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EXPLORING THE INFLUENCE BETWEEN MENTAL HEALTH CONDITIONS AND MOBILE PHONE ADDICTION AMONG COLLEGE STUDENTS BASED ON THE I-PACE MODEL THEORY

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Abstract

Today, the dual high trend of college students' mental health conditions (MHC) and mobile phone addiction (MPA) cannot be ignored. This study was based on the Interaction of Person-Affect-Cognition-Execution (I-PACE) model theory and used the Simplified Version of Smartphone Addiction Scale (SAS-SV) and College Student Mental Health Scale (CSMHS) to explore the relationship between college students' MHC and MPA, in order to better understand the psychological mechanism of college students' MPA. A survey was conducted on 9961 college students from a private university, in China, relevant data on their degree of mobile phone addiction and mental health conditions were collected. SPSS 29.0 was used to analyze the influence mechanism among variables with descriptive statistical methods, inferential analysis, and regression analysis. The result revealed that the detection rate of MPA among college students was high. MHC were significantly positively correlated with MPA. Impact factors including physical and mental function (PMF), cognitive bias (CB), negative emotions (NE), and negative coping styles (NCS) extracted from MHC all had significant hierarchical predictive effects on MPA. This study provides theoretical support for understanding the psychological mechanisms of college students and practical guidance for preventing and intervening in.

Keywords: College Students, I-PACE Model Theory, Impact Factors, Mental Health Conditions, Mobile Phone Addiction.

INTRODUCTION

In recent years, the problem of mobile phone addiction among college students has become increasingly prominent and has become a social phenomenon that urgently needs attention (Vettriselvan et al., 2025). According to the 54th Statistical Report on Internet Development in China released by the China Internet Network Information Center (CNNIC), as of June 2024, the number of internet users in China has reached nearly 1.1 billion (1,099.67 million), an increase of 7.42 million compared to December 2023, with teenagers accounting for 49.0% of the new internet users (2024). Meanwhile, a meta-analysis study found that the positive rates of major mental health issues (anxiety, depression, sleep problems, and suicide attempts) among Chinese college students have significantly increased compared to ten years ago and were closely related to excessive

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mobile phone use (Chen, Zhang, & Yu, 2022; Malek Mohammadi et al., 2024). Globally, the issue of mobile phone addiction and related mental health problems among teenagers cannot be ignored. According to a recent article published by the World Health Organization (WHO), “Young people’s mental health is being shaped by digital spaces just as much as by schools or families, but without the same protections,” said Dr. Hans Henri P. Kluge, WHO Regional Director for Europe (Copenhagen, 2025).

Scholars have revealed the psychological mechanism of addiction through theories such as Brand's I-PACE model (2016), which views addictive behavior (such as mobile phone addiction) as the result of the interaction of four main dimensions: personality, affect, cognition, and execution. Specifically, personality represents the core characteristic of an individual's involvement in the addiction process and serves as a susceptibility variable. These susceptibility variables may make significant contributions to all types of addictive behaviors, including genetic factors, impulsivity, and stress vulnerability. Affect involves an individual's psychopathological response to specific stimuli, such as depression and anxiety. These emotional reactions can stimulate individuals to develop a desire to engage in addictive behavior. Cognition refers to an individual's cognitive evaluation and expectation of addictive behavior, such as being misled into thinking that participating in addictive behavior can bring satisfaction or alleviate negative emotions. This cognitive bias (wrong expectancies, illusions, and implicit associations) further reinforces an individual's tendency to engage in addictive behavior. Execution mainly involves reductions in executive functions and inhibitory control. During the process of addiction, an individual's inhibitory control ability may weaken, making it difficult to resist the impulse of addictive behavior. The I-PACE model also integrates various neuroscience theories and models, such as the Impaired Response Inhibition and Salience Attribution (I-RISA) model, Stimulus Sensitization Theory, and Reward Deficiency Syndrome model. These theories suggest that the development of addictive behavior is related to the activation of the brain's neural reward system, weakened inhibitory control ability, and increased sensitivity to addiction-related stimuli (Brand et al., 2016).

