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Longitudinal association between habitual mobile phone use and subjective well-being among university students: The chain mediating effect of self-management and learning burnout

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Abstract: This longitudinal study investigated how self-management and learning burnout influences the relationship between habitual mobile phone use and subjective well-being among first-year university students. A sample of 1172 Chinese university students participated in a two-wave survey, with data collected six months apart at two time points (T1, T2). The results of Pearson correlation revealed that higher habitual mobile phone use at T1 was associated with lower subjective well-being at T2. Self-management was associated with healthy phone use habits and higher subjective wellbeing. Learning burnout risk was higher with habitual phone usage. Lower self-management and learning burnout at T2 played a chain mediating role between habitual mobile phone use at T1 and subjective well-being at T2 so that subjective well-being was much lower that with either of the variables alone. Overall, these findings suggest that habitual mobile phone use is a reliable predictor of college student's subjective well-being, by their self-management and level of learning burnout over time. This research highlights the long-term impact of habitual mobile phone use on students' subjective well-being and provides valuable insights for developing effective interventions to support students well-being.

Keywords: habitual mobile phone use; subjective well-being; self-management; learning burnout; university first-year students

Introduction

The widespread use of mobile phones has become deeply integrated into daily life, bringing convenience, while also raising certain concerns regarding its potential for fostering detachment (Mei et al., 2023). Younger adults, in particular, use mobile phones to stay updated with current events, access emails and social media platforms as well as participate in gaming and network-based navigation services (see Elhai et al., 2019). In China, the number of underage internet users surpassed 193 million by 2022, with a penetration rate of 97.2% among minors and 99.3% among senior high school students, mostly through mobile phones (Central Committee of the Communist Youth League, 2023).

However, young adults carry a high risk for mobile phone dependence or addiction (Van Deursen et al., 2015; Mei et al., 2023), also known as problematic phone use (Horwood & Anglim, 2018). Such habitual mobile phone use has been linked to mental health challenges, including declines in subjective well-being (Moqbel et al., 2023; Walsh et al., 2024). Subjective well-being refers to an individual evaluation of his/her overall quality of life according to his/her own criteria, and is composed of three dimensions: positive emotion, negative emotion, and life satisfaction, which is characterized by subjectivity, stability, and wholeness (Wu, 2000). Notably, these effects are not uniform as some studies suggest that habitual mobile phone use has a positive impact on students' mental health (e.g., Brailovskaia et al., 2023; Mathews, 2004). This highlights the importance of exploring mediating factors in the relationship between mobile phone use and subjective well-being.

Emerging evidence suggests that individual factors, such as self-management (e.g., Wang & Kong, 2020) and learning burnout (e.g., Meier, 2022), may influence the relationship between mobile phone use and subjective well-being. Self-management encompasses a set of activities that leverage both internal and external resources to maintain, improve, and enhance oneself (Curtin et al., 2002a, 2002b). Learning burnout refers to negative attitudes and behaviors that are bored with learning due to stress or disinterest in learning (Lian et al., 2006). However, little is known about the mechanisms underlying these associations, particularly in university students, who represent a key demographic of frequent mobile phone users. This study aimed to address this gap in the evidence in the Chinese context.

Habitual mobile phone use and subjective well-being

Habitual phone usage is by frequency of mobile phone use that lacks awareness, attention, intention, and control due to impulsive dependence associated with usage contextual cues (Yang, 2022). Young adults transitioning from adolescence to adulthood undergo substantial psychosocial changes that make them highly susceptible unhealthy relationship budiling and sustenance tools (Iorga et al., 2018; Mei et al., 2023). For instance, their university freshman year, young adults rely heavily on mobile phone usage (Liu et al., 2022), and which they may perceive as "unconscious", "emotional" and "uncontrollable" (Duan, 2020) as in habitual mobile phone use. This would be harmful to their subjective well-being if not well managed and as they may encounter school learning pressures with risk of learning burnout of which some may over rely on their phones for emotional comfort. However, previous research on the impact of mobile phone use

behaviour on mental health among university students have yielded inconsistent findings. While some studies have reported college students' excessive mobile phone use is closely related to the decline of subjective well-being (Li, 2023; Moqbel et al., 2023), others have reported mobile phone to actually help students improve their mental health by relieving their stress from the ease of interactions with others (Mathews, 2004; Brailovskaia et al., 2023). This inconsistency in the evidence calls for further investigation into the relationship between mobile phone use and mental health among young adults.

