

Examining the Association Between Boredom Proneness and Bedtime Procrastination Among Chinese College Students: A Sequential Mediation Model with Mobile Phone Addiction and Negative Emotions

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Purpose: The phenomenon of bedtime procrastination has become very common in China in recent years, especially among college students, and it can have numerous negative implications for both physical and mental health. However, the impacting factors and possible underlying mechanisms of bedtime procrastination have not yet been fully clarified. The present study aims to explore the relationship between boredom proneness and bedtime procrastination in Chinese college students, and propose a multiple mediation model to further explore the mediating effects of mobile phone addiction and negative emotions in this link.

Participants and Methods: A cross-sectional study was conducted involving 668 Chinese college students aged 18 to 32 years old ($M=20.36$ years [$SD=1.69$]; 35.03% male). A series of self-rating questionnaires measuring degrees of boredom proneness, mobile phone addiction, bedtime procrastination, as well as negative emotions (depression, anxiety and stress) were administered.

Results: The results showed that boredom proneness, mobile phone addiction, negative emotions and bedtime procrastination were significantly and positively correlated with each other in college students. Mobile phone addiction and negative emotions separately played partial mediating roles in the relationship between boredom proneness and bedtime procrastination. Furthermore, a sequential mediation pathway was significant whereby boredom proneness predicted mobile phone addiction, which was associated with higher levels of negative emotions, which were then associated with more bedtime procrastination behaviors.

Conclusion: The present findings indicate that both mobile phone addiction and negative emotions are important risk-enhancing mediators in the association between boredom proneness and bedtime procrastination in Chinese college students. Therefore, intervention management that concentrating on reducing mobile phone addiction as well as improving negative emotions may be useful for decreasing bedtime procrastination among college students.

Keywords: boredom proneness, bedtime procrastination, mobile phone addiction, negative emotions, mediating effect

Introduction

As a special kind of procrastination associated with sleep, bedtime procrastination is usually defined as being unable to go to bed as intended without an external cause.¹ It is different from typical procrastination, which involves a delay in aversive tasks, in that sleep is not generally regarded as aversive.² In recent years, bedtime procrastination has become a pervasive phenomenon in the Chinese population, especially among college students.³ A cross-sectional study by Yang and colleagues reported that more than 52% of college students had the habit of delaying their bedtimes, and the reason for staying up late was

to a large extent related to the use of electronic media such as mobile phones before bedtime.⁴ Research evidence has indicated that bedtime procrastination is related to many negative health conditions, such as sleep insufficiency, poor sleep quality, high levels of daytime fatigue and sleepiness.^{5,6} Thus, given the links between bedtime procrastination and these adverse consequences, it is vital to examine the predictors of bedtime procrastination and possible mechanisms to inform a more holistic physical and mental health intervention and promotion approach for college students.

Existing literature shows that bedtime procrastination can be influenced by many factors, such as an individual's self-regulation/self-control capacity,⁷ bedtime routines and immersive activities (eg, watching TV),⁸ emotional states,⁹ and biological factors (eg, chronotypes).¹⁰ However, little research has been carried out to investigate the relationship between an individual's negative personality traits (such as trait boredom) and bedtime procrastination. The model of individual-context relations also suggests that one's behavior problems are the result of the dynamic interactions between intrapersonal trait factors and external factors.¹¹ Boredom proneness, also known as trait boredom, is characterized by a frequency and intensity of individuals to experience a low dissatisfaction and arousal state, which has been proven to be a stable personality trait.^{12,13} Studies have repeatedly demonstrated that boredom proneness is closely associated with general procrastination.^{14–16} Individuals with higher levels of boredom proneness, for instance, tend to perceive time as passing more slowly and have more frequent thoughts about time, and as a consequence, they are likely to procrastinate on an assigned task in spite of its long-term value.^{17,18} Similar trends were observed among Chinese college students,¹⁹ revealing that boredom proneness could independently predict students' procrastination behavior. As a special procrastination behavior, the link between bedtime procrastination and boredom proneness has also been supported by some indirect evidence. For example, it has been shown that to eliminate boredom, bored individuals refuse to go to bed and attempt to find something interesting to do even when they are wrapped by tiredness.²⁰ Such an urge to find stimulation near bedtime might contribute to bedtime procrastination. Therefore, based on previous theory and research, it is reasonable for us to infer that boredom proneness may predict bedtime procrastination. Although many studies have tested the relation between boredom proneness and general procrastination, few studies have directly investigated the association between boredom proneness and bedtime procrastination and especially the underlying mechanisms by which boredom proneness influences bedtime procrastination. The current study thus, on the one hand, examined the relationship between boredom proneness and bedtime procrastination and, on the other hand, explored its possible mechanisms among Chinese college students.

