Review article

The relationship between mobile phone addiction and time management disposition among Chinese college students : A cross-lagged panel model

Yake Wang [a], Yao Lu [b,*], Xiaoxia Tian [c], Yongchun Liu [d], Wenhua Ma [d]

[a] School of Educational Studies, Universiti Sanis Malaysia, Penang, Malaysia
[b] Faculty of Education, Southwest University, Chongqing, China
[c] School of Mathematical Sciences, Henan Institute of Science and Technology, Xinxiang, China
[d] School of Preschool Education, Sichuan Preschool Education College, Mianyang, China

ARTICLE INFO

ABSTRACT

Previous research has identified a negative association between mobile phone addiction and time management disposition among college students; however, the direction of this relationship remains divergent. This study utilized a cross-lagged panel model to elucidate the directionality of the relationship between mobile phone addiction and time management disposition. A total of 466 college students completed two measures at seven-month intervals. The findings revealed a prevalence of mobile phone addiction at 10.94 % and 13.73 % in the two surveys. Notably, both mobile phone addiction and time management disposition demonstrated stability over time. Furthermore, a discernible negative bidirectional relationship was observed between the two. The present findings underscore the importance of timely intervention for college students facing challenges in mobile phone usage and time management.

1. Introduction

According to the survey carried out by the China Internet Network Information Center [1], China's Internet users reported an average weekly online duration of 29.1 hours per capita as of June 2023, with 99.8 % accessing the Internet through mobile phones. Among mobile phone users, over 50 % of college students spend two to 3 h daily on their mobile phones [2]. Mobile phones are integral to the daily lives of college students. Apart from normal usage, they can also be used for learning [3,4]. Nonetheless, excessive usage may contribute to the development of mobile phone addiction [5].

Mobile phone addiction refers to the uncontrolled use of mobile phones, resulting in various physical, psychological, and social issues characterized by symptoms of withdrawal, tolerance, and mood modification [6]. Globally, China ranks among the highest scores for mobile phone addiction among adolescents and young adults [7], with the reported prevalence of addiction among Chinese college students reaching 46.3 % [8]. Multiple studies have identified the detrimental effects of mobile phone addiction on college students, encompassing adverse impacts on physical and psychological health [9,10], academic performance [11], interpersonal relationships [12], and personality development [13].

Time management disposition is a stable personality trait that refers to the psychological and behavioral characteristics that

individuals exhibit in the way they use their time [14]. Notably, Chinese college students' time management disposition has exhibited a steady decline over the past 22 years [15]. Effective time management reflects an individual's capability to use time efficiently, promoting the pursuit of valued goals while avoiding distractions, procrastination, and other inefficient uses of time [16]. Time management skills play a pivotal role in academic achievement, and often serving as a cornerstone for success in college [17]. Inadequacies in time management disposition negatively affect college students' academic engagement [18], and academic performance [19], leading to learning burnout [19], and academic procrastination [20]. Additionally, research indicates that time management disposition is associated with mental health [21], career anxiety [22], and negative coping styles among college students [23].

1.1. Relationship between mobile phone addiction and time management disposition

One of the signs that mobile phone addicts exhibit is an increasing amount of time spent on mobile phones [24]. Time management and its challenges are acknowledged as one of the psychological features of mobile phone addiction [25,26]. Mobile phone addiction is negatively associated with time management disposition among college students [27]. However, there are two perspectives on the directionality of the relationship between the two.

One perspective proposes that mobile phone addiction can predict time management disposition. According to constructivist theory [28], individuals have the capacity for self-construction of their personalities through the utilization of mobile phones, which play a crucial role in people's lives due to their robust functionalities. Therefore, mobile phone addiction may influence the construction of individual personality traits. Furthermore, in accordance with the cognitive model of time perception, mood states dictate arousal and attention, thereby exerting a significant influence on time perception [29]. Notably, mobile phone addiction has been identified as being correlated with mood states [30]. The intricate relationship between time perception and time management has also been highlighted [31]. Evidence from cross-sectional studies suggests that mobile phone addiction significantly predicts time management disposition among college students, leading to impaired time cognitive systems and loss of the ability to monitor and manage time [20,32].