Empirical studies have shown that negative coping styles such as compulsion (Bai, 2024), impulsivity (Zhu et al., 2021), reliance (Holte & Richard Ferraro, 2021), social aggression (Wu et al., 2023), and social withdrawal (Jeong, 2021) can exacerbate an individual's perception of stress, thereby increasing the risk of addictive behavior. Physical and mental functions such as somatization (Vasiliu & Vasiliu, 2024), sexual psychological disorders (Zarski, 2022), and psychiatric tendencies (Ruihong & Qiuxiang, 2021) can affect college students' use of mobile phones, making them more susceptible to the dilemma of mobile phone addiction. Negative emotions, including anxiety and depression, are also important risk factors for mobile phone addiction, and individuals may use their phones to escape these negative emotions (Choksi & Patel, 2021). Cognitive bias, including inferiority complex and paranoia, is highly correlated with mobile phone addiction (Kim & Suh, 2024).

However, currently, few scholars have conducted a comprehensive and systematic summary of the relationship between specific risk factors in mental health conditions and

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mobile phone addiction, as most studies focus only on the analysis of single factors. Therefore, this study aims to explore the key factors of mental health conditions on mobile phone addiction based on the I-PACE model theory. The dimensions of somatization, sexual psychological disorders, impulsivity, and psychiatric tendencies in mental health conditions can be included in the 'personality' dimension and are named physical and mental function (PMF). The dimensions of paranoia and inferiority in mental health conditions are included in the 'cognition' dimension and named cognitive bias (CB). The dimensions of anxiety and depression in mental health conditions are included in the 'affect' dimension and named negative emotions (NE). The dimensions of compulsion, reliance, aggression, and withdrawal in mental health conditions are all included in the 'execution' dimension and named negative coping styles (NCS).

Based on the theoretical framework and existing empirical findings, this study further investigates how different dimensions of mental health conditions contribute to mobile phone addiction among college students. To provide a clear direction for empirical testing, the following hypotheses are proposed:

H1: The detection rate of mobile phone addiction among college students is high.

H2: There is a significant relationship between mental health conditions and mobile phone addiction.

H3: Physical and mental function, cognitive bias, negative emotions, and negative coping styles all have significant predictive effects on mobile phone addiction.

METHODS

Participants and Procedure

This study used random sampling, and 10,252 individuals were selected from a private university in China. After excluding invalid questionnaires, 9,961 individuals (97.16%) were retained, including 5,440 males (54.6%) and 4,521 females (45.4%). Among them, 2,538 were freshmen (25.5%), 2,149 sophomores (21.6%), 2,665 juniors (26.8%), and 2,609 seniors (26.2%).

Instruments

Simplified Version of Smartphone Addiction Scale (SAS-SV) The SAS-SV is a tool developed by Korean scholar Kwon et al. (2013) to assess the severity of smartphone addiction based on the diagnostic criteria for addiction disorders in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV). The scale consists of 10 items scored using a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The total score ranges from 10 to 60 points, and a total score of 32 points or higher indicates mobile phone addiction. The higher the score, the greater the degree of addiction. The SAS-SV has demonstrated good reliability and validity across different cultural backgrounds and is widely used in research and clinical practice (Zhang et al., 2021). In this study, reliability testing indicated that the SAS-SV had high internal

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consistency (Cronbach's alpha = 0.903), confirming its effectiveness as a measurement tool.

College Student Mental Health Scale (CSMHS)

The CSMHS is a psychological health assessment tool developed by Zheng Richang (2005) and colleagues under the guidance of the Chinese Ministry of Education. It was designed based on localized cultural contexts and the specific characteristics of college students. The scale contains 104 items, divided as follows: 9 items for somatization, 6 items for anxiety, 7 items for depression, 11 items for inferiority complex, 12 items for obsession, 7 items for compulsion, 10 items for withdrawal, 10 items for aggression, 8 items for sexual psychological disorders, 7 items for reliance, 7 items for impulsivity, 6 items for psychotic tendencies, and 4 items for lie detection. The scale uses a 5-point rating system (0 = Never, 4 = Always), where higher scores indicate more severe mental health conditions. The CSMHS has demonstrated good reliability, with Cronbach's alpha values ranging from 0.7330 to 0.8552.