Mobile phone addiction (MPA), a behavioral addiction analogous to gambling and internet addiction, refers to a condition involving an uncontrolled and excessive use of mobile phones along with withdrawal symptoms as well as functional impairment.^{21,22} Several empirical studies have found that mobile phone addiction can positively predict bedtime procrastination.^{23,24} According to the conceptual model of procrastination, temptation is an important antecedent of procrastination behavior.²⁵ Mobile phones, as one of the main communication tools of modern times, could provide many entertaining distractions and afford individuals pleasant, interesting, and entertaining experiences with considerable ease, especially for those with excessive and prolonged use of mobile phones.²⁶ Such individuals often cannot resist the temptations offered by mobile phones and therefore spend more time using them, ultimately resulting in a delay in the completion of targeted tasks (such as going to sleep).²⁷ Moreover, according to the displacement hypothesis of the internet, for everyone, time is constant. The more time and energy an individual spends using a mobile phone, the less time and energy they will spend on other activities and tasks (such as sleep), which leads to the delayed completion of such activities and tasks.²⁸ Empirical research has also verified that individuals' excessive use of mobile phones can easily lead to a vicious cycle of mobile phone dependence and bedtime delay.²⁹ Additionally, previous studies have also shown that people with higher levels of boredom proneness often have more excessive mobile phone use,^{30,31} which can be explained by the perspective of sensation seeking theory.³² According to this theory, boredom-prone individuals usually experience an aversive state of under arousal and a lack of stimulation, leading them to intend to achieve physiological arousal or positive internal states (eg, enjoyment and excitement) through the use of media-based activities. Since mobile phones can provide a variety of novel and exciting activities, such as gaming, chatting, online shopping, and video viewing, these pleasurable and exciting activities provided by mobile phones can easily arouse one's physiology and psychology. Thus, people experiencing boredom are more likely to use mobile phones to alleviate their boredom and arousal themselves; however, by constantly using mobile phones, people may ultimately become increasingly reliant on them. A large number of studies have demonstrated that boredom proneness can significantly predict the frequency and intensity of an individual's mobile phone use/addiction.^{33,34} From these findings, we believe that mobile phone addiction is a plausible mediator of the relationship between boredom proneness and bedtime procrastination.

Boredom proneness as a negative personality trait can not only hinder an individual's accurate emotional experience and judgment but also affect his/her emotional regulation and coping strategies, ultimately leading to more negative emotions.^{35,36} A strong relationship between boredom proneness and negative emotions has been found in numerous studies. For example, Sommers et al observed in an earlier study that boredom proneness was significantly associated with more reports of psychological and physical health symptoms such as depression and anxiety symptoms.³⁷ German et al and Yan et al revealed that individuals high in boredom proneness were vulnerable to emotional distress, including experiences of depression, anxiety and fear.^{38,39} Recent cross-sectional studies also demonstrate that people scoring higher on boredom proneness were more prone to feel less subjective well-being and report more emotional regulation problems, which in turn resulted in more negative emotions.^{40,41} However, negative emotion has been shown to be an important risk factor for procrastination.⁴² The misregulation hypothesis of procrastination suggests that procrastination may function as an emotion regulation strategy to relieve negative emotions experienced in the moment, indicating that people who are more likely to experience negative emotions will show an increased likelihood of engaging in procrastination.⁴³ Studies conducted in China and abroad have found that procrastination is positively associated with depression and anxiety among young adults.^{44–46} That is, people with higher levels of depression and anxiety symptoms tend to report more procrastinatory behavior than those with lower levels of depression and anxiety symptoms. In addition to the close link between negative emotions and general procrastination, researchers also noted that negative emotion had a significant prediction effect on individuals' bedtime procrastination behavior. Sirois et al indicated from an emotion regulation study that individuals' reduction in bedtime procrastination was significantly associated with decreased negative emotions, and meanwhile they suggested some healthy emotion regulation strategies (ie, cognitive reappraisal) can be used to help downregulate negative affect and thereby contribute to a decrease in bedtime procrastination behavior.⁹ A recent cross-sectional survey also revealed that individuals with high levels of anxiety showed weakened self-control ability, which in turn led to more bedtime procrastination.⁴⁷ Based on the above evidence, it is reasonable for us to infer that negative emotions, such as depression and anxiety, may also be a mediating variable in the relationship between boredom proneness and bedtime procrastination in college students.

