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ORIGINAL RESEARCH

Why Cannot I Stop Phubbing? Boredom Proneness and Phubbing: A Multiple Mediation Model

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Background: With the popularity of smartphone and their increasingly rich functions, people's attachment to their phones is increasing. While people enjoy the convenience that smartphone bring (eg, accessing information and socializing), it also leads to problematic smartphone use (eg, phubbing). Previous research has shown that boredom proneness can trigger phubbing. However, the underlying psychological mechanisms are not yet clear.

Methods: To address this research gap, we surveyed 556 Chinese college students (M_{age} = 18.89 years, SD = 1.18) during the COVID-19 pandemic and all participants completed a self-report questionnaire. Drawing the Interaction of Person-Affect-Cognition-Execution model (I-PACE) for addictive behaviors, this study developed and examined a multiple mediation model incorporating boredom proneness, loneliness, fear of missing out (FoMO), and phubbing.

Results: (1) Boredom proneness could positively predict phubbing; (2) loneliness and FoMO mediated the relationship between boredom proneness and phubbing, respectively; and (3) loneliness and FoMO sequentially mediated the relationship between boredom proneness and phubbing.

Conclusion: These findings are not only valuable for understanding the underlying mechanisms linking boredom proneness and phubbing, but also suggest that three types of interventions could be effectively used to decrease the risk of phubbing among college students, namely, reducing boredom proneness, relieving loneliness, and decreasing FoMO.

Keywords: boredom proneness, loneliness, FoMO, phubbing, multiple mediation model, college students

Introduction

With the increasing richness of functions, smartphone, like an accessory organ, have gradually become an inseparable part of people's lives.[1] While smartphone have brought many conveniences to people (eg, online learning and chatting), their negative effects (eg, phubbing) have become more prominent, gradually emerging as a major academic concern.[2,3] Phubbing, which is a combination of "phone" and "subbing", refers to the act of snubbing or ignoring other people by concentrating on one's cell phone in social interactions.[2] The term was included in the updated version of Macquarie Dictionary in 2012. The same year, "Stopphubbing" website (https://www.stopphubbing.com) was launched to call for global attention to this social issue. As a common phenomenon in the era of mobile internet, phubbing is widely observed in family, work, and study environments.[3–5] David and Roberts[6] believe that phubbing is a form of social exclusion and interpersonal neglect, which has a potential negative impact on people's social life. For example, in terms of the quality of interpersonal relationships, the mere presence of mobile phone might interfere with human relationship formation,[7] partner phubbing can reduce relationship satisfaction;[8] In terms of the happiness of interpersonal objects, parental phubbing may enhance adolescents' alienation,[9] supervisor phubbing can increase subordinates' psychological distress and reduces employees' supervisor identification;[4] In terms of the behavior of interpersonal objects, parental phubbing

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can decrease the academic engagement of elementary students,[10] and increase adolescents' learning burnout, interpersonal aggression and smartphone addiction.[3,11] In terms of the mental health of interpersonal objects, phubbing can threaten the basic psychological needs of the phubbees, such as belonging, self-esteem, control and meaningful existence,[12] parental phubbing positively predicts adolescents' depressive symptoms,[13] alexithymia[14] and suicidal ideation.[15]