In this study, the overall reliability of the total scale was high (Cronbach's alpha = 0.958). According to theoretical assumptions and factor recombination, PMF (α = 0.440) included somatization (9 items), sexual psychological disorders (8 items), impulsivity (7 items), and psychiatric tendencies (6 items). CB (α = 0.416) included paranoia (12 items) and inferiority complex (11 items). NE (α = 0.614) included anxiety (6 items) and depression (7 items). NCS (α = 0.763) included compulsion (7 items), reliance (7 items), social aggression (10 items), and withdrawal (10 items). Overall, the reliability and validity of the scale met the required psychometric standards.

Data Collection and Analyses

The study adopted a questionnaire survey method, and the questionnaires were distributed through the school’s psychological assessment system. Students completed the scales on a voluntary basis. After data collection was completed, SPSS 29.0 software was used for data cleaning and analysis. The analytical methods included descriptive analysis to measure the detection rate of mobile phone addiction using mode, median, percentage, and frequency values. Inferential analyses were conducted to examine the correlation between mental health conditions and mobile phone addiction using Pearson correlation analysis and regression analysis (binary logistic regression analysis).

RESULTS

Exploratory Factor Analysis

This study used principal component analysis to extract 12 factors, with the first factor explaining a cumulative variance of 19.927%. The eigenvalues of each factor were all greater than 1, indicating that the factor extraction was reasonable and consistent with the expected structure of the original scale. Based on the content of the factors, somatization, sexual psychological disorders, impulsivity, and tendencies toward mental illness were categorized as *PMF*; paranoia and inferiority were categorized as *CB*; anxiety

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and depression were categorized as *NE*; and compulsion, reliance, aggression, and withdrawal were categorized as *NCS*.

Descriptive Analysis

Descriptive statistical analysis was conducted to test the normal distribution of the data. The research results are presented in the following table.

Table 1: Descriptive statistics among all observed variables.

	Number	Minimum Value	Maximum Value	Average Value	SD	Skewness		Kurtosis	
						Statistics	SE	Statistics	SE
MPA	9961	10.000	58.000	27.130	9.008	-0.038	0.025	-0.491	0.049
MHC		100.000	294.000	140.580	30.532	1.517	0.025	2.623	0.049
PMF		30.000	100.000	38.330	8.520	1.907	0.025	4.862	0.049
CB		23.000	102.000	32.880	9.759	2.138	0.025	6.246	0.049
NE		13.000	62.000	19.177	6.979	1.849	0.025	3.931	0.049
NCS		34.000	141.000	50.201	15.853	1.392	0.025	1.730	0.049
Note：MPA=Mobile Phone Addiction, MHC= Mental health conditions, PMF=Physical and Mental Function, CB=Cognitive Bias, NE=Negative Emotions, NCS=negative coping styles									

From Table 1, it can be observed that the skewness and kurtosis values of the variables in this study met the required criteria (absolute skewness < 3, absolute kurtosis < 10). This indicates that the data basically followed a normal distribution and were suitable for subsequent analyses.

Findings of Research Objective One

To achieve Research Objective 1, a one-way ANOVA test was conducted on the SAS-SV scores across different subject, grade, and hometown groups. Additionally, an independent sample t-test was performed to examine differences across gender. The results are presented as follows:

Table 2: Detection Rates of MPA among Different Groups of College Students

Groups	Options	N	Mean	F	P	Addicts detected rate (scores≥32)	
Subject	Arts	2053	28.45	49.650	<0.001***	38.97%	33.17%
	Science	1752	28.03			37.27%	
	Engineering	6156	26.44			30.07%	
Gender	Male	5540	27.08	0.289	0.591	32.33%	
	Female	4521	27.20			33.47%	
Grade	Freshman	2538	26.87	3.551	0.014*	31.17%	
	Sophomore	2149	26.79			32.20%	
	Junior	2665	27.29			34.11%	
	Senior	2609	27.51			34.96%	
Hometown	City	2020	26.98	0.536	0.585	32.38%	
	Town	2178	27.07			32.92%	
	Rural area	5763	27.21			33.54%	
Noted: * indicates p<0.05, *** indicates p<0.001							