Although mobile phone addiction and negative emotions may mediate the association between boredom proneness and bedtime procrastination, there is also an association between them. As previously hypothesized, mobile phone addiction and negative emotions may play a mediating role in the boredom proneness and bedtime procrastination of college students. However, we wonder if there is a relationship between mobile phone addiction and negative emotions when both are considered mediators. Prior studies have shown a significant correlation between mobile phone addiction and individuals' emotional and behavioral problems.^{48,49} For instance, Zhang et al found in young adults that mobile phone addiction was positively related with emotional disturbance, such as depression, anxiety, and stress. Individuals with higher severity of mobile phone addiction tend to report greater symptoms of emotional disturbance.⁵⁰ Another study with a college students sample aged 17 to 25 years old indicated that mobile phone addiction had a significant prediction effect on students' depression and anxiety.⁵¹ Besides, mobile phone addiction has also been found to be associated with difficulties in emotional regulation,⁵² which can contribute to more emotional problems. Based on previous findings, we hypothesize that mobile phone addiction and negative emotions may act as serial mediators of the relationship between boredom proneness and bedtime procrastination among college students.

To sum up, this study attempts to investigate the relationship between boredom proneness and bedtime procrastination among Chinese college students and explore whether mobile phone addiction and negative emotions play multiple mediating roles between boredom proneness and bedtime procrastination. Based on related theories and empirical evidence, we propose the following hypotheses: H1: Boredom proneness is positively related to bedtime procrastination in college students; H2: Boredom proneness has an indirect effect on college students' bedtime procrastination via mobile phone addiction. H3: Negative emotions play a mediating role in the relationship between boredom proneness and bedtime procrastination; H4: Mobile phone addiction and negative emotions serve sequential mediating roles between boredom proneness and bedtime procrastination.

Methods

Participants and Procedure

A questionnaire survey was carried out using convenience sampling method with participants from three public universities in Tianjin, China. A total of 668 college students (434 females) completed this study. The mean age of the participants was 20.36 years old ($SD=1.69$, range = 18–32 years). Freshman, sophomore, junior and senior students accounted for 12.28%, 35.18%, 22.90%, and 21.26% of the sample, respectively, and the rest were postgraduate students (8.38%). All participants provided informed consent and voluntarily participated based on an assurance of confidentiality and anonymity. The data collectors were well-trained researchers to ensure the standardization of the data collection process. A quick response (QR) code or link to the questionnaires was delivered to the students after informing them of the purpose of our survey and obtaining their informed consent. Each participant could scan the QR code or click the link to access a website to complete the questionnaires. After completing the survey, the participants were given small gifts for participating. This study was performed in compliance with the Declaration of Helsinki and was approved by the Research Ethics Committee of the university the first author was affiliated with.

Measures

Boredom Proneness Scale (BPS-SF)

The Boredom Proneness Scale-Short Form compiled by Vodanovich, Wallace and Kass was used to measure individuals' boredom proneness.⁵³ The Chinese version of the scale has demonstrated satisfactory construct validity and internal reliability.⁵⁴ The BPS-SF consists of 12 items rated on a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Sample items are "Having to look at someone's home movies or travel slides bores me tremendously" and "It would be very hard for me to find a job that is exciting enough." The higher the total score, the higher an individual's level of boredom proneness is. In this study, the Cronbach's α for this scale was 0.76.