It is worth noting that in relevant studies, phubbing often alternates with smartphone addiction, exhibiting both distinctions and intrinsic connections between the two concepts.[16,17] Phubbing highlights the damage to interpersonal relationships due to excessive smartphone use,[2] whereas smartphone addiction emphasizes dependence on smartphone, leading to psychological or behavioral harm to oneself.[18,19] The dependency on smartphones inadvertently increases the time individuals spend using phones in different contexts, objectively contributing to phubbing. Therefore, Karada et al regard phubbing as a summation of various virtual addictions, representing a multidimensional and complex structure that includes addiction to mobile phones, the internet, SMS, social media, and games.[17] As of December 2022, the number of mobile internet users in China has reached 1.65 billion, with a mobile internet user penetration rate of 99.8%.[20] A cross-border survey revealed that Chinese youth (aged 15–35) ranked first in smartphone addiction,[21] and phubbing is also a widespread social phenomenon in China.[22] Given the numerous negative impacts of phubbing, exploring potential risk factors that may increase phubbing holds theoretical and practical significance, especially for Chinese university students. Brand et al[23] proposed the interaction of person-affect-cognition-execution (I-PACE) model to explain the psychological and neurobiological processes underlying the development and maintenance of an addictive use of specific internet applications. The model suggests that problematic and addictive behavior (eg, phubbing) are the result of the interaction between individuals' predisposing variables and specific situations, in which individual factors are important predictive variables. Previous literature has identified some individual traits (such as neuroticism, lack of self-control, and anxiety) can positively predict phubbing.[24] However, little empirical research has explored the link between boredom and phubbing and the understanding of the factors which can help account for this relationship is also limited. Thus, taking the I-PACE model as a theoretical framework, we utilized a sample of Chinese college students to examine whether boredom can significantly predict college students' phubbing and explore whether loneliness and fear of missing out would significantly mediate this relationship.

Boredom Proneness and Phubbing

Boredom is a complex emotional experience characterized by feelings of dullness, emptiness, and helplessness in response to a lack of engaging internal and external stimuli, resulting in an unsatisfactory fulfillment of needs.[25,26] It is widely prevalent among college students and referred to as the "plague" of modern society.[27,28] Boredom can be classified into state boredom and trait boredom. State boredom is context-dependent and of short duration, whereas trait boredom, known as boredom proneness, refers to a relatively stable personality characteristic manifested by experiencing boredom consistently across different situations.[26] Individuals with high boredom proneness often experience boredom due to low perceptual sensitivity to environmental stimuli and a lack of intrinsic interests. Sensation seeking theory suggests that this internal dissatisfaction and aversive experience drive individuals to seek stimulation to alleviate or mitigate this negative psychological state.[29] Mobile phones, characterized by their accessibility, affordability, rich functionality, and connectivity, have become an ideal medium for individuals to seek stimulation and alleviate boredom. Surveys indicate that 62.4% of college students choose to use their phones to kill time when feeling bored in the classroom.[30] Further empirical research has found that boredom proneness positively predicts problematic mobile phone use and internet addiction among college students.[31] Karadağ et al[17] identified phubbing behavior as a combination of various addictive behaviors involving mobile phones, the internet, and gaming. Therefore, we hypothesize that boredom proneness positively predicts phubbing behavior (H1).

Loneliness as a Mediator

Loneliness is a subjective psychological experience that occurs when an individual's desired social relationships in terms of quantity and quality fall short of their actual social relationships, often accompanied by negative emotions such as helplessness, emptiness, and distress.[32] Empirical research indicates that loneliness often co-occurs with boredom, and boredom positively predicts loneliness.[33] Specifically, individuals with high boredom proneness experience insufficient

fulfillment of psychological needs in different contexts, leading to a composite experience of negative emotions, including emptiness, apathy, and loneliness. Moreover, boredom has been found to negatively predict life satisfaction.[34] Therefore, these negative experiences may undermine individuals' interpersonal relationships and exacerbate feelings of loneliness. In addition, loneliness may also contribute to boredom proneness,[35–37] suggesting a bidirectional relationship between boredom proneness and loneliness. It is important to note that these cross-sectional studies cannot establish a causal relationship between the two variables.[33,35–37] Given the widespread prevalence of boredom among college students,[27,28] this study primarily examines the unidirectional predictive effect of boredom proneness on loneliness.

Furthermore, the Compensatory Internet Use Theory (CIUT) posits that people turn to the virtual world to escape from stressful events in real life or alleviate feelings of loneliness.[38] Thus, smartphones, which combine functions such as interpersonal communication, emotional expression, self-presentation, and leisure entertainment, naturally become an ideal medium for college students to alleviate their loneliness. Particularly in modern, hectic urban lifestyles where outdoor leisure activities and face-to-face interactions are relatively challenging, individuals are more likely to turn to feature-rich and conveniently interactive smartphones to seek social connection, further intensifying the dependence of individuals with high levels of loneliness on their phones and subsequently triggering phubbing behavior. Empirical research has also found that loneliness positively predicts college students' mobile phone addiction[36] and problematic mobile social media use.[39] Taken together, we hypothesize that loneliness mediates the relationship between boredom proneness and phubbing (H2).