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From Table 2, the detection rate of mobile phone addiction among college students was **33.17%** (scores ≥ 32 indicate mobile phone addiction). There was a significant difference in the detection rate of mobile phone addiction across different disciplines ($p < 0.001$). The detection rate was highest among students in the **Arts** (mean = 28.45, 38.97%), followed by **science** (mean = 28.03, 37.27%), and lowest in **Engineering** (mean = 26.44, 30.07%). The detection rate among **females** (33.47%) was slightly higher than among **males** (32.33%), but the difference was not statistically significant ($p > 0.05$), with average scores of 27.20 and 27.08, respectively.

There were some differences across **grades** ($p < 0.05$), with detection rates of 34.96% (mean = 27.51), 34.11% (mean = 27.29), 32.20% (mean = 26.79), and 31.17% (mean = 26.87) among seniors, juniors, sophomores, and freshmen, respectively. There was no significant difference between students from different **hometowns** ($p > 0.05$); however, the detection rate was highest among students from **rural areas** (33.54%, mean = 27.21), followed by **towns** (32.92%, mean = 27.07), and lowest among those from **cities** (32.38%, mean = 26.98). These findings support **Hypothesis 1 (H1),** which proposes that the detection rate of mobile phone addiction among college students is high.

Findings of Research Objectives Two

To achieve Research Objective 2, a Pearson correlation analysis was conducted to examine the relationship between the total scores of the SAS-SV and CSMHS, as well as the sub-dimensions of physical and mental function, cognitive bias, negative emotions, and negative coping styles. The results are presented as follows:

Table 3: Correlation Analysis Results of All Variables (N=9961)

Variables	MHC	MPA	PHF	CB	NE	NCS
MHC	1					
MPA	0.566***	1				
PHF	0.798***	0.448***	1			
CB	0.661***	0.358***	0.392***	1		
NE	0.657***	0.363***	0.442***	0.543***	1	
NCS	0.801***	0.470***	0.564***	0.209***	0.253***	1
Note： ***indicates p<0.001						

From Table 3, it can be seen that there was a significant positive correlation between mental health conditions and mobile phone addiction ($r = 0.566$, $p < 0.001$), indicating that the more severe the mental health conditions, the higher the degree of mobile phone addiction among college students. Physical and mental function ($r = 0.448$, $p < 0.001$), cognitive bias ($r = 0.358$, $p < 0.001$), negative emotions ($r = 0.363$, $p < 0.001$), and negative coping styles ($r = 0.470$, $p < 0.001$) were all significantly and positively correlated with mobile phone addiction. These research results verify H2.

Findings of Research Objective Three

To achieve Research Objective 3, it was first necessary to ensure the stability, explanatory power, and predictive ability of the influence model.

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This required examining whether severe multicollinearity existed among the variables. If a high degree of correlation was found between variables in the model, some variables would need to be removed to reduce model complexity.

Therefore, this study used the mobile phone addiction score as the dependent variable, with PMF, CB, NE, and NCS as independent variables, while subject, gender, grade, and hometown were used as control variables in a linear regression analysis.

The results are presented as follows:

Table 4: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	Constant	27.133	.074		364.837	<.001		
	PMF	1.316	.099	.146	13.318	<.001	.567	1.764
	CB	1.472	.090	.163	16.273	<.001	.676	1.479
	NE	1.161	.093	.129	12.524	<.001	.643	1.555
	NCS	2.888	.090	.321	32.071	<.001	.682	1.466
2	Constant	28.720	.423		67.826	<.001		
	PMF	1.301	.099	.144	13.207	<.001	.567	1.765
	CB	1.456	.090	.162	16.141	<.001	.676	1.480
	NE	1.164	.092	.129	12.583	<.001	.643	1.556
	NCS	2.872	.090	.319	31.974	<.001	.681	1.467
	Subject	-.712	.093	-.064	-7.681	<.001	.977	1.024
	Gender	.066	.150	.004	.442	.659	.991	1.009
	Grade	.036	.067	.005	.543	.587	.967	1.034
	Hometown	-.023	.094	-.002	-.250	.802	.982	1.018

a. Dependent Variable: Mobile phone addiction

From Table 4, it can be seen that all VIF values were less than 10, indicating that the model did not suffer from multicollinearity issues and could be used for further analysis.