Well-being, as an essential characteristic of mental health, focuses on the positive feelings and experiences of individuals and is the cognitive foundation of their healthy mental state (Yu, 2022), of which the unprecedented reliance on mobile technologies presents a huge vacuum in protective practices with vulnerable human populations such as young adults. What and how subjective well-being entails in the digital age is an open questions (Walsh et al., 2024). On the one hand, mobile phone use satisfies many needs in daily life, such as shopping, learning, entertainment, socializing, etc., which enhances people's satisfaction (Mei et al., 2023). On the other hand, when basic needs are satisfied, mobile phone use, if it replaces or interferes with other activities, may affect well-being in the opposite direction. According to the reciprocal determinism of social cognitive theory (Chen et al., 2016), the effect of habitual cell phone use behavior on individuals' mood may indirectly affect and predict his/her subjective well-being through some mediating variables such as their self-management.

Self-management and learning burnout in mobile phone usage

Social cognitive theory of self-management (Sun & Xue, 2008) posits that the interaction of three variables: individual, behavior, and environment explain personal coping. Individuals engage in self-management as coping to align various aspects of their lives with their personal goals for greater life satisfaction (Sheldon & Elliot, 1998; Judge et al., 2005). Previous research (Wang & Kong, 2020) has shown that the frequency of mobile phone use affects the self-management ability of university students, with those who use mobile phones for less than three hours per day performing significantly better than other college students in the areas of time management, study management, goal management, and emotional control.

Learning burnout is associated with lower psychological well-being. There is evidence to suggest that excessive mobile phone use and addiction can lead to learning burnout among university students (Gundogan, 2023; Li et al., 2021; Yang, 2022; Zhang et al., 2021), assuming poorer self-management. Notably, students may experience high levels of study burnout and moderate to low levels of subjective well-being by academic demands on them (Deng, 2020; Zhang et al., 2021). Excessive mobile phone usage compromizes self-regulation, which would lead poorer academic performance and mental health well-being (Meier, 2022).

Goals of the Study

Given the pervasive integration of mobile phones into daily life, this study aimed to determine the role of self-management and learning burnout in habitual mobile phone and subjective well-being among college students. A longitudinal research design was used to explore the interactions between the variables at two successive time points: Time 1 (T1), and Time 2 (T2). We tested the following hypotheses:

Hypothesis H1: Higher habitual mobile phone use at T1 is associated negatively with subjective well-being at T2.

Hypothesis H2: Self-management plays a mediating role in the relationship between habitual mobile phone use at T1 and subjective well-being at T2 for higher subjective well-being at T2.

Hypothesis H3: Learning burnout plays a mediating role in the relationship between habitual mobile phone use at T1 and subjective well-being at T2 for higher subjective well-being at T2.

Hypothesis H4: Self-management and learning burnout have a chain mediating effect at on the habitual mobile phone and subjective well- over time for higher subjective well-being with higher self management and lower learning burnout.

Methods

Participants and setting

Our study sample comprised 1647 college students (females = 54.22%, mean age = 17.96, SD = 0.66) at Time 1 and 1172 college students (females = 53.92%, mean age = 17.97, SD = 0.63) at Time 2 or 6 months after (attrition rate = 28.84%). This students were freshmen from a university in Changsha, Hunan Province, China. Notably, there were no significant differences observed among the T1, T2, and valid sample groups regarding age, gender and birthplace ($p > 0.05$) (see Table 1). About 46.25% of participants were from cities, and the rest of them were from rural areas. By phone usage, 267 students (22.78%) used their phones for more than 6 h a day.

Measures

Habitual Mobile Phone Use (HMPU)

Participants self-reported their own habitual mobile phone use using the Habitual Mobile Phone Use Scale (HMPUS, Yang, 2022). The HMPUS consists of 31 items which are mainly divided into 5 factors: lack of control, context dependence, goal independence, patterned behavior, and efficiency. Sample items included statements such as "I involuntarily want to use my phone when I feel bored, embarrassed, or in a bad mood", "I occasionally unlock my phone screen and don't know what to do", "every time I open my phone, I use some fixed phone functions", "I can use my phone while paying attention to other things", and "I tried to reduce phone usage time but was unsuccessful". Items are on a five-point Likert scale ratings from "never" to "always", with scores of 1 to 5 assigned accordingly. A higher score indicated more pronounced habitual mobile phone use. The Cronbach's alpha coefficient for HMPUS scores was 0.93 at TI of this study.