Another perspective believes that time management disposition contribute to mobile phone addiction. According to the self-control theory [33], individuals with low self-control are more prone to engaging in problem behaviors. Time management can be viewed as the monitoring and control of time [34]. Mobile phone addiction, also recognized as problematic mobile phone use [9], is a type of mobile phone use behavior [35]. Moreover, according to the problem behavior theory [36], personality system, perceived environment system, and behavior system, together, generate the proneness of problem hebavior. Time management disposition is a stable personality trait [14]. Empirical evidence from cross-sectional studies shows that time management significantly predicts mobile phone addiction among college students [37,38].

In conclusion, existing studies on mobile phone addiction and time management disposition are all cross-sectional research. Cross-sectional studies cannot determine the direction of effects or elucidate substantive relationships between statistically associated variables [39]. Therefore, this study will utilize longitudinal research to examine the relationship between mobile phone addiction and time management disposition. Theoretically, this study has the potential to enhance comprehension regarding the generative and developmental mechanisms that underlie time management and mobile phone addiction. Practically, time management and mobile phone addiction, as well as their relationship, could affect mental health and academic performance. Examining their relationship could lead to the development of clinical interventions designed to address these issues. For instance, if we identify time management disposition as a potential predictor of mobile phone addiction, then time management training could be used as an intervention to address mobile phone addiction. Alternatively, it might be important to reduce mobile phone use in any intervention that targets improving time management.

2. Method

2.1. Participants and procedures

This study received approval from the ethics committee of Sichuan Preschool Education College (SLB202009). Time 1 was conducted in December 2020, with 663 respondents, including 164 males and 499 females, aged 16–25 years old, with a mean age of 19.80 years (SD = 2.24). Time 2 was in July 2021, with 570 respondents, including 127 males and 443 females, aged 17–26 years old, with a mean age of 20.29 years (SD = 2.15). After excluding the questionnaires with unidentifiable personal information, regular answers, and those failing to meet the criteria of the polygraph question, 466 participants ($M_{age} = 20.49$ years, $SD_{age} = 2.18$; range from 17 to 26 years) were included in the analysis. Among them, 23.4 % were males and 76.6 % were females; 35.6 % were freshmen, 21.9 % were sophomores, 25.1 % were juniors, and 17.4 % were seniors.

The study comprised college students from three colleges in Sichuan, Henan, and Guangxi, China. Using convenience sampling, two classes from each of the four grades in each college were selected for the survey. The survey was carried out in the classroom after school hours and administered by the psychology faculty. An electronic questionnaire was distributed through the online survey platform (www.wjx.com), where participants scanned the QR code to complete the survey. The platform will automatically prompt for missing responses, and the subject can only submit successfully after completing all the questions. Therefore, there were no missing data in this study. All participants volunteered and provided informed consent. Upon completing the survey, participants were offered a gift as an incentive for their involvement.

2.2. Measures

2.2.1. Time management disposition

Time management disposition was measured by the Time Management Tisposition Scale [14]. The scale consisted of 44 items, including three subscales: sense of time value, sense of time control, and sense of time efficacy. Sample items included "I set my study goal every day.'' Items were assessed on a 5-point Likert scale, ranging from 1 (completely disagree) to 5 (completely agree). The Cronbach's alpha was 0.91 at Wave 1 and 0.92 at Wave 2.