Fear of Missing Out as a Mediator

Fear of Missing Out (FoMO) is a pervasive anxiety caused by individuals' fear of missing out on others' new experiences or positive events.[40] The internal cognitive manifestation of FoMO is a strong desire to know what others are doing, while the external behavioral manifestation is continuous engagement in social activities or checking social media.[41] In the era of mobile media, FoMO is a widely prevalent psychological phenomenon. Surveys have shown that 75% of young people have experienced FoMO,[42] with 32.6% frequently refreshing social media platforms (eg, Weibo) to avoid missing out on various topics, and 15.2% reporting severe FoMO symptoms such as worrying about missing updates from friends, family, or colleagues.[43] Previous research has demonstrated that boredom proneness positively predicts FoMO, indicating that higher levels of boredom proneness are associated with greater FoMO.[44] Specifically, individuals with high levels of boredom proneness often excessively focus on others' information or updates due to the dissatisfaction with internal and external stimulation, potentially leading to the experience of FoMO.

Previous research has suggested that the root cause of FoMO is the absence of basic psychological needs.[45] Based on the Compensatory Internet Use Theory, unfulfilled psychological needs in real life can be sought through alternative fulfillment in the virtual world.[38] Individuals with FoMO desire to keep up with what others are doing and promptly acquire external information. Therefore, mobile phone, as important medium connecting others and the world, naturally become their preferred choice.[41] Research has shown that individuals with FoMO often exhibit social media addiction[46] and problematic smartphone use.[47] More specifically, FoMO can significantly predict individuals' phubbing behavior.[48] Therefore, we hypothesize that FoMO mediates the relationship between boredom proneness and phubbing (H3).

A Multiple Mediation Model

In fact, FoMO as a pervasive anxiety emotion in mobile phone usage is also influenced by feelings of loneliness. Loneliness not only directly and positively predicts FoMO,[49] but it can also indirectly influence FoMO through the intensity of social media use.[50] Specifically, individuals with high levels of loneliness seek to satisfy their social needs through their phones, experience more satisfaction and happiness, and are more concerned about missing important information, whether it's their own or others'. As a result, they may become more engrossed in using their phones, neglecting or snubbing the people or things around them. Some empirical studies also indirectly support the sequential mediating effect of loneliness and FoMO in the relationship between boredom proneness and phubbing. Previous negative emotional states, such as depression, social anxiety, and low life satisfaction, have been found to positively predict subsequent FoMO,[51] and loneliness often triggers experiences of depression and anxiety.[52] Therefore, we

hypothesize that loneliness and FoMO play a sequential mediating role between boredom proneness and phubbing (Hypothesis 4).

The Present Study

The I-PACE model indicates that individuals' predisposing variables (eg, boredom proneness) and negative emotions (eg, loneliness, FoMO) are important factors leading to problematic smartphone use (eg, phubbing). We constructed a multiple mediation model (see Figure 1) applying the I-PACE model as a theoretical framework to explore the impact of boredom proneness on phubbing among college students, and to examine the sequential mediating effects of loneliness and FoMO in this relationship, so as to reveal potential risk factors leading to phubbing and provide theoretical basis and practical guidance for intervention of phubbing behavior of college students.

Method

Participants and Procedures

Utilizing the web-based survey platform, Sojump (wjx.cn), the current research employed a clustered convenience sampling method to recruit 612 undergraduate students from two universities in China. After eliminating invalid responses, the final sample included 556 participants (M_{age} = 18.89, SD = 1.18). The sample was comprised of 329 freshmen, 121 sophomores, and 106 juniors, with a gender distribution of 163 males and 393 females. All participants reported prior cell phone use experience and an average daily usage of 7.38 hours (SD = 2.94).

Data collection occurred during the ongoing COVID-19 pandemic, specifically from April to May 2022. Prior to participating in the online survey, participants provided informed consent. Participation was voluntary, and no financial incentives were provided. The survey took approximately 15 minutes to complete. This study was approved by the ethics committee at the corresponding author's institution.