Bedtime Procrastination Scale (BPS)

The Chinese version of the Bedtime Procrastination Scale was used to measure bedtime procrastination behaviors.⁵⁵ The scale consists of 9 items rated on a five-point scale ranging from 1 (almost never) to 5 (almost always). Items 2, 3, 7, 9 were scored reversely. The BPS score was calculated as the average of ratings of all items (after the negatively worded items had been reverse coded). Higher scores indicate higher levels of bedtime procrastination. Sample items are "I go to bed later than I had intended" and "Often I am still doing other things when it is time to go to bed." Prior research has demonstrated the satisfactory validity and reliability of scale among Chinese college students.⁶ In this study, the Cronbach's α for the scale was 0.78.

Mobile Phone Addiction Tendency Scale (MPATS)

Mobile phone addiction was assessed using the Mobile Phone Addiction Tendency Scale compiled by Xiong et al,⁵⁶ which comprises 16 items. Sample items are "I will feel lonely without my mobile phone" and "Friends tell me that I spend too much time on the mobile phone." Participants rated these items on a five-point scale ranging from 1 (totally disagree) to 5 (totally agree). The total scores were calculated by summing all of the scores given by the participants on each item, and the higher the score was, the greater a participant's tendency toward mobile phone addiction was. The reliability and validity of the scale have been tested among Chinese college students.²⁹ In this study, the Cronbach's α was 0.95.

Depression-Anxiety-Stress Scale (DASS-21)

The Chinese version of the 21-item Depression-Anxiety-Stress Scale was used to measure participants' negative emotions.⁵⁷ The DASS-21 includes three subscales: a depression subscale (7 items, for example, "I felt that life was meaningless"), anxiety subscale (7 items, for example, "I felt I was close to panic") and stress subscale (7 items, for example, "I found it hard to wind down"). Items were rated on a four-point scale ranging from 0 (totally disagree) to 3 (totally agree), with higher scores reflecting higher levels of negative emotions. Previous studies have shown the satisfactory validity and reliability of scale among Chinese college students.⁵¹ In this study, the Cronbach's α for the total scale was 0.92, and the Cronbach's α of the depression, anxiety and stress subscales were 0.84, 0.87 and 0.88, respectively.

Data Analysis

SPSS version 25.0 package and the PROCESS macro were used for data analyses.⁵⁸ We first collected descriptive statistics: The mean and standard deviation ($M \pm SD$) for all demographic and studied variables. Preliminarily, bivariate correlation analysis was used to measure the relationships between the variables of interest. Second, SPSS PROCESS macro was used to investigate the mediating effects of mobile phone addiction and negative emotions between boredom proneness and bedtime procrastination, which was specifically developed for testing the complex models. In PROCESS, Model 6 software was applied for two mediators. Indirect effects were computed using a bias-corrected bootstrapping procedure. If the 95% confidence interval (CI) did not include zero, it meant that the mediation effect was significant. Age and gender were included as covariates in the models. All of the predictors were standardized to minimize multicollinearity.⁵⁹

Results

Common Method Deviation Test

Common variance analysis was performed to the four questionnaires through Harman's one-factor method. Principal component analysis of all variables extracted 9 eigenvalues greater than 1. The first factor explained 24.2% of the variance, which was less than the critical value of 40%, demonstrating that the common method bias effect was not problematic in the present study.⁶⁰

Descriptive Statistics and Correlational Analyses

Table 1 presents the descriptive statistics and bivariate correlations for all observed variables. For demographic variables, gender was significantly correlated with bedtime procrastination ($r = 0.14, p < 0.001$) and mobile phone addiction ($r = -0.08, p < 0.05$). Both grade ($r = -0.18, p < 0.001$) and age ($r = -0.25, p < 0.001$) were significantly correlated with mobile phone addiction. Pearson correlation analyses revealed that boredom proneness was significantly and positively correlated with bedtime procrastination ($r = 0.23, p < 0.001$) and mobile phone addiction ($r = 0.22, p < 0.001$). Bedtime procrastination had a significant positive association with mobile phone addiction ($r = 0.22, p < 0.001$). There were positive associations between negative emotions and boredom proneness ($r = 0.49, p < 0.001$) as well as bedtime procrastination ($r = 0.23, p < 0.001$).