At the same time, since the demographic variables of gender, grade, and hometown showed no significant differences in mobile phone addiction levels ($p > 0.05$), they were not included in the influence model.

Although a significant difference was found between academic discipline and mobile phone addiction, the majority of engineering students (61.8%) had the lowest detection rate of mobile phone addiction.

Therefore, this variable was also excluded from the model.

Subsequently, this study used mobile phone addiction (MPA) as the dependent variable (with a critical value of 32, where scores < 32 were coded as 0 for non-addicted and scores ≥ 32 were coded as 1 for addicted), while PMF, CB, NE, and NCS were used as independent variables.

Binary logistic regression analysis was then conducted to explore the effects of mental health conditions on mobile phone addiction. The results are presented as follows:

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Table 5: Binary Logistic Regression Analysis of Factors Influencing MPA

		B	OR	R^2	95% Confidence Interval of EXP (B)		
					Boot LLCI	Boot ULCI	Sig
IV	PMF	0.372	1.450	0.329	1.354	1.358	<0.001
	CB	0.381	1.464		1.374	1.379	<0.001
	NE	0.291	1.338		1.263	1.261	<0.001
	NCS	0.719	2.053		1.935	1.935	<0.001
	Constant	-0.791	0.454				<0.001
Note: IV=Independent Variables.							

From Table 5, the influence model in this study had a moderate explanatory ability (R^2 = 0.329). Physical and mental function, cognitive bias, negative emotions, and negative coping styles all had a significant positive effect on mobile phone addiction ($p < 0.001$). Specifically, the partial regression coefficient of physical and mental function (B = 0.372, $p < 0.001$) indicated that for every unit increase in PMF, the probability of individuals exhibiting mobile phone addiction increased 1.45 times (OR = 1.450). The partial regression coefficient of cognitive bias (B = 0.381, $p < 0.001$) indicated that for every unit increase in CB, the probability of mobile phone addiction increased 1.464 times (OR = 1.464). The partial regression coefficient of negative emotions (B = 0.291, $p < 0.001$) indicated that for every unit increase in NE, the probability of mobile phone addiction increased 1.338 times (OR = 1.338). The partial regression coefficient of negative coping styles (B = 0.791, $p < 0.001$) indicated that for every unit increase in NCS, the probability of mobile phone addiction increased 2.053 times (OR = 2.053). Overall, physical and mental function, cognitive bias, negative emotions, and negative coping styles are all risk factors for mobile phone addiction and can significantly predict its occurrence, effectively validating H3.

CONCLUSION AND DISCUSSION

Discussion on Finding 1

Universality and Trends of Mobile Phone Addiction among College Students

The detection rate of mobile phone addiction among college students in this study was 33.17%, which is higher than some earlier research findings. For example, a survey conducted in Yunnan Province, China, reported a detection rate of 19.2% among college students (Zhu, 2024). This indicates that mobile phone addiction is relatively common among college students and may be increasing, which could be closely related to the rapid iteration of smartphone functions and the widespread use of social media (Singha, 2025). Meanwhile, college students are at high risk of developing mobile phone addiction due to their pronounced self-awareness, strong social needs, and limited psychological resilience (Arcemont, 2024). For instance, research has found that individuals with higher levels of adult attachment are more likely to compensate for loneliness in real-life social situations through mobile phone use, leading to maladaptive cognition and ultimately addictive behavior (Hung et al., 2025; Du et al., 2023; Zhou et al., 2021).