Table 1. Demographic characteristics of the T1, T2, and effective samples and sample differences

	T1 (N = 1647)	T2 (N = 1179)	Effective samples (N = 1172)	χ^2/t	*p*
Age (Mean ± SD)	17.96 ± 0.66	17.97 ± 0.63	17.97 ± 0.63	0.06	0.95
Males (%)	754 (45.78)	545 (46.23)	540 (46.08)	0.14	0.71
Urban (%)	772 (46.87)	543 (46.06)	542 (46.25)	0.64	0.42

Note. T1 and T2 were the test at Time 1 and Time 2.

Self-Management (SM)

Self-management was assessed using the Self-management Scale (SMS, Zhang et al., 2009). The SMS comprises 42 items divided into 4 factors: cognitive management, emotional management, behavior management and time management. Sample items are "I am able to set learning goals according to my own actual situation", "I often lose my temper over small things", "Before class, I often prepare for what I am going to study", and "I can complete my study tasks within the time limit". Items are on a five-point Likert scale ranging from "never", to "always", with scores of 1 to 5 assigned accordingly. A higher score indicated a higher level of self-management. The present study, SMS scores achieved a Cronbach's alpha coefficient of 0.92 at T1 of this study.

Learning Burnout (LB)

The Learning Burnout Scale (LBS, Lian et al., 2006) consists of 20 items covering three domains of burnout: dejection, improper behavior and reduced personal accomplishment. Sample items are "So far, my university studies have enabled me to demonstrate my abilities to the fullest", "It is difficult for me to stay enthusiastic about studying for a long time", and "I want to study but I feel that it is boring". Participants rateeach item on a five-point Likert scale ranging from "never" to "always", with scores of 1 to 5 assigned accordingly. A higher the score indicated a higher level of learning burnout. The scale consists of statements such as The LBS scores yielded a a Cronbach's alpha coefficient of 0.87 at T1 of this study.

Subjective Well-Being (SWB)

Participants' subjective well-being was assessed using the Index of Well-Being Scale (IWBS, Campbell et al., 1976), as adapted by Wang et al. (1999). This scale comprises nine bipolar adjective items rated on a seven-point scale, ranging from "painful" to "happy". The final score was calculated as the average score of the first eight items plus the score of the last item with a weight of 1.1; possible scores range between 2.1 (indicating the lowest level of happiness) and 14.7 (indicating the highest level of happiness). The IWBS scores had a Cronbach's alpha coefficient of 0.92 at T1 of this study.

Procedure

The Human Research Ethics Committee of Hunan Normal University approved this study. Participants granted informed consent. Data were collected by trained psychology postgraduate students, who informed the participants about the purpose of the study and voluntary participation as well as their right to withdraw at any time without penalty. Furthermore, participants were assured that the data would be kept strictly confidential and that the completed questionnaires were only available to research personnel.

Data analyses

Data were analyzed SPSS 27.0.1. and Mplus 8.0. We used habitual mobile phone use at T1 as independent variables, self-management and learning burnout at T2 as mediating variables, and subjective well-being at T2 as dependent variables, respectively, to construct the hypothetical mediating model. We employed structural equation modeling and bootstrapping to test these relations by specifying a sample of 1000 to examine the significance of the role of the mediators.

We employed the Harman single-factor test (Podsakoff & Organ, 1986), to check whether there was a common method deviation. The results showed that the explanatory capacity of the first principal component variation extracted by non-rotating factors was 19.59% and 19.13% in turn, which was less than the standard threshold of 40%, and 26 and 24 factors with characteristic values greater than 1 were separated in turn. Therefore, common methodological biases were excluded in this study.

In order to test the chain mediating effect of self-management at T2 and learning burnout at T2 between habitual cell phone use at T1 and well-being at T2, a structural equation model to test the chain mediating effect was constructed using Mplus 8.0 (Figure 1), which was found to be a saturated model, and therefore its goodness-of-fit indices were not estimated, and only the path coefficients were focused on. To further examine the internal mechanism of the relationship between habitual mobile phone use at T1 and subjective well-being at T2, the Bootstrap method (repeated sampling 1000 times) was used.

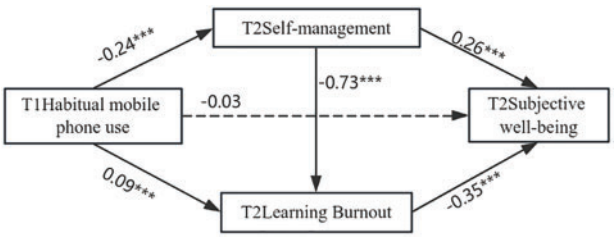

Figure 1. The chain mediating model of habitual mobile phone use and subjective well-being. ***$p < 0.001$. T1 and T2 were the test at Time 1 and Time 2.