Testing for the Mediating Model

Hayes' PROCESS macro (Model 6) was adopted to examine whether mobile phone addiction and negative emotions mediate the relationship between boredom proneness and college students' bedtime procrastination. Table 2 and Figure 1

Table 1 Means, Standard Deviations and the Bivariate Correlations of Studied Variables

Variables	1	2	3	4	5	6	7	8	9	10
1 Gender ^a	1.00									
2 Grade	0.06	1.00								
3 Age	0.03	0.79***	1.00							
4 BP	-0.03	0.05	0.04	1.00						
5 BPS	0.14***	-0.04	-0.04	0.23***	1.00					
6 MPA	-0.08*	-0.18***	-0.25***	0.22***	0.22***	1.00				
7 NE	-0.07	0.02	0.02	0.49***	0.23***	0.38***	1.00			
8 DEP	-0.06	0.03	0.04	0.52***	0.21***	0.33***	0.95***	1.00		
9 ANX	-0.09*	-0.01	-0.14	0.41***	0.19***	0.39***	0.96***	0.86***	1.00	
10 STR	-0.06	0.04	0.03	0.47***	0.26***	0.37***	0.95***	0.84***	0.87***	1.00
Mean	—	—	20.36	43.48	3.35	48.56	16.03	4.98	5.15	5.91
SD	—	—	1.69	7.94	0.66	14.47	12.93	4.63	4.45	4.51

Notes: ^aMale = 0, Female = 1. * $p < 0.05$, *** $p < 0.001$.

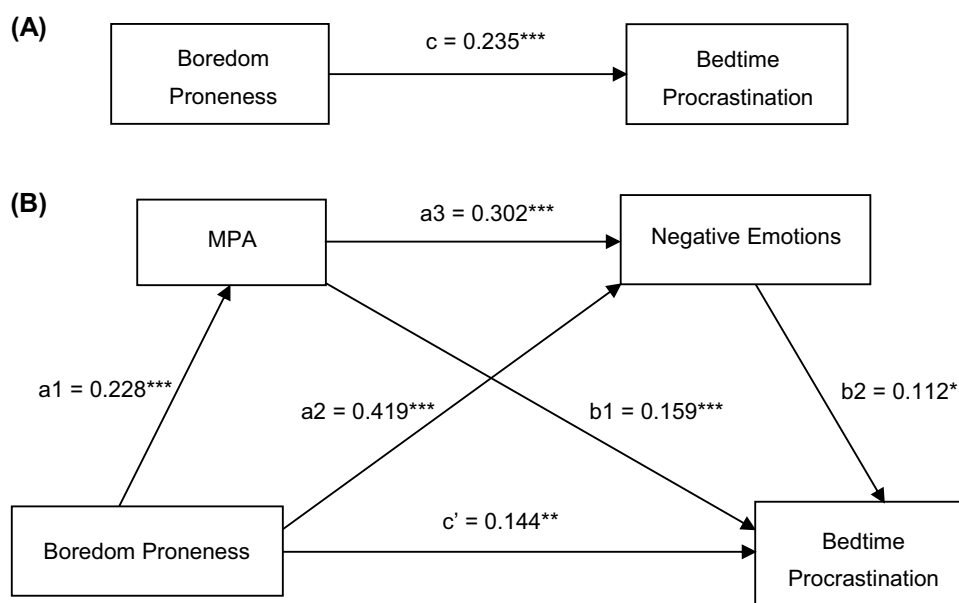
Abbreviations: BP, boredom proneness; BPS, bedtime procrastination; MPA, mobile phone addiction; NE, negative emotions; DEP, depression; ANX, anxiety; STR, stress; SD, standard deviations.