2.2.2. Mobile phone addiction

Mobile phone addiction was assessed using the Mobile Phone Addiction Tendency Scale [40]. The scale included 16 items with four dimensions, including withdrawal symptoms, prominent behavior, social comfort, and mood change. Sample items included "I am obsessed with my mobile phone." Items were rated on a 5-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). Higher scores indicate more severe addiction tendencies. A score of 16–30 indicates "no mobile phone addiction," a score of 31–42 indicates "low risk of mobile phone addiction," a score of 43–56 indicates "high risk of mobile phone addiction," and a score of 57 or above indicates "mobile phone addiction" [41]. The Cronbach's alpha was 0.91 at Wave 1 and 0.93 at Wave 2.

2.3. Data analyses

The descriptive analysis, correlation analysis, independent samples *t*-test, and paired-samples *t*-test of the variables were calculated using SPSS 24.0. A descriptive analysis was conducted to scrutinize the demographic characteristics of the participants and the variable scores from the two surveys. Correlation analysis was utilized to examine the correlation between the variables at the same and different time points. A paired samples *t*-test was used to examine the differences between the variables in the two surveys.

The cross-lagged model was specified with Mplus 7.4, and maximum likelihood estimation with robust standard errors (MLR) was employed to examine the fit of the model and the directionality of the relationship between the variables. Model fit was evaluated based on the following criteria: CFI > 0.90, TLI > 0.90, RMSEA<0.08, and SRMR <0.08 [42].

Common method biases might exist because both time management disposition and mobile phone addiction were self-reported by the subjects. Common method variance was analyzed using Harman's single-factor test [43]. This test was performed for variables at the two time-points separately. The findings indicated that there were 12 and 11 factors with eigenvalues >1 in the two measures, and the amount of variance explained by the first factor was 20.32 % and 23.19 %, respectively, and they were both <40 % [44]. Hence, the common method bias observed in this study is deemed acceptable.

2.4. Power analyses

The power analyses were conducted using R4.3.1. The post-hoc power of the paired samples *t*-test was tested using the PWR [45] package. The sample size was 466, and the alpha was 0.05. The effect sizes of the *t*-test were 0.2, 0.5, and 0.8, corresponding to small, medium, and large magnitudes, respectively [46]. The results showed that the statistical power of post-hoc for all three effect conditions exceeded 0.99. The post-hoc power of the cross-lagged panel model was calculated using the semCLPM [47] package. Among the parameters, alpha was 0.05, the sample size was 466, autoregressive effects were 0.48 and 0.63, and cross-lagged effects were-0.17 and-0.10 (see Fig. 1). The results showed that the post-hoc power of CLPM in this study was 0.99.
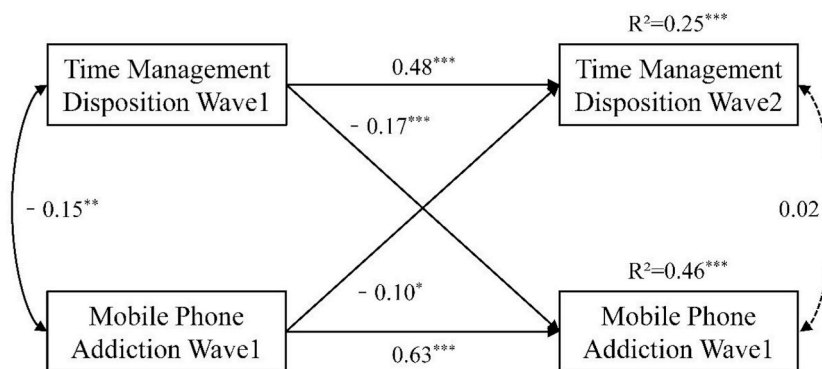

Fig. 1. Cross-lagged model between time management disposition and mobile phone addiction.
*P < 0.05, **P < 0.01, ***P < 0.001.

3. Results

3.1. Preliminary analyses

The results of the descriptive analysis, correlation analysis, and paired-samples *t*-test are shown in Table 1. A total of 466 participants completed two surveys; 51 participants at Time 1 and 64 participants at Time 2 were identified with mobile phone addiction, with a prevalence of 10.94 % and 13.73 %, respectively. Correlation analysis revealed a significant and negative association between time management disposition and mobile phone addiction at each time point (all $Ps < 0.01$). The paired samples *t*-test revealed no significant difference in scores for time management disposition and mobile phone addiction between T1 and T2 (all $Ps>0.05$). This suggests their levels among college students remained relatively stable during the observed period.