Results

Descriptive statistics and correlation coefficients

Table 2 presents the descriptive statistics for each of the main variables and correlations between variables. As

Table 2. Descriptive statistics for each of the main variables and correlations between variables

Variables	1	2	3	4
1. Habitual mobile phone use T1	1			
2. Self-management T2	−0.24***	1		
3. Learning Burnout T2	0.27***	−0.76***	1	
4. Subjective well-being T2	−0.18***	0.52***	−0.55***	1
M	103.05	143.49	55.46	9.49
SD	18.24	18.63	9.89	2.02

Note. ***$p < 0.001$. T1 and T2 were the test at Time 1 and Time 2.

expected, habitual mobile phone use at T1 was significantly negatively associated with self-management and subjective well-being at T2. Also, habitual mobile phone use at T1 was significantly positively correlated with learning burnout at T2. Self-management at T2 was negatively associated with learning burnout at T2. It was also significantly positively correlated with subjective well-being at T2. Learning burnout at T2 was significantly negatively correlated with subjective well-being at T2.

Testing for the chain mediating model

Habitual cell phone use at T1 was not a significant direct predictor of well-being at T2 ($\beta = -0.03$, $p = 0.353$). However, habitual phone usage significantly and negatively predicted self-management at T2 ($\beta = -0.24$, $p < 0.001$), and significantly and positively predicted learning burnout at T2 ($\beta = 0.09$, $p < 0.001$). Self-management at T1 significantly and negatively predict learning burnout at T2 ($\beta = -0.73$, $p < 0.001$) and significantly positively predicted well-being at T2 ($\beta = 0.26$, $p < 0.001$); learning burnout at T2 was a significant negative predictor of well-being at T2 ($\beta = -0.35$, $p < 0.001$). Higher habitual mobile phone use at T1 is associated negatively with subjective well-being at T2, which is consistent with Hypothesis 1.

Self-management and learning burnout mediation. Table 3 shows that self-management at T2 and learning burnout at T2 played a fully mediating role in the mechanism of action of habitual mobile phone use at T1 and subjective well-being at T2. The results of the mediation effect test showed that self-management at T2 and learning burnout at T2 had a significant mediating effect, with a total indirect effect of −0.017. Specifically, the model contained three indirect paths:

(1) T1 habitual mobile phone use→T2 self-management→T2 subjective well-being (e = −0.007, 95% CI [−0.010, −0.004]), and the 95% confidence interval for the mediating effect of self-management at T2 did not contain 0, indicating that the mediating effect of self-management at T2 was significant. This result is consistent with Hypothesis 2.

(2) T1 habitual mobile phone use→T2 learning burnout→T2 subjective well-being (e = −0.003, 95% CI [−0.005, −0.002]), with a significant mediating effect of learning burnout at T2. This result is consistent with Hypothesis 3.

(3) T1 habitual mobile phone use→T2 self-management→T2 learning burnout→T2 subjective well-being (e = −0.007, 95% CI [−0.010, −0.005]), with a significant mediating effect of self-management at T2 vs. learning burnout at T2 had a significant chain-mediated effect in the mechanism of action of habitual mobile phone use at T1 affecting subjective well-being at T2. This result is consistent with Hypothesis 4.

Discussion

Utilizing a longitudinal design, the present study investigated the relationship between habitual mobile phone use and subjective well-being and the underlying mechanisms. Our findings indicated that habitual mobile phone use is associated negatively with subjective well-being among university students, and cannot directly predict their subjective well-being. The present study confirmed the long-term effects of habitual mobile phone use on university freshmen' subjective well-being, and the relationship has been shown to have cross-cultural validity (Kushlev & Leitao, 2020; Meier, 2022). Conceivably, habitual mobile phone usage may affect individual's psychological outcomes by displacing other activities (Putnam, 2015). Although the concept of habit does not entail a moral judgment, as Kushlev and Leitao (2020) proposed, we reiterate the fact that habitual mobile phone use had only a modest adverse effect on the overall subjective well-being of university students, while excessive and problematic use could be harmful to both physical and mental health.

