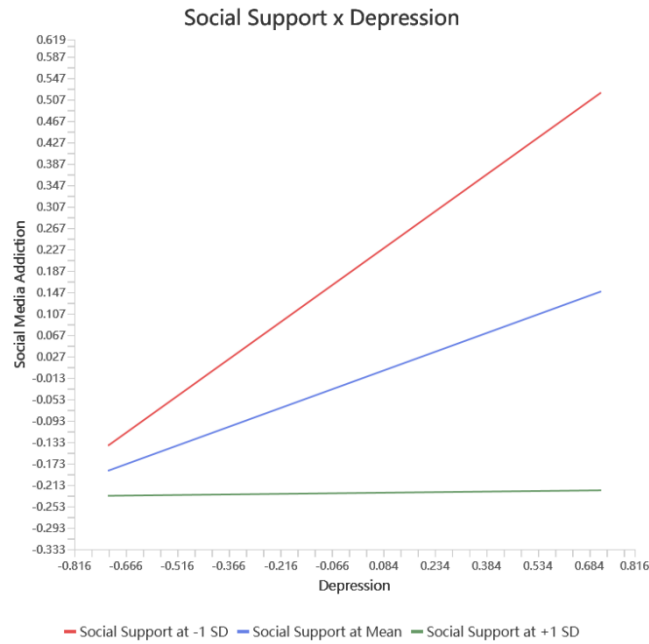


Figure 5 Moderating effect of SS on the relationship between DEP and SMA

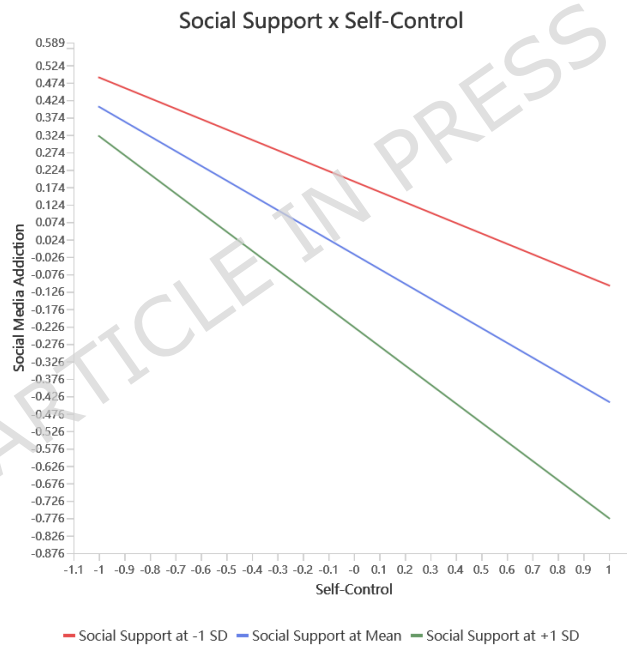


Figure 6 Moderating effect of SS on the relationship between SC and SMA

5. Discussion

This study systematically examines how AP, ANX, and DEP affect SMA in college students. It specifically investigates SC as a potential mediator and explores SS as a moderating factor. The study employed a questionnaire-based survey and robust statistical analyses to test these hypotheses. Notably, the final model accounted for 77.70% of the total variance in SMA, indicating substantial explanatory power. The following sections discuss the empirical findings in relation to each research hypothesis.

5.1 Academic Pressure, Anxiety, Depression, Self-Control and Social Media Addiction

This study showed that AP, ANX, DEP, and lower SC among college students were each significantly and positively associated with SMA, supporting H1, H2, H3, and H4. The pattern aligns with prior evidence ^{1,15,48}. According to CBT, AP and negative emotions such as ANX and DEP elicit marked psychological distress. Immediate stimuli on social media (for example, short videos and “likes”) can divert attention and briefly ease these feelings ²⁷. Short-lived relief then sustains a negative-reinforcement loop, through which students increasingly treat social media as a tool for emotion regulation, and their use and dependence rise accordingly ¹. Based on SCT, low SC reflects a deficit in core regulatory resources. Students with lower SC struggle to resist immediate rewards and to carry out behavior aligned with long-term goals ¹⁷. Under academic strain or emotional distress, they are more likely to opt for low-effort social interactions online instead of sustained learning activities, which can escalate into uncontrolled use ¹⁵. Prolonged exposure to deadlines and heavy coursework increases cognitive load and depletes resources for self-regulation. SC then weakens, which is associated with a higher risk of SMA ⁴⁴. Students experiencing ANX and DEP may also adopt avoidance-oriented automatic thinking and view social media as a safe, quick way to relieve negative mood. Although such short-term regulation can reduce distress temporarily, the resulting negative reinforcement strengthens excessive use over time ³⁴.