Table 2 Regression Analysis of Mobile Phone Addiction and Negative Emotions in the Relation Between Boredom Proneness and Bedtime Procrastination

Outcome variable	Predictor variable	R ²	F	β	t	Boot LLCI	Boot ULCI
Bedtime procrastination	Gender ^a	0.077	13.735***	0.150	4.002***	0.076	0.223
	Age			-0.012	-0.198	-0.133	0.108
	Grade			-0.047	-0.770	-0.168	0.073
	Boredom proneness			0.235	6.281***	0.161	0.308
MPA	Gender ^a	0.121	22.796***	-0.068	-1.860	-0.140	0.004
	Age			-0.294	-4.912***	-0.411	-0.176
	Grade			0.045	0.756	-0.072	0.163
	Boredom proneness			0.228	6.260***	0.157	0.300
Negative emotions	Gender ^a	0.324	63.428***	-0.039	-1.218	-0.102	0.024
	Age			0.087	1.632	-0.018	0.192
	Grade			-0.011	-0.211	-0.114	0.092
	MPA			0.302	8.870***	0.235	0.369
Bedtime procrastination	Boredom proneness	0.117	14.667***	0.419	12.719***	0.354	0.484
	Gender ^a			0.167	4.547***	0.095	0.239
	Age			0.035	0.566	-0.086	0.155
	Grade			-0.055	-0.910	-0.173	0.063
	Negative emotions			0.112	2.510*	0.024	0.199
	MPA			0.159	3.850***	0.078	0.240
	Boredom proneness			0.144	3.430**	0.062	0.227

Notes: ^aMale = 0, Female = 1. Boot LLCI, and Boot ULCI refer, respectively, to the lower and upper limits of the 95% confidence interval of the indirect effects estimated by the percentile bootstrap method with deviation correction. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

showed the regression of the chain mediating model analysis outcomes, for which gender, age and grade were control variables. The results showed that boredom proneness had a significant positive predictive effect on bedtime procrastination ($c = 0.235$, $p < 0.001$). When mobile phone addiction and negative emotions were included in the regression equation, boredom proneness significantly and positively predicted mobile phone addiction ($a1 = 0.228$, $p < 0.001$) and negative emotions ($a2 = 0.419$, $p < 0.001$). Mobile phone addiction significantly and positively predicted negative emotions ($a3 = 0.302$, $p < 0.001$) and bedtime procrastination ($b1 = 0.159$, $p < 0.001$). In addition, negative emotion was

**Figure 1** The chain mediating model for the association between boredom proneness and bedtime procrastination.

Note: (A) The total effect model; (B) The chain mediating effect of MPA and negative emotions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3 Bootstrap Analysis of the Standardized Indirect Effects Between the Main Variables

Pathways	Effect	Boot SE	Boot LLCI	Boot ULCI	Relative Mediation Effect
Total effect	0.235	0.037	0.161	0.308	–
Direct effect	0.144	0.042	0.062	0.227	–
Total indirect effect	0.091	0.021	0.050	0.132	38.72%
Indirect effect 1 (Boredom proneness → MPA → Bedtime procrastination)	0.036	0.010	0.018	0.058	15.32%
Indirect effect 2 (Boredom proneness → Negative emotion → Bedtime procrastination)	0.047	0.019	0.011	0.084	20.00%
Indirect effect 3 (Boredom proneness → MPA → Negative emotion → Bedtime procrastination)	0.008	0.003	0.002	0.014	3.40%

Notes: BootSE, BootLLCI, and BootULCI refer to the standard error of indirect effect estimated by percentile Bootstrap method of deviation correction and the lower and upper limits of the 95% confidence interval of the indirect effects estimated by the percentile bootstrap method with deviation correction respectively.

a significant positive predictor of bedtime procrastination ($b_2 = 0.112$, $p < 0.05$). At this point, the direct effect of boredom proneness on bedtime procrastination was significantly reduced ($c' = 0.144$, $p < 0.01$). These results indicate that mobile phone addiction, negative emotions and the chain mediating effect of mobile phone addiction → negative emotions were significant among the influences of boredom proneness on bedtime procrastination.