Measurements

Boredom Proneness

Boredom proneness was assessed by the Chinese version of Boredom Proneness Scale Short Form,[53] which was originally developed by Vodanovich et al.[54] This scale has two dimensions (ie, the perceived lack of internal and external stimulation) and 12 items (eg, "Having to look at someone's home movies or travel slides bores me tremendously"). Subjects made their own responses on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Reverse scoring is required for items 1, 2, 4, 7, 8, and 12. A higher score indicates greater boredom proneness. In the present study, Cronbach's α for this scale was 0.82.

Loneliness

Loneliness was measured with the Short-Form Loneliness Scale developed by Hays and Dimatteo.[55] This is a one-dimensional eight-item scale, such as "I feel isolated from others", which has acceptable reliability and validity in the Chinese young adults.[56] The participants made their own responses on a 4-point Likert scale ranging from 1 (never) to 4 (always). Reverse scoring is required for items 3 and 6. A higher score indicates greater loneliness. In the present study, Cronbach's α for this scale was 0.84.

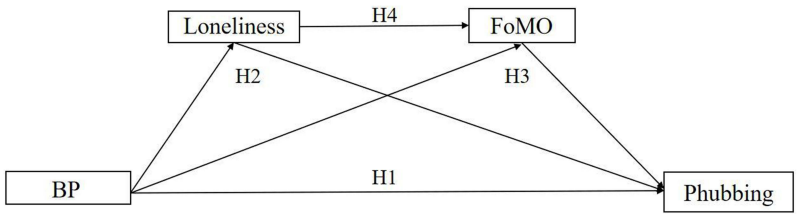

Figure 1 The hypothesized model.
Abbreviations: FoMO, fear of missing out; BP, boredom proneness.

Fear of Missing Out

Fear of missing out was evaluated by the Chinese 8-item version of Fear of Missing Out Scale,[57] which was originally developed by Przybylski et al.[40] This scale has two dimensions and 8 items (eg, "I get worried when I find out my friends are having fun without me"). Subjects made their own responses on a 5-point Likert scale ranging from 1 (Not at all true of me) to 5 (Extremely true of me). A Higher score indicates greater FoMO. In the present study, Cronbach's α for this scale was 0.77.

Phubbing

Phubbing was measured with the Chinese version of the Generic Scale of Phubbing,[58] which was developed by Chotpitayasunondh and Douglas.[59] This scale consists of 15 items (eg, "I would rather pay attention to my phone than talk to others") and four dimensions, such as nomophobia, interpersonal conflict, self-isolation and problem acknowledgement. The participants made their own responses on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicates greater phubbing. In the present study, Cronbach's α for this scale was 0.84.

Data Analysis

Descriptive statistics and bivariate correlations were initially computed for the study variables. To explore the mediation effects, the PROCESS macro in SPSS 24.0 was employed. Hypothesis 2 and 3 were evaluated through a simple mediation model (Model 4), while Hypothesis 4 was assessed using Model 6. Prior to conducting the regression analyses, all continuous variables were standardized. The significance of the results was determined using the bias-corrected percentile bootstrap method with 5000 resamples and a 95% confidence interval (CI). Mediation effects were considered statistically significant when the 95% CI did not include zero. To examine multicollinearity in the regression analysis, the variance inflation factor (VIF) was calculated for each predictor variable. VIF values ranged from 1.06 to 1.79, all below 5,[60] indicating that multicollinearity was not a major concern in our analysis. Skewness and kurtosis values for all variables were assessed to ensure a normal distribution of the data. All values fell within the acceptable range of −2 to +2 for skewness and −7 to +7 for kurtosis.[61]

Previous research has suggested that gender, age, and daily smartphone use may influence phubbing.[24,62] Therefore, we included these factors as control variables in our regression analysis, following the approach taken by Lepp et al.[63] Daily smartphone use was assessed using a single question: Please estimate the total number of hours you spend using your mobile phone each day.

Common Method Bias Analysis

To address potential common method bias, Harman's one-factor test was performed on the self-reported data used in this study. Unrotated principal component factor analysis was applied to all items of the study variables. The results showed that there were nine factors with eigenvalues greater than one, and the first factor variance contribution rate was 23.95%, which was lower than the recommended threshold of 40%.[64] Thus, the findings suggest that common method bias is not a serious issue in this study.