3.2. Cross-lagged analyses

To examine the directional relationship between time management disposition and mobile phone addiction, we computed model fit indices by systematically applying equality constraints to the two cross-lagged paths and comparing them to a saturated model (i.e., a model with all possible paths). The hypothesized cross-lagged path (Time 1 time management disposition predicting Time 2 mobile phone addiction) was freely estimated, while the alternative cross-lagged path was constrained. The results indicated that the model exhibited a poor fit to the data, $\chi^2 = 5.53$, df = 1, CFI = 0.98, TLI = 0.90, RMSEA = 0.10, SRMR = 0.03. Likewise, when the alternative cross-lagged path (Time 1 mobile phone addiction predicting Time 2 time management disposition) was freely estimated, the hypothesized cross-lagged path was constrained, and the results indicated that the model exhibited a poorer fit to the data, $\chi^2 = 19.74$, df = 1, CFI = 0.92, TLI = 0.57, RMSEA = 0.20, SRMR = 0.05.

Finally, when both hypothesized cross-lagged paths were allowed to be estimated freely, we obtained the saturated model, $\chi^2 = 0$, df = 0, CFI = 1, TLI = 1, RMSEA = 0, SRMR = 0. As shown in Fig. 1, the saturated model indicated that time management disposition in Wave 1 significantly and negatively predicted mobile phone addiction in Wave 2 ($\beta = -0.17$, $P < 0.001$), and mobile phone addiction in Wave 1 significantly and negatively predicted time management disposition in Wave 2 ($\beta = -0.10$, $P < 0.05$). The results indicated a negative bidirectional relationship between time management disposition and mobile phone addiction.

4. Discussion

According to existing studies, the prevalence of mobile phone addiction among Chinese college students ranges from 4.05 % to 63.58 % [48,49]. In this study, the prevalence was 10.94 % in Time 1 and increased to 13.73 % at Time 2. This result closely aligns with the findings of previous studies [50–52], wherein the prevalence of mobile phone addiction was reported as 13.5 %, 13.14 %, and 15.6 %, respectively. Moreover, there was a slight increase in the prevalence of mobile phone addiction over time, indicating a gradual rise in the number of mobile phone addicts. Although mobile phone addiction scores remained stable over time in this study, changes in addiction rates are still noteworthy. It is important to highlight the persistent lack of standardized diagnostic criteria for mobile phone addiction [53,54], indicating that scale scores may not fully reflect the actual situation of mobile phone addiction among college students.

Time management disposition among college students in this study remained stable across two surveys. This contradicts prior research that documented a persistent decline in time management disposition among Chinese college students over the past 22 years [55]. Three macro-social factors, the economy, employment, and the Internet, contribute to this decline [55]. The time interval for this study is seven months. During this period, the macro-social environment is stable. Therefore, college students' time management disposition will remain stable. In this study, mobile phone addiction among college students remained constant over time, aligning with earlier research findings [56,57]. Mobile phone addiction is a type of behavioral addiction [58], that develops from habits [59]. Changing habits is notoriously challenging, and the cue-action memory traces that constitute habits are difficult to erase and override [60]. According to the rational addiction theory [61], individuals consider the effects, rewards, and risks of addictive behaviors, and if the use of the addictive good or activity is superior to non-use, individuals will increase their usage. The rewards associated with mobile phone addiction predominantly hinge on the features and conveniences of the device, which remain consistent both prior to and subsequent to the addiction. Therefore, stable rewards lead to the stabilization of college students' mobile phone addiction.

Table 1
Descriptive statistics, bivariate correlations, and paired samples *t*-test for key variables.