The results of the analysis of the mediating effect showed that mobile phone addiction and negative emotions played significant mediating roles between boredom proneness and bedtime procrastination (see Table 3 and Figure 1). Specifically, the total effect value of boredom proneness and bedtime procrastination was 0.235, the direct effect value of boredom proneness and bedtime procrastination was 0.144, and the total mediating effect value was 0.091. The ratio of the total mediation effect to the total effect was 38.72%. The mediating effect included three indirect effects: path 1: boredom proneness → mobile phone addiction → bedtime procrastination ($\beta = 0.036$, 95% CI [0.018, 0.058]), path 2: boredom proneness → negative emotions → bedtime procrastination ($\beta = 0.047$, 95% CI [0.011, 0.084]), and path 3: boredom proneness → mobile phone addiction → negative emotions → bedtime procrastination ($\beta = 0.008$, 95% CI [0.002, 0.014]). The ratios of the three indirect effects to the total effect were 15.32%, 20.00%, and 3.40% for path 1, 2, and 3, respectively.

Discussion

This study examined the relationship between boredom proneness, mobile phone addiction, negative emotions and bedtime procrastination among college students and further explored the specific mechanism by which boredom proneness influences bedtime procrastination. The results indicated that the boredom proneness of college students was positively correlated with higher levels of mobile phone addiction, negative emotions and bedtime procrastination. Moreover, according to the multiple mediation model, mobile phone addiction and negative emotions had respective and serial mediation effects in the association between boredom proneness and bedtime procrastination, which supports our hypotheses. These findings underscore the importance of mobile phone addiction and negative moods as potential factors in explaining the relationship between boredom proneness and bedtime procrastination among Chinese college students. The current study is the first to suggest that mobile phone addiction and negative emotion together play a role in this connection.

The present study revealed that boredom proneness had a positive effect on college students' bedtime procrastination. That is, compared to students with higher levels of boredom proneness, students with lower levels of boredom proneness are more prone to postpone their bedtime. This result lends support to previous findings on the relationship between boredom proneness and individuals' procrastination behavior.^{15,19} Through the analysis of the path coefficient in the chain mediation model, we found that boredom proneness can directly affect bedtime procrastination; and can also affect bedtime procrastination through the partial mediating effects of mobile phone addiction or depression/anxiety; and further affect bedtime procrastination through the chain mediating effect of mobile phone addiction, depression and

anxiety. These results suggest that boredom proneness not only affects depression directly but also affects bedtime procrastination by increasing mobile phone addiction and negative emotions such as depression and anxiety. This result will help us further understand the health risks of boredom proneness and the relationship between boredom proneness and bedtime procrastination and help relevant institutions take effective measures to alleviate and lessen bedtime procrastination among college students.

Additionally, the present study found that mobile phone addiction played a significant mediating role in the relationship between boredom proneness and bedtime procrastination in college students. Lower levels of boredom proneness were associated with higher levels of mobile phone addiction, which in turn contributed to lower levels of bedtime procrastination among college students, and higher levels of boredom proneness were associated with lower levels of mobile phone addiction, which in turn led to higher bedtime procrastination. This result is consistent with previous research showing that people high in boredom proneness are more likely to become addicted to the internet or smartphones^{61,62} and is also consistent with sensation seeking theory.³² When college students are in a state of boredom proneness, they tend to seek activities such as mobile phone use to excite and satisfy them.^{19,63} However, due to feelings of satisfaction and happiness brought by mobile phones, students easily become immersed in them and lose track of time, which in turn leads to the delay of necessary tasks (such as sleep). Recently, a qualitative study further confirmed that most bedtime procrastinators reported that they mainly postponed their bedtime due to being too deeply immersed in evening activities (eg, watching TV or browsing websites) and therefore missing their intended bedtime without them noticing.¹⁸ Thus, boredom proneness is positively associated with mobile phone addiction, which in turn influences the bedtime procrastination of college students.

Apart from that, boredom proneness can significantly positively predict bedtime procrastination through the mediating effect of negative emotions among college students. Previous studies have found that boredom proneness has a strong relationship with negative emotions such as depression and anxiety,^{64,65} which is consistent with our results. According to the conceptual model of procrastination,²⁵ negative affect is an important anticipator of procrastination. The more serious the negative emotions people experience are, the greater the impact on their procrastination behavior is. In our study, the more boredom proneness college students report, the higher their levels of negative emotions (eg, depression, anxiety and stress), which can in turn lead to more bedtime procrastination behaviors. Additionally, our results provide empirical evidence for the proposition that delaying bedtime may be a consequence of short-term mood repair,⁹ That is, for individuals with high levels of negative mood, procrastinating going to bed can function as an inadequate emotion regulation strategy to help them cope with their current negative state; however, as a consequence of doing so, they are prone to becoming sleep deprived, which may further make them increasingly likely to engage in bedtime procrastination.