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Differences in MPA among Different Subjects

This study found significant differences in the detection rate of mobile phone addiction among different subjects ($p < 0.001$), with Arts students having the highest rate (38.97%), followed by science students (37.27%), and Engineering students having the lowest rate (30.07%). This difference may be related to the characteristics of the subjects and their learning methods (Bhanderi, Pandya & Sharma, 2021). For example, the learning content of Arts students in China often relies more on text and information acquisition, and mobile phones provide convenient channels for accessing information, which may make them more prone to mobile phone addiction. In contrast, Engineering and Science students' professional courses are more practical and technical, requiring time and energy for experiments and hands-on operations, which reduces their mobile phone usage (He, 2019). Consequently, Science students may be more inclined to cope with stress through logical thinking and problem-solving rather than using their phones to escape reality (Al-Thallab, 2021).

In addition, Arts students may be more inclined to use mobile phones for social and entertainment purposes. Specifically, these students tend to have more active thinking and are more easily integrated into open online platforms. The frequency of online activities, such as writing, making friends, and shopping, is significantly higher than that of Science and Engineering students (He, 2019).

The Relationship between Gender and MPA

This study found that the detection rate of mobile phone addiction in females was slightly higher than in males (33.47% vs. 32.33%), but the difference was not significant ($p > 0.05$). This finding is consistent with previous research, suggesting that gender may have a relatively small effect on mobile phone addiction (Nikolic et al., 2023). Both females and males have demands for mobile phone use, and differences may primarily reflect variations in social needs and entertainment preferences (Liu & Lu, 2022). For example, females are more likely to use mobile phones for social and entertainment activities such as chatting, watching TV shows, and viewing short videos, whereas males are more likely to be addicted to mobile games (Nagata et al., 2022).

Furthermore, research has highlighted gender differences in smartphone use for maintaining interpersonal relationships. Women are more likely to believe that text messaging enhances intimate relationships, whereas men tend to view smartphone use as a way to expand social resources (Shabur & Jahan, 2024).

The Relationship Between Grade and MPA

This study found differences in the detection rate of mobile phone addiction across different grades ($p < 0.05$), with the highest rates among seniors (34.96%), followed by juniors (34.11%), sophomores (32.20%), and freshmen (31.17%). These differences may be related to the academic pressure and living conditions associated with grade level (Xiu, 2024). Specifically, senior students face pressures such as graduation and employment, and may rely more on mobile phones to obtain information and relieve

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stress. In addition, senior students generally have fewer social activities and entertainment options on campus, making mobile phones their primary tool for entertainment and social interaction (Kumban, Cetthakrikul & Santiworakul, 2025). For example, in China, freshmen participate in activities such as the Freshman Cup Basketball and Volleyball Games, which occupy much of their time (Dong et al., 2023). Moreover, freshmen often experience a sense of novelty and are eager to explore new experiences, such as joining student associations and making diverse friends (Zhao et al., 2023). In contrast, seniors have usually adapted to college life and established stable social networks and may spend more leisure time in dormitories using mobile phones.

The Relationship between Hometown and MPA

This study found no significant differences in mobile phone addiction detection rates among students from different hometowns ($p > 0.05$), although the rate was slightly higher in rural areas (33.54%) than in towns (32.92%) and cities (32.38%). This difference may be associated with family economic conditions and educational resources (Lin & Liu, 2020). Rural families may provide less supervision of mobile phone use and offer fewer extracurricular activities, increasing the risk of mobile phone addiction. In contrast, students in towns and cities often have more extracurricular options, and their parents may pay closer attention to managing their mobile phone usage, thereby reducing addiction risk (Gao, 2023). Additionally, school-based guidance on values (Merma-Molina, Gavilán-Martín & Álvarez-Herrero, 2021) and strong teacher-student relationships (Dong et al., 2024) may further reduce mobile phone addiction, helping to narrow regional differences.