Results

Descriptive Statistics and Correlation Analysis

As depicted in Table 1, there is a significant positive correlation observed between boredom proneness and phubbing. Furthermore, boredom proneness demonstrates a significant positive correlation with loneliness and FoMO. Similarly, a positive correlation exists between loneliness and FoMO. Notably, both loneliness and FoMO exhibit significant positive correlations with phubbing.

Testing the Mediating Role of Loneliness

In this study, we utilized Model 4 of the PROCESS macro to examine the mediating effect of loneliness in the association between boredom proneness and phubbing. Controlling for gender, age and daily smartphone use, the results (see

Table 1 The Descriptive Statistics and Correlation Matrix for Each Variable

Variables	1	2	3	4	5
1. DSU	1				
2. Boredom proneness	0.15**	1			
3. Loneliness	0.14**	0.56**	1		
4. FoMO	0.11**	0.29**	0.36**	1	
5. Phubbing	0.27**	0.39**	0.36**	0.34**	1
M (*SD*)	7.38 (2.94)	3.63 (0.93)	2.08 (0.61)	2.81 (0.75)	2.69 (0.77)

Note: **$p < 0.01$.
Abbreviations: DSU, daily smartphone use; FoMO, fear of missing out.

Figure 2) revealed that boredom proneness had a significant positive effect on loneliness (β = 0.55, $t = 15.46$, $p < 0.001$), and loneliness had a significant positive effect on phubbing (β = 0.18, $t = 4.08$, $p < 0.001$). Also, the direct effect of boredom proneness on phubbing was significant (β = 0.25, $t = 5.61$, $p < 0.001$). These results suggest that loneliness played a mediating role in the relationship between boredom proneness and phubbing (indirect effect = 0.10, 95% CI = [0.05, 0.15]), accounting for 28.57% of the total effect. Thus, Hypothesis 2 was supported.

Testing the Mediating Role of FoMO

Similarly, the same procedures were performed to test the mediating effect of FoMO in the link between boredom proneness and phubbing. After controlling for gender, age and daily smartphone use, the results (see Figure 3) revealed that boredom proneness had a significant positive effect on FoMO (β = 0.27, $t = 6.71$, $p < 0.001$), and FoMO had a significant positive effect on phubbing (β = 0.23, $t = 5.95$, $p < 0.001$). Also, the direct effect of boredom proneness on phubbing was significant (β = 0.29, $t = 7.56$, $p < 0.001$). These results suggest that FoMO played a mediating role in the relationship between boredom proneness and phubbing (indirect effect = 0.06, 95% CI = [0.03, 0.09]), accounting for 17.14% of the total effect. Thus, Hypothesis 3 was supported.

Testing the Multiple Mediation Model

Next, Model 6 of the PROCESS macro was utilized to test the multiple mediating effect of boredom proneness through loneliness and FoMO. As shown in Table 2 and Figure 4, all pathways were found to be significant. Specifically, the first pathway of

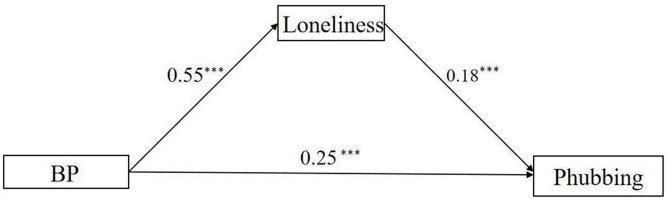

Figure 2 The mediation effect of loneliness.
Note: ***$p < 0.001$.
Abbreviation: BP, boredom proneness.

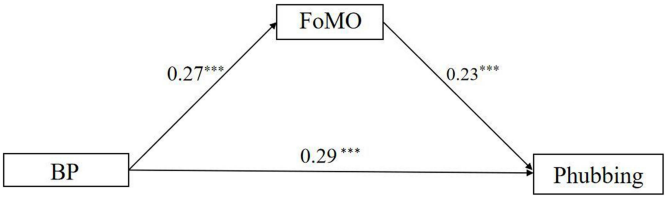

Figure 3 The mediation effect of FoMO.
Note: ***$p < 0.001$.
Abbreviations: FoMO, fear of missing out; BP, boredom proneness.