Targeted psychological support is therefore warranted for students with high AP, ANX, and DEP. Mindfulness training can reduce reliance on social media for mood regulation and help rebuild healthier daily routines ¹⁰. In addition, structured SC training can enhance self-management of digital media use ³⁴. Strengthening SC thus represents a practical avenue for preventing and mitigating SMA among college students.

5.2 The Mediating Role of Self-Control

This study shows that AP, ANX, and DEP among college students are significantly and negatively associated with SC, supporting hypotheses H5, H6, and H7. This result aligns with earlier studies ^{34,36,41,43}. Based on SCT ¹⁷, persistent AP and negative emotions consume students’ limited psychological resources, reducing their capacity for cognitive regulation. This depletion weakens their ability to suppress impulses and maintain goal-directed behavior ⁴⁴. According to CBT, AP, ANX, and DEP generate negative cognitive biases, forming a self-reinforcing cycle of emotional distress and psychological depletion ⁴⁷. In this process, the mental energy needed to resist temptations such as uncontrolled

social media use is gradually exhausted, leading students to prefer immediate rewards over long-term benefits and showing poorer SC¹⁴. Furthermore, students experiencing low mood tend to browse social media unconsciously, a pattern that reflects loss of SC⁴⁷. These findings highlight the importance of providing targeted psychological support for students facing high levels of AP, ANX, and DEP. Strengthening campus mental health services could help them interrupt this negative cycle, enhance self-regulation, and prevent behavioral dysregulation.

SC partially mediates the relationship of AP, ANX, DEP, and SMA, supporting hypotheses H8, H9, and H10, which aligns with previous evidence^{34,36,44}. Under the CBT framework¹⁷, high stress and negative emotions contribute to negative self-evaluations. A lack of SC in college students can create a dynamic imbalance, where rising negative emotions diminish SC and accelerate SMA⁴⁸. Negative affect can also activate avoidance coping, while diminished SC heightens dependence on social media as a quick emotional relief strategy⁴⁷. This reliance becomes habitual through positive reinforcement: repeated use of social media for temporary comfort gradually turns into a compulsive, addiction-like behavior³⁹. Over time, chronic AP and emotional distress may deplete SC resources, fostering dependency on social media¹². What begins as controllable use may evolve into compulsive behavior and, eventually, clinical addiction⁴⁵. These findings confirm the interactive model of emotion, cognition, and behavior, emphasizing the need to reduce negative emotions while cultivating students' self-monitoring and regulation skills.

5.3 The Moderating Role of Social Support

College students' SS moderated the associations among AP, DEP, SC, and SMA, supporting H11, H13, and H14. This result aligns with several prior studies^{56,57,78}. From the lens of SCT¹⁷, emotional and practical assistance from peers, friends, and family not only offers comfort but also motivates students to adopt constructive coping behaviors, such as seeking help or adjusting their thoughts, instead of turning to social media for avoidance⁵⁴. Furthermore, SS from classmates and instructors enhances college students' sense of belonging¹⁷. Active participation in offline campus activities, including study groups and clubs, provides emotional resonance and authentic human connection. These experiences strengthen social identity and reduce the emotional dependence on online interactions, thereby lowering the likelihood of SMA^{53,56}. SS can buffer the associations of AP, DEP, and weak SC with SMA by influencing cognitive appraisal and behavioral regulation because of CBT⁴⁶. Cognitively, receiving positive SS helps students interpret stress as manageable rather than threatening, reducing the tendency toward avoidant thinking⁴⁶. Moreover, external affirmation and

encouragement can weaken depressive self-schemas and improve emotional regulation⁵⁵. Behaviorally, a strong support network offers adaptive solutions and healthy alternatives⁷⁹. Thus, interventions addressing SMA among college students should priorities fostering supportive interpersonal networks.

By contrast, SS did not moderate the link between ANX and SMA, and H12 was not supported. This finding contradicts Miao, et al.¹², who reported a significant moderating effect of SS on the association between ANX and Internet addiction among left-behind adolescents. From a SCT viewpoint, anxious students may misinterpret social encounters as sources of judgmental pressure, weakening the perceived usefulness of SS as a coping resource¹⁷. According to CBT, anxious individuals' rigid cognitive patterns can hinder the effective use of supportive resources, leading to a maladaptive cycle of emotional release, short-term relief, and avoidance reinforcement, in which SS becomes part of the problem rather than the solution⁵⁵. In digital contexts, superficial social interactions, such as likes and brief comments, often lack emotional depth and situational sensitivity⁴⁶. These limited exchanges reduce empathic accuracy and fail to stimulate students' self-efficacy, making it difficult for SS to interrupt the pathway from ANX to addictive use⁸⁰. Consequently, depersonalized online support provides little buffer against the persistent cognitive fixation typical of ANX, explaining the nonsignificant moderating effect observed¹². This outcome highlights the need for more targeted interventions, shifting from general SS to cognitive-based approaches, such as cognitive behavioral training to help students identify and correct distorted perceptions of social communication and develop the capacity to recognize and use high-quality support resources effectively.