Discussion on Finding 2 and Finding 3

This study found a significant positive correlation between mental health conditions and mobile phone addiction among college students ($r = 0.566$, $p < 0.001$), indicating that more severe mental health conditions are associated with higher levels of mobile phone addiction. Furthermore, physical and mental function, cognitive bias, negative emotions, and negative coping styles all had significant predictive effects on mobile phone addiction ($p < 0.001$), which is consistent with previous research findings. The following discussion is organized in descending order of predictive strength:

The Effect of NCS on MPA

This study found that negative coping styles were significantly positively correlated with mobile phone addiction ($r = 0.470$, $p < 0.001$) and could positively predict addiction levels ($B = 0.719$, $p < 0.001$). Students exhibiting negative coping styles had a 2.053 times higher risk of mobile phone addiction than those without such tendencies ($OR = 2.053$). According to the I-PACE model, negative coping styles, as a critical component of executive function, play an important role in mobile phone addiction. These coping styles can exacerbate individuals' perceptions of stress. For example, individuals who rely excessively on their phones for psychological support under stress may perceive mobile phone use as the only effective way to cope, thereby increasing both the frequency and duration of use and elevating addiction risk (Ding et al., 2021). Compulsive behavior is a

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significant indicator of mobile phone addiction and effectively predicts its severity (Lin et al., 2017). Research has shown that compulsiveness is a key factor in maintaining and exacerbating mobile phone addiction, and it is closely associated with activity in the prefrontal cortex of the brain (Pedrero-Pérez, Morales-Alonso & Ruiz-Sánchez de León, 2020).

Individuals with aggressive behaviors often experience more interpersonal conflicts and challenges in real life, leading them to seek relief in virtual environments (Wenzel et al., 2024). Compared to real-life confrontations, cyber aggression is easier to engage in and typically does not result in immediate negative consequences. For instance, the anonymity of the internet has facilitated the proliferation of online “trolls,” which can further reinforce mobile phone addiction (Smith-Jones, 2023). Similarly, withdrawal behavior can result in social isolation or social failure. Individuals who withdraw from social interactions often seek social satisfaction through their mobile phones. Additionally, those prone to withdrawal tend to have sensitive personalities; their excessive attention to or overreaction to negative information may further contribute to mobile phone addiction (Ling et al., 2025).

The Effect of PMF on MPA

This study found a significant positive correlation between physical and mental function and mobile phone addiction ($r = 0.448$, $p < 0.001$), which can positively predict college students’ mobile phone addiction ($B = 0.372$, $p < 0.001$). Students with physical and mental function problems had a 1.450 times higher risk of mobile phone addiction than those without such issues (OR = 1.450). Individuals with physical and mental vulnerabilities may already possess psychological or physiological susceptibilities (Bertelli et al., 2022). For example, college students with somatization disorders may reduce participation in other activities due to physical discomfort, leading to increased mobile phone use (Solon Júnior et al., 2021). Physical and mental dysfunction is often accompanied by emotional problems. For instance, students with sexual psychological disorders may seek emotional support by browsing pornographic content or searching for emotional connections online due to psychological distress, thereby increasing their risk of mobile phone addiction (Zarski et al., 2022). Moreover, individuals with psychiatric tendencies may have cognitive distortions, such as overestimating the positive effects of mobile phone use and underestimating its potential harm (Zou et al., 2024). Research has also shown that individuals with high levels of neuroticism—characterized by emotional instability and anxiety are more likely to become absorbed in the virtual world of smartphones. They often struggle to focus on real-world tasks and are easily drawn to entertainment apps and social media, which makes it difficult to control their usage and can ultimately lead to addiction (Dong et al., 2022; Barlow, Curreri & Woodard, 2021; Hodes, 2021).

Impulsive individuals, due to limited self-control and awareness of the consequences of phone use, find it difficult to resist various temptations on their phones (Zhu et al., 2021). Impulsivity may also contribute to attention issues, making individuals more easily distracted by stimuli on their phones, thereby increasing usage time (Greenfield, 2021).

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Furthermore, impulsivity can indirectly contribute to addiction by shaping the motives for phone use. For example, thrill-seeking or risk-taking individuals may use their phones to pursue novel experiences, which increases the likelihood of addiction (Pérez de Albéniz Garrote, 2021).