Table 2 Testing the Multiple Mediation Model

Predictors	Model 1 (Loneliness)			Model 2 (FoMO)			Model 3 (Phubbing)		
	β	t	95% CI	β	t	95% CI	β	t	95% CI
Gender	0.07	0.80	[–0.10, 0.24]	0.24*	2.51	[0.05, 0.42]	0.10	1.11	[–0.07, 0.27]
Age	–0.01	–0.58	[–0.08, 0.04]	–0.03	–0.97	[–0.10, 0.04]	0.06*	2.05	[0.01, 0.13]
DSU	0.02	1.44	[–0.01, 0.04]	0.02	1.12	[–0.01, 0.04]	0.07***	5.24	[0.04, 0.09]
Boredom proneness	0.55***	15.46	[0.48, 0.62]	0.12**	2.61	[0.03, 0.22]	0.22***	5.14	[0.14, 0.32]
Loneliness				0.27***	5.74	[0.18, 0.36]	0.13**	2.84	[0.04, 0.22]
FoMO							0.21***	5.14	[0.12, 0.28]
R^2	0.32			0.15			0.26		
F	64.11**			20.07***			32.42***		

Notes: *p < 0.05, **p < 0.01, ***p < 0.001; Gender is a dummy variable (0 for male and 1 for female).
Abbreviations: DSU, daily smartphone use; FoMO, fear of missing out.

"boredom proneness→ loneliness → phubbing" indicated a significant indirect effect (indirect effect = 0.07, 95% CI = [0.02, 0.12]). The second pathway of "boredom proneness→ FoMO → phubbing" also revealed a significant indirect effect (indirect effect = 0.02, 95% CI = [0.01, 0.04]). Additionally, the sequential pathway of "boredom proneness→ loneliness → FoMO → phubbing" was also significant (indirect effect = 0.03, 95% CI = [0.01, 0.05]). Therefore, these findings suggest that loneliness and FoMO played multiple mediating roles in the association between boredom proneness and phubbing (total indirect effect = 0.12, 95% CI = [0.07, 0.18]), accounting for 34.29% of the total effect (0.35). As a result, Hypothesis 4 was supported.

Discussion

Boredom Proneness and Phubbing

This study found that boredom proneness positively predicts phubbing behavior, supporting Hypothesis 1. Previous research has shown that individuals with high boredom proneness are more likely to experience academic burnout,[27] engage in aggressive behavior,[25] develop mobile phone addiction,[31] and even exhibit psychological behaviors such as alcohol addiction, gambling addiction, and substance abuse.[65,66] These findings suggest that boredom proneness may serve as a warning signal for various physiological, psychological, and social problems, and that phubbing shares similar risk factors with other behavioral and substance addictions. This result supports the Sensation Seeking Theory,[29] which suggests that individuals with high boredom proneness engage in behaviors that provide a high level of stimulation or pleasure to escape the feeling of imbalance caused by a lack of stimulation. Mobile phones, as a source of novel and diverse stimuli, can easily lead to addiction in such individuals. Furthermore, the I-PACE model indicates that individual dispositional factors (such as boredom proneness) and negative emotions (such as the lack of interest and loneliness caused by boredom proneness) are important factors in triggering addictive behaviors (eg, phubbing), and the pleasure derived from these addictive behaviors further reinforces the behavior.[23] Evidence from physiology also suggests a link between boredom and a decrease in dopamine levels, while mobile phone use promotes dopamine secretion, leading to

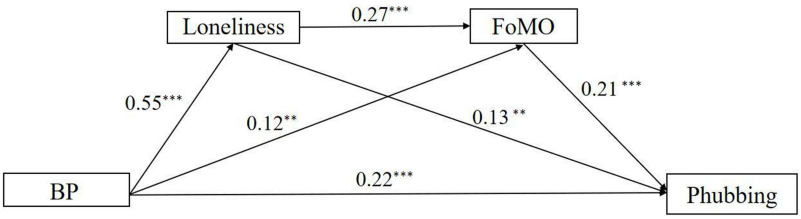

Figure 4 The multiple mediation effects of loneliness and FoMO.
Notes: **p < 0.01, ***p < 0.001.
Abbreviations: FoMO, fear of missing out; BP, boredom proneness.

feelings of excitement and stimulation.[67,68] Therefore, this emotional and physiological positive reinforcement strengthens the association between boredom and phubbing behavior.