6. Implications

This study investigates the psychological mechanisms behind SMA in college students. This study elucidates the pathways through which AP, ANX, and DEP shape SMA, with SC serving as a mediator and SS moderating this mediating process. These findings not only enrich the application of CBT in the digital age but also provide valuable practical guidance for mental health education in higher education settings.

6.1 Theoretical Implications

First, this study innovatively integrates SCT and CBT, extending their applicability to research on college students' mental health in the digital era. The findings demonstrate that psychological factors such as AP, ANX, and DEP can trigger SMA through the "cognition, emotion, behavior" chain reaction mechanism emphasized in CBT. Moreover, these psychological factors indirectly influence SMA via SC. This not only validates the applicability of traditional theories to

virtual behaviors but also uncovers new interactive patterns between digital behavior and mental health issues. Specifically, the results suggest that when college students experience psychological distress, they are more likely to exhibit addictive behavioral response patterns. This transformation from real-world psychological problems to virtual behaviors provides a novel theoretical perspective for understanding the mental health status of contemporary college students.

Second, the study confirms the critical mediating role of SC in the relationship between AP, ANX, DEP, and SMA. When SC resources are depleted, students are more likely to transform AP, ANX, and DEP into excessive reliance on social media. Furthermore, the study demonstrates that SS can buffer the impact of SC deficits and certain negative factors, such as AP and DEP, but has limited moderating effects on ANX related addictive behaviors. This indicates that traditional forms of SS may have boundary effects in the context of digital behavior interventions. These findings highlight the need for effective intervention strategies that integrate cognitive restructuring and behavioral training, offering a strong theoretical foundation for university mental health initiatives.

6.2 Practical Implications for Campus Mental Health Initiatives

Grounded in SCT and CBT, this study clarifies the relationships among AP, ANX, DEP, and SMA in college students. **This finding further confirms that SC serves as a mediator and SS as a moderator, offering three practical implications:** First, for students experiencing high AP and low SC, intervention programs focusing on “cognitive restructuring and behavioral training” should be implemented. Group counseling can help students identify irrational beliefs, such as the fear of academic failure, and apply behavioral experiments (such as gradually reducing study hours to test real-world effects) to correct cognitive distortions. Simultaneously, programs to strengthen SC, including mindfulness training and delayed gratification tasks, should be developed to prevent the progression from stress to addictive behaviors.

Second, to optimize the psychological effectiveness of SS, a “tiered support” system should be established. For students showing depressive tendencies, efforts should focus on enhancing the quality rather than the quantity of SS. For students dominated by ANX, “gradual real world social exposure” programs (such as transitioning from online group discussions to offline collaborative tasks) can help progressively replace the instant gratification of virtual social interaction with real life support networks.

Finally, students should be encouraged to track their stress events, emotional fluctuations, and time spent on social media in real-time. By identifying high-risk

addiction patterns (such as frequent late-night scrolling) “micro-interventions” can be deployed, including mindfulness breathing prompts or alternative activity suggestions (e.g., physical exercise or in-person socializing), thereby disrupting negative behavioral cycles at the behavioral level.

7. Limitations and Future Directions

Guided by SCT and CBT, this study examined the connections between AP, ANX, DEP, and SMA among college students, incorporating SC as a mediator and SS as a moderator. Nevertheless, certain limitations persist, pointing to areas for further investigation. First, this research relied on convenience sampling and focused solely on college students, which may have introduced sampling bias due to unequal gender ratios or uneven representation across disciplines. Subsequent studies could include participants from various educational backgrounds and demographic groups to clarify whether the observed associations differ across populations. Second, the cross-sectional nature of the data limits definitive conclusions regarding causal relationships between variables. To address this limitation, future studies could collect time-lagged subsamples for more robust longitudinal analysis. Third, because the data were obtained from a Chinese cultural context, the findings may not fully apply to more individualistic societies, such as those in Europe. Future investigations could employ cross-cultural comparisons to examine the model's cultural generalizability and contextual boundaries. Overall, future work may incorporate multi-group analysis, longitudinal frameworks, and cross-cultural validation to refine and expand the theoretical model and offer more evidence-based guidance for improving college students' mental health interventions.