The Effect of NE on MPA

This study found a significant positive correlation between negative emotions and mobile phone addiction ($r = 0.363$, $p < 0.001$), which can positively predict college students' mobile phone addiction ($B = 0.291$, $p < 0.001$). Students experiencing negative emotions had a 1.338 times higher risk of mobile phone addiction than those without such issues ($OR = 1.338$). Empirical studies indicate that negative emotions are important risk factors for mobile phone addiction. For instance, individuals experiencing depression or anxiety may distract themselves by browsing short videos or playing mobile games (Kowal et al., 2021).

Negative emotions activate the brain's stress response system, promoting the release of pleasure-related neurotransmitters, such as dopamine, through mobile phone use. This provides temporary happiness, reinforcing phone usage (Thangavel, 2024). Prolonged dopamine release can alter neural circuits, gradually extending reliance on mobile phones from psychological to physiological levels. Physiological dependence may result in withdrawal symptoms such as anxiety, irritability, insomnia, eating disorders, and avoidance of outdoor and social activities, further exacerbating addiction (Dresp-Langley & Hutt, 2022).

The Effect of CB on MPA

This study found a significant positive correlation between cognitive bias and mobile phone addiction ($r = 0.358$, $p < 0.001$), which can positively predict college students' mobile phone addiction ($B = 0.381$, $p < 0.001$). Students with cognitive bias had a 1.464 times higher risk of mobile phone addiction than those without ($OR = 1.464$).

Inferiority, as an important psychological characteristic, often leads to underestimation of one's abilities and value. After experiencing setbacks, individuals may develop self-doubt and attempt to enhance self-worth through quick virtual rewards, such as gaining likes, attention, or achieving success in mobile games, which increases the likelihood of excessive reliance on phones (Wu & Zhang, 2023).

Paranoid individuals often exhibit excessive skepticism and distrust toward others' intentions. This may lead them to rely heavily on their phones to verify suspicions or obtain information (Yılmaz & Bekaroğlu, 2022). For example, they may frequently check social media to find "evidence" supporting their beliefs, increasing both frequency and dependence on mobile phone use. Additionally, paranoid individuals may resist accepting others' opinions, resulting in excessive focus on certain content or viewpoints while using their phones, which prolongs usage and contributes to addiction (Suthaharan & Corlett, 2023).

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CONCLUSION

This study investigated the complex relationship between college students' mental health and mobile phone addiction using the I-PACE model. By categorizing mental health dimensions into physical and mental function, cognitive bias, negative emotions, and negative coping styles, a hierarchical framework was developed to systematically analyze the multidimensional psychological basis of mobile phone addiction. The findings demonstrated a high prevalence of mobile phone addiction among college students, with 33.17 percent showing significant psychological dependence. Mental health conditions were strongly correlated with addiction, indicating that students with negative coping styles, cognitive biases, emotional distress, or physical and psychological difficulties are at greater risk of excessive mobile phone use. These results highlight the importance of understanding both the theoretical underpinnings and practical implications of mobile phone addiction in the college population. The study also provided practical guidance for intervention and prevention. Students exhibiting negative coping behaviors such as impulsivity or social withdrawal may benefit from behavior correction and social skills training. Those with cognitive biases, including paranoia or inferiority tendencies, could benefit from cognitive-behavioral therapy to correct distorted thinking and improve confidence.

Health education and counseling can address physical and psychological function issues, while emotional management training can help students cope with anxiety and depression. By targeting these key areas, interventions can reduce the risk of mobile phone addiction, support mental health, and promote overall student development. The integration of theoretical and practical perspectives enhances understanding of the mechanisms behind mobile phone addiction and informs evidence-based strategies to address it effectively. Despite its contributions, the study has limitations. Its cross-sectional design prevents causal conclusions, and the model fit suggests other influencing factors should be explored, including neuroscience, network analysis, and cultural psychology. The sample was limited to students from a private university, which restricts generalizability. Future research should use longitudinal designs and larger, more diverse samples to validate and extend these findings. Overall, this study advances both theoretical knowledge and practical approaches for understanding and managing mobile phone addiction among college students, emphasizing the need for multidimensional strategies to support mental health and wellbeing.

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