The Mediating Role of Loneliness

The results of this study demonstrate that loneliness mediates the relationship between boredom proneness and phubbing, supporting Hypothesis 2. Boredom has become a common emotional experience in modern society.[69] Due to the lack of internal and external stimulation, individuals' psychological needs often remain unfulfilled, leading to the emergence of negative emotions such as loneliness. Numerous studies have shown a significant positive correlation between loneliness and boredom.[35] Our findings further indicate that boredom is an important predictor of loneliness. Additionally, boredom proneness reduces individuals' subjective well-being[70] and induces academic disengagement,[27] which may lead to interpersonal avoidance and increase feelings of loneliness. Moreover, individuals with high levels of boredom proneness may directly experience loneliness due to their slowed time perception and lack of meaning in life.[71] Previous research has pointed out that individuals with high levels of boredom proneness exhibit higher impulsivity, anger, and aggression tendencies,[72] which may impact the quantity and quality of their interpersonal relationships, thus exacerbating feelings of loneliness. Furthermore, our results confirm that loneliness serves as a predictive variable for phubbing, supporting the Compensatory Internet Use Theory.[38] Specifically, individuals frequently use social media platforms or check their friends' updates to avoid feelings of loneliness and attain positive social experiences. At the same time, the entertainment and global connectivity functions of smartphones significantly expand college students' psychological space, providing support and compensation in the virtual realm, consequently leading to phubbing. It is worth noting that this study was conducted during the COVID-19 pandemic, when the Chinese government implemented stay-at-home policies and dynamic eradication strategies, disrupting regular offline social activities for college students and prompting them to turn to the virtual world facilitated by smartphones, which may have intensified their phubbing behavior.

The Mediating Role of FoMO

The results of this study demonstrate that FoMO mediates the relationship between boredom proneness and phubbing, supporting Hypothesis 3. Previous research on the relationship between boredom and FoMO is limited, but a cross-sectional study has shown a significant positive correlation between boredom proneness and FoMO.[44] Our findings confirm that boredom proneness is an important predictor of FoMO, expanding upon previous related research. Specifically, individuals with high levels of boredom proneness, due to the lack of internal and external stimulation, are more likely to exhibit attention to others' new and novel experiences and social information, as well as anxiety about missing such information, namely, FoMO. Additionally, our results confirm that FoMO is a predictor of phubbing behavior. This finding supports the Compensatory Internet Use Theory, which posits that individuals with FoMO are motivated to use mobile social media to alleviate negative emotions and satisfy their psychological needs for external change.[38] As a stable personality trait, individuals with higher levels of FoMO are habitually concerned about missing out on others' novel experiences and social information. This leads them to experience pervasive anxiety at the emotional level, strong expectations to keep up with others at the cognitive level, and frequent use of maladaptive mobile social media at the behavioral level.[41] Previous related research has indicated that FoMO is an important predictor of addictive social media use and problematic mobile phone use.[46,47] In other words, individuals with higher levels of FoMO are more likely to develop smartphone addiction and engage in phubbing behavior. Brown and Kuss[73] conducted an experimental study and found that after 7 days of social media abstinence, individuals (with an average age of 24.4) showed significant reductions in FoMO and smartphone use, along with significant increases in mental well-being and social connectedness. Smartphones serve as important tools for individuals to engage in social activities and access social media information, and individuals with FoMO are inseparable from their phones due to their fear of missing out on social activities or social media content. Previous research has suggested that FoMO may serve as a mediator to explain the relationship between psychological factors and phubbing.[74] Our research results have confirmed the mediating role of FoMO between boredom proneness and phubbing.