8. Conclusion

Guided by SCT and CBT, this study employed a questionnaire-based survey among 900 college students to construct and validate a moderated mediation model exploring the psychological mechanisms of SMA. The analysis reveals statistically significant associations of AP, ANX, and DEP with SMA levels. These psychological factors similarly undermine SC, establishing a statistically significant negative relationship with SMA manifestations. SC was found to partially mediate the associations of AP, ANX, and DEP on SMA. Furthermore, SS moderated the relationships between AP, DEP, SC, and SMA, but no significant moderating effect was found in the relationship between ANX and SMA. These findings reveal the complex formation mechanisms of SMA in the digital era and provide empirical support for the application of SCT and CBT in this field. However, due to the limited sample (college students only) and cross-sectional design, future research should adopt longitudinal tracking and cross-group comparisons to

strengthen the model's causal inference and external validity.

List of abbreviations

CFA=Confirmatory Factor Analysis; VIF=Variance Inflation Factor, KMO=Kaiser-Meyer-Olkin; CMIN=Chi-Square Value, DF=Degree of Freedom; RMSEA=Root Mean Square Error of Approximation, **SRMR: Standardized Root Mean Square Residual**, GFI=Goodness-of-fit Index, AGFI = Adjusted Goodness-of-fit Index, CFI=Comparative Fit Index, IFI=Incremental Fit Index, TLI=Tucker-Lewis Index; AVE=Average Variance Extracted, CR=Composite Reliability HTMT= Heterotrait-Monotrait; CPM=Complementary Partial Mediation; AP=Academic pressure, DEP=Depression, ANX=Anxiety, SMA=Social media addiction, SS=Social support, SC=Self-control

Declarations

Ethics approval and consent to participate: The researchers confirms that all research was performed in accordance with relevant guidelines/regulations applicable when human participants are involved (e.g., Declaration of Helsinki or similar). **This study was approved by the Ethics Committee of Guangzhou No.12 Hospital.** The participants received oral and written information and provided written informed consent before participating in the study.

Consent for publication □ Not applicable.

Availability of data and materials: The data that support the findings of this study are available on request from the corresponding author.

Competing interests: The authors have no competing interests to declare that are relevant to the content of this article.

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Appendix

Appendix 1 Original outer loadings, construct reliability and validity

Constructs	Items	Outer Loadings	Cronbach' α	CR	AVE
AP	AP1	0.860	0.980	0.982	0.773
	AP2	0.883			
	AP3	0.866			
	AP4	0.880			
	AP5	0.890			
	AP6	0.880			
	AP7	0.899			
	AP8	0.894			
	AP9	0.896			
	AP10	0.897			
	AP11	0.885			
	AP12	0.870			
	AP13	0.839			
	AP14	0.882			
	AP15	0.861			
	AP16	0.884			
ANX	ANX1	0.717	0.741	0.819	0.430
	ANX2	0.706			
	ANX3	0.701			
	ANX4	0.706			
	ANX5	0.002			
	ANX6	0.702			
	ANX7	0.718			
DEP	DEP1	0.696	0.738	0.818	0.428
	DEP2	0.712			
	DEP3	0.713			
	DEP4	0.708			
	DEP5	0.703			
	DEP6	0.005			
	DEP7	0.710			
SC	SC1	0.751	0.883	0.893	0.390
	SC2	0.046			
	SC3	0.008			
	SC4	0.094			
	SC5	0.756			
	SC6	0.765			
	SC7	0.750			
	SC8	0.777			
	SC9	0.082			
	SC10	0.089			
	SC11	0.012			

	SC12	0.799			
	SC13	0.834			
	SC14	0.097			
	SC15	0.820			
	SC16	0.815			
	SC17	0.835			
	SC18	0.792			
	SC19	0.704			
	SS1	0.864			
	SS2	0.911			
	SS3	0.872			
	SS4	0.891			
	SS5	0.909			
SS	SS6	0.908	0.904	0.929	0.587
	SS7	0.902			
	SS8	0.918			
	SS9	0.044			
	SS10	0.777			
	SS11	0.023			
	SS12	0.012			
	SMA1	0.886			
	SMA2	0.856			
SMA	SMA3	0.887	0.945	0.956	0.784
	SMA4	0.881			
	SMA5	0.906			
	SMA6	0.896			

Note: AP: Academic pressure, DEP: Depression, ANX: Anxiety, SMA: Social media addiction, SS: Social support, SC: Self-control.