Variables	M	SD	1	2	3	t	P
1.Wave 1 TMD	160.26	17.43				0.11	0.910
2.Wave 2 TMD	160.17	18.19	0.49**				
3.Wave 1 MPA	43.56	10.98	-0.15**	-0.18**		0.60	0.550
4.Wave 2 MPA	43.30	11.78	-0.26**	-0.18**	0.66**		

Note. N = 466. TMD = time management disposition; MPA = mobile phone addiction.
**$P < 0.01$.

4.1. The relationship between mobile phone addiction and time management disposition

In alignment with previous cross-sectional studies [20,32], this study suggests that mobile phone addiction significantly predicts time management disposition among college students. Time management disposition is a stable personality trait [14]. According to constructivist theory, personality emerges as a result of individual self-construction [28]. Individuals employ behavior as a means of exploring the world and fostering self-construction. Hence, the use of mobile phones, encompassing instances of mobile phone addiction, inherently shapes an individual's personality traits. This assertion is further supported by a longitudinal study revealing a significant predictive relationship between problem behaviors and personality traits [62]. Moreover, this finding is consistent with the cognitive model of time perception [29]. This theory suggests that emotional states affect pacemaker and transition through arousal and attention, respectively. Mood modification is one of the symptoms of mobile phone addiction [6], which can lead to negative emotions [48]. In addition, mobile phone addiction can cause distraction and attention problems [63,64]. Therefore, time perception can be affected by mobile phone addiction. Furthermore, mobile phone addiction is considered an impulse control disorder [24]. Impulsive individuals tend to exhibit a heightened focus on the passage of time and often encounter challenges in time estimation [65]. Eventually, the perception and estimation of time will affect time management disposition.

Time management disposition significantly predicts mobile phone addiction among college students, aligning with previous cross-sectional studies [37,38]. It is in line with the problem behavior theory [36], which posits that personality systems, social environmental system, and perceived environmental system contribute to problem behavior. Time management disposition is a stable personality trait [14]. Behavior is an external manifestation of psychology, and college students who face challenges in time management disposition will also show this trait when using mobile phones. This trait will make it difficult for them to manage their mobile phone usage. Mobile phone usage positively predicts mobile phone addiction (Javaid et al., 2019). In addition, it is also consistent with self-control theory [33]. According to self-control theory, individuals with low self-control may struggle to regulate their behaviors. Notably, loss of control is one of the core components of behavioral addiction [66]. Time management is indicative of an individual's monitoring and control of their time [14]. Therefore, time management disposition negatively predicts mobile phone addiction among college students.

5. Conclusion

The prevalence of mobile phone addiction among Chinese college students was observed to be at a low level. Time management disposition and mobile phone addiction demonstrated relative stability over time within this population. Furthermore, a negative bidirectional relationship was identified between time management disposition and mobile phone addiction among Chinese college students.

6. Implications and limitations

Mobile phone addiction scores remain stable over time, but the number of addicts is increasing, which suggests that subgroups with different addiction levels within our group may have different trends over time. Therefore, it is crucial to optimize screening efforts and improve the targeting and effectiveness of interventions. Previous studies have indicated a steady decline in time management disposition among Chinese college students over the past 22 years [15]. This study reveals the enduring stability of this trait over time, providing crucial insights for a re-examination of the evolution of time management disposition. This study has unveiled a negative bidirectional relationship between time management disposition and mobile phone addiction among college students, carrying several crucial implications. First, the conclusions emphasize the significance of developing healthy mobile phone use habits, especially time management in mobile phone use, and providing time management education for college students, which not only helps to reduce mobile phone addiction but also contributes to academic performance and psychological health. Second, this study discloses the impact of mobile phone addiction on the personality trait of time management disposition, which helps to expose the mechanism of change in college students' time management disposition.