The Multiple Mediation Model

In this study, the sequential mediating effect of loneliness and FoMO between boredom proneness and phubbing behavior has also been validated. Hypothesis 4 is supported. Boredom proneness, as a negative psychological trait, leads individuals to experience negative emotions, including loneliness and anxiety. Lonely individuals may choose their phones to fulfill their unmet needs. However, when individuals become engrossed in satisfying their psychological needs through phone use, it can potentially trigger phone dependency and result in fear of missing out on information,[50] which in turn exacerbates dependency on phones.[47] Excessive reliance on phones transforms individuals into "phubbers", causing them to neglect the people or things around them. Additionally, as heavy users of smartphones and social media, young adults, especially during the COVID-19 lockdowns, have had to spend more time at home and reduce their usual social activities, intensifying their experience of loneliness. When individuals have a strong sense of loneliness, their relational needs are often unmet, leading to a sense of disconnection and reduced interaction with others, which may trigger FoMO. Individuals with high levels of FoMO tend to use their phones more frequently to interact with others, fulfilling their social needs and alleviating psychological stress. During COVID-19 lockdowns, young adults may spend more time at home, and people were more likely to use their cell phones to interact with others to meet their social needs as well as to relieve negative emotions including boredom, loneliness and FoMO.

Implications, Limitations and Future Directions

Based on the I-PACE model, this study constructed a multiple mediation model to reveal the risk factors leading to phubbing, which has implications for the intervention of phubbing among college students. For example, expanding offline activities and enriching campus life can reduce negative emotional experience such as boredom, loneliness, and anxiety among college students. Additionally, offering related courses and lectures to help college students improve their emotional management abilities, thereby suppressing phubbing.

Although our research has some contributions, several limitations should be considered. First, this research used a cross-sectional study design to obtain data, so we cannot confidently establish causal inferences between variables. For instance, prior cross-sectional research indicates boredom proneness predicts loneliness,[33] and vice versa,[35–37] but lacks longitudinal or cross-lagged evidence for a two-way predictive relationship between boredom proneness and loneliness. Future study can investigate this adopting longitudinal research design or experimental method. Second, we selected college students as the study sample, and thus our findings should be cautiously to extended to other sample groups. Future work should validate our findings in a more diverse population. Third, the data were collected using self-report questionnaires, so the results may be affected by social desirability bias. For instance, previous research has found that people tend to underestimate the amount of time they use their smartphones.[75] Future study can use objective data from smartphone logs to enhance the ecological validity of the findings. Fourth, previous research has suggested that, influenced by philosophical traditions, the Chinese tend to adopt coping strategies of avoidance or suppression when faced with negative emotions in contrast to the majority of Westerners.[76] How do these coping strategies for negative emotions (eg, loneliness) impact phubbing? In addition, there is no strict boundary between work and life in China,[77] and people are often informed by their superiors to handle company affairs even when they are off work at home. Does this exacerbate their FoMO and increase phubbing? Future cross-cultural research will help to clarify these questions. Fifth, this study employed the I-PACE model as a theoretical framework and confirmed that certain individual predisposing variables (such as boredom proneness) and negative emotions (such as loneliness, FoMO) can predict phubbing, while cognitive factors of the I-PACE model were not addressed. Future research can delve into the cognitive aspects to further investigate the underlying causes of phubbing. Finally, this study only examined risk factors that contribute to phubbing, future research can identify protective factors (such as self-control, mindfulness, nature connectedness) to offer a more comprehensive understanding of phubbing.

Conclusion

Phubbing is a significant public concern among emerging adults, and its risk factors are a major academic concern. Our research revealed that: (a) boredom proneness could positively predict phubbing; (b) loneliness and FoMO mediated the relationship between boredom proneness and phubbing, respectively; and (c) loneliness and FoMO sequentially mediated the relationship between boredom proneness and phubbing. This study enhances our understanding of risk factors of phubbing and provides

insightful coping strategies for guiding college students to use their smartphone phones rationally and preventing and intervening in phubbing (eg, interventions based on boredom proneness, loneliness or FoMO).

Data Sharing Statement

The dataset analyzed during the current study is available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

This study was approved by the Academic Ethics and Ethics Committee of Shanghai Normal University and conducted in accordance with the 1964 Declaration of Helsinki. All participants provided written informed consent.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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