We found decreases self-management levels of university students to be associated with lower subjective well-being. Various habitual mobile phone use patterns reflect self-management capabilities for improved subjective well-being (Takwin et al., 2012; Wang & Kong, 2020; Yang, 2022). University students adept at managing their cognition, emotions, behaviors, and time are inclined to set higher goals through proactive strategies (Syawaludin et al., 2020), from which they will experience more satisfaction and happiness.

Second, habitual mobile phone use was found to indirectly influence university first-year students' subjective well-being through learning burnout. This may be explained by the fact that heightened levels of learning burnout among university students predisposes to excessive use of mobile phones, which could be depleting of time and energy (Yang, 2022), which would lower subjective well-being amomg university students (Gundogan, 2023).

Finally, this study also found that learning burnout mediated the relationship between self-management and subjective well-being among university students, so that self-management proficiency could mitigate learning burnout and enhance subjective well-being. This findings is consistent with the a previous study (Meier, 2022). This study further found that self-management and learning burnout as chain mediators in the relationship

Table 3. Significance assessment of the bootstrap analysis of the mediating effects

Model pathways	Estimate	Boot SE	95% CI		% mediated
			Lower	Upper	
Ind1 T1 habitual mobile phone use→T2 self-management→T2 subjective well-being	−0.007	0.002	−0.010	−0.004	39.8%
Ind2 T1 habitual mobile phone use→T2 learning burnout→T2 subjective well-being	−0.003	0.001	−0.005	−0.002	20.6%
Ind3 T1 habitual mobile phone use→T2 self-management→T2 learning burnout→T2 subjective well-being	−0.007	0.001	−0.010	−0.005	39.6%
Total Indirect effect	−0.017	0.002	−0.022	−0.012	100.0%
Ind1-Ind2	−0.003	0.002	−0.007	0.000	
Ind1-Ind3	0.000	0.002	−0.003	0.003	
Ind2-Ind3	0.003	0.001	0.001	0.006	

Note. T1 and T2 were the test at Time 1 and Time 2.

between habitual mobile phone use and subjective well-being among university students. This could be explained by the fact that students with poorer self-management become mobile phones "slaves", risking heavy, excessive use which is harmful to well-being (Kushlev & Leitao, 2020; Meier, 2022).

Implications for research and practice

This study provides a foundation for advancing theoretical inquiry into the long-term impacts of habitual mobile phone use on mental health among university students. Exploring these effects of habitual mobile phone use across various mental health dimensions, beyond subjective well-being to include depression, anxiety and stress would be beneficial. Furthermore, several potential mediators in the relationship between habitual mobile phone use and subjective well-being among university students, such as cognitive control, perceived social support, and sleep quality, warrant further investigation.

The study also provides insights for future practical interventions to enhance student well-being in the digital age. Since self-management plays a crucial role in mitigating emotional challenges (Town et al., 2023) and promoting subjective well-being (Takwin et al., 2012), interventions should prioritize building self-management skills in students. Workshops and counseling sessions focused on cognitive management, emotional management, behavior management and time management could empower students to balance mobile phone use and subjective well-being more effectively. Moreover, educators should prioritize recognizing signs of learning burnout related to mobile overuse and provide proactive support to prevent its negative impacts on students' well-being. Through these targeted interventions, university students would develop coping strategies that support sustained well-being, both academically and personally.

Limitations of the study and future directions

Like other studies, this study has several limitations that should be discussed. First, although we adopted a rigorous design to enhance the potential generalizability of the results, the relationship between mobile phone use and subjective well-being may also be influenced by cultural factors. Therefore, conducting cross-cultural comparisons in future studies would be beneficial. Second, this study used a self-report questionnaire that is easily influenced by social expectations. Although the bias effect caused by the common method was minimal, we recommend incorporating observational data as an additional triangulation method to enhance the reliability of the results. Third, although longitudinal studies have advantages over cross-sectional studies, the ability to make causal claims is limited. Future research could strengthen causal inferences by incorporating experimental or quasi-experimental designs.

Conclusion

This study found habitual mobile phone use among university students is closely related to their subjective well-being. Over time, habitual mobile phone usage predicts subjective well-being by the student's self-management abilities and levels of learning burnout. These findings contribute to the understanding of how mobile phone habits influence well-being over time taking into account personal factors of self-management ability and risk for learning burnout. This study offers insights for future studies and interventions related to mobile phone use and subjective well-being among university students.

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Ethics Approval: This study involving human participants was reviewed and approved by the Biomedical Research Ethics Committee of Hunan Normal University. Approval Number: 2024-No.389.

Conflicts of Interest: The authors declare no conflicts of interest to report regarding the present study.

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