The current study is constrained by several limitations. First, self-evaluation scales were utilized, inevitably introducing measurement errors. Further research should consider adopting multi-source and objective indicators. Second, the present two-time measurement point study did not allow for examination of the dynamic relationship between time management disposition and mobile phone addiction. In addition, the time interval in this study was seven months, so it is unclear whether the current results present the psychological state or characteristics of the subjects. To address this issue, future research could contemplate employing multiple waves of data and extending the duration of the study. Third, the sample distribution was not balanced across gender and grade levels. This imbalance precludes the examination of within-subject differences and exerts a discernible impact on the generalizability of the findings. Therefore, further research should address this limitation by using a more equitable sampling strategy. Finally, considering the exclusive focus on Chinese college students in this study, it is imperative for future research to replicate these findings across varied countries and demographic groups, thereby enhancing the generalizability of the results.

Ethical statement

This study was approved by the Ethics Committee of Sichuan Preschool Education College (SLB202009). All research subjects signed an informed consent form.

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Yake Wang: Writing – original draft, Formal analysis, Data curation, Conceptualization. **Yao Lu:** Writing – review & editing, Supervision, Project administration. **Xiaoxia Tian:** Supervision, Investigation. **Yongchun Liu:** Software, Investigation. **Wenhua Ma:** Supervision, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] China Internet Network Information Center, The 52th Statistical Report on China's Internet Development, 2023.
[2] L. Li, L. Wang, X. Wang, Effect of smartphone use before bedtime on smartphone addiction behaviors among Chinese college students, Front. Psychol. 13 (2022) 1023245.
[3] E. Yu, S. Canton, Student-inspired optimal Design of online learning for generation Z, J. Educ. Online 17 (2020) 1–11.
[4] H. Alfawareh, S. Jusoh, Smartphones usage among university students: najran University case, Int. J. Acad. Res. 6 (2014) 321–326.
[5] Ş. Gökçearslan, F.K. Mumcu, T. Haşlaman, Y.D. Çevik, Modelling smartphone addiction: the role of smartphone usage, self-regulation, general self-efficacy and cyberloafing in university students, Comput, Hum. Behav. 63 (2016) 639–649.
[6] Z. Zou, H. Wang, F.d.O. Uquillas, X. Wang, J. Ding, H. Chen, Definition of substance and non-substance addiction, Adv. Exp. Med. Biol. (2017) 21–41.
[7] J.A. Olson, D.A. Sandra, É.S. Colucci, A. Al Bikaii, D. Chmoulevitch, J. Nahas, A. Raz, S.P.L. Veissière, Smartphone addiction is increasing across the world: a meta-analysis of 24 countries, Comput. Hum. Behav. 129 (2022) 107138.
[8] J. Ge, Y. Liu, W. Cao, S. Zhou, The relationship between anxiety and depression with smartphone addiction among college students: the mediating effect of executive dysfunction, Front. Psychol. 13 (2023).
[9] G. Zhang, X. Yang, X. Tu, N. Ding, J.T.F. Lau, Prospective relationships between mobile phone dependence and mental health status among Chinese undergraduate students with college adjustment as a mediator, J. Affect. Disord. 260 (2020) 498–505.
[10] S.A. Volkmer, E. Lermer, Unhappy and addicted to your phone? – Higher mobile phone use is associated with lower well-being, Comput. Hum. Behav. 93 (2019) 210–218.
[11] O.J. Sunday, O.O. Adesope, P.L. Maarhuis, The effects of smartphone addiction on learning: a meta-analysis, Comput. Hum. Behav. Rep. 4 (2021) 100114.
[12] C. Osorio-Molina, M.B. Martos-Cabrera, M.J. Membrive-Jiménez, K. Vargas-Roman, N. Suleiman-Martos, E. Ortega-Campos, J.L. Gómez-Urquiza, Smartphone addiction, risk factors and its adverse effects in nursing students: a systematic review and meta-analysis, Nurse Educ. Today 98 (2021) 104741.
[13] S. Lee, M. Kim, J.S. Mendoza, I.M. McDonough, Addicted to cellphones: exploring the psychometric properties between the nomophobia questionnaire and obsessiveness in college students, Heliyon 4 (2018) e00895.
[14] X. Huang, Z. Zhang, The compiling of the adolescence time management disposition inventory, Acta Psychol. Sin. 33 (2001) 338–343.
[15] B. Chen, X. Sun, Cross-temporal changes of college students' time management disposition in the mainland of China during 1999∼ 2020, Adv. Psychol. Sci. 30 (2022) 1968–1980.
[16] C.A. Wolters, A.C. Brady, College students' time management: a self-regulated learning perspective, Educ. Psychol. Rev. 33 (2021) 1319–1351.
[17] L.C. Hensley, C.A. Wolters, S. Won, A.C. Brady, Academic probation, time management, and time use in a college success course, J. Coll. Read. Learn. 48 (2018) 105–123.
[18] J.-y. Liu, Y.-h. Liu, J.-p. Yang, Impact of learning adaptability and time management disposition on study engagement among Chinese baccalaureate nursing students, J. Prof. Nurs. 30 (2014) 502–510.
[19] Y. Hou, M. Yuan, Relationship between time management disposition and learning burnout among undergraduates in medical university: mediating effect of academic self-efficacy, in: Proceedings of the 2019 International Conference on Pedagogy, Communication and Sociology (ICPCS 2019), Atlantis Press, 2019, pp. 293–297.
[20] F. Liu, Y. Xu, T. Yang, Z. Li, Y. Dong, L. Chen, X. Sun, The mediating roles of time management and learning strategic approach in the relationship between smartphone addiction and academic procrastination, Psychol. Res. Behav. Manag. 15 (2022) 2639–2648.
[21] S. Liu, M. Song, H. Teng, Postgraduates' time management disposition and mental health: mediating role of life satisfaction and moderating role of core self-evaluations, BMC Psychol 11 (2023) 316.
[22] P. Han, The influence of college students' time management tendency on job-hunting anxiety: mediating role of job-hunting self-efficacy, Psychiatr. Danub. 34 (2022) 79–83.
[23] S. Sun, Y. Yao, A study on the relationship of time management disposition and coping style, personality characteristics of college students, Chin. J. Clin. Psychol. 14 (2006) 186–188.
[24] L. Leung, Linking psychological attributes to addiction and improper use of the mobile phone among adolescents in Hong Kong, J. Child. Media 2 (2008) 93–113.
[25] F.-Y. Hong, S.-I. Chiu, D.-H. Huang, A model of the relationship between psychological characteristics, mobile phone addiction and use of mobile phones by Taiwanese university female students, Comput. Hum. Behav. 28 (2012) 2152–2159.
[26] S.-I. Chiu, F.-Y. Hong, S.-L. Chiu, An Analysis on the Correlation and Gender Difference between College Students' Internet Addiction and Mobile Phone Addiction in Taiwan, ISRN Addict., 2013 360607, 2013.
[27] X. Liang, W. Lin, T. Zhao, X. Guo, Associations between time management disposition, mobile phone dependence and boredom proneness in college freshmen: a cross-lagged study, J. Psychol. Sci. 45 (2022) 1214–1221.
[28] J.C. Thomas, D.L. Segal, Comprehensive handbook of personality and psychopathology, in: Personality and Everyday Functioning, Wiley, 2006.
[29] M. Wittmann, M.P. Paulus, Decision making, impulsivity and time perception, Trends Cogn. Sci. 12 (2008) 7–12.
[30] C. Nupur, J. Dr Madhu, Mobile phone dependence and its relation with mood states among adolescents, Int. J. Indian Psychol. 8 (2022).

[31] E.A. Makarova, E.L. Makarova, I.S. Korovin, Time perception and time management during COVID-19 pandemic lockdown, Int. J. Cogn. Res. Sci. Eng. Educ. 10 (2022) 57–69.
[32] P. Chen, J. Li, S. Kim, Structural relationship among