Furthermore, the results also demonstrated that mobile phone addiction could influence college students' negative emotions and consequently influence bedtime procrastination, which supported our hypothesis. More specifically, students with higher boredom proneness tend to experience more mobile phone addiction, which result in higher levels of negative emotions and finally contribute to an increasing likelihood of bedtime procrastination. In the chain mediating pathway of boredom proneness and bedtime procrastination, mobile phone addiction played a mediating role in the association between boredom proneness and negative emotion. On the one hand, boredom proneness can negatively affect individual' mood state by increasing mobile phone addictive behaviors, and on the other hand, mobile phone addiction, as a prevalent addictive behavior, can aggravate the impact of boredom proneness on their current state. Prior studies have indicated that mobile phone addiction has a positive impact on the generation and development of individuals' negative emotions such as depression and anxiety.^{52,66} Demirci et al and Dalbudak et al observed that depression and anxiety symptoms were significantly more severe in a smartphone and internet overuse group than in a normal use group among college students.^{67,68} However, excessive and prolonged usage of mobile phones can make people more inclined to pay attention to negative information in their environment,⁶⁹ especially under negative affect, and this cognitive processing bias will be further strengthened, which may in turn lead to the aggravation of their negative mood.⁵¹ Moreover, according to the misregulation hypothesis of procrastination,⁴³ when people experience negative emotions, they are likely to regard procrastination as an emotion regulation strategy to relieve the negative mood experienced in the moment, thus making it difficult to complete the original task (such as going to bed) on time. Our findings suggest that reducing college students' mobile phone addiction and negative emotions can greatly help decrease or even eliminate bedtime procrastination, especially for those high in boredom proneness.

More targeted psychological intervention measures can be developed to reduce the mobile phone addiction and negative emotion of college students to promote their improvements in sleep and mental health.

Limitations and Future Research Directions

Several limitations should be considered when interpreting the results of this study. First, due to the cross-sectional design used, we could not test the causal/reciprocal relationships among boredom proneness, mobile phone addiction, negative emotions and bedtime procrastination in college students. Longitudinal studies and behavioral experiments should be improved to further reveal causality between these variables. Second, all variables included in this study were measured in the form of subjective reports, which may lead to social desirability and response bias. More objective methods can be adopted for measurement in the future. Third, the sample of college students included in the current study was mainly recruited from several universities in China, so generalizations of our findings to other populations must be made with caution. Future research may explore the proposed model among diverse populations. Finally, the effect of boredom proneness on bedtime procrastination may also be accounted for by other factors, such as time management and self-control capacity. Future research should consider examining the mediating effects of factors other than mobile phone addiction and negative emotions on the relationship between boredom proneness and bedtime procrastination.

Conclusion

The present study found higher levels of boredom proneness to be associated with greater severity of bedtime procrastination among college students, both directly and indirectly. Mobile phone addiction and negative emotions mediated the relationship between boredom proneness and bedtime procrastination. Specifically, boredom proneness was positively related to mobile phone addiction and negative emotions, which increased the risk of bedtime procrastination. Furthermore, mobile phone addiction and negative emotions serve as sequential mediators between boredom proneness and bedtime procrastination. Boredom proneness was positively related to mobile phone addiction, which raised the levels of negative emotions, thus increasing the prevalence of bedtime procrastination. These findings contribute to a better understanding of how boredom proneness prompts the risk of bedtime procrastination in college students and suggest some practical interventions aimed at reducing mobile phone addiction and negative affect should be conducted to alleviate the adverse impact of boredom proneness on bedtime procrastination among college students.

Ethics Statement

This study was carried out in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants before the survey. The research protocol was approved by the Research Ethics Review Committee of Tianjin Normal University (No. 2022112302).

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Disclosure

All authors declare that they have no conflicts of interest in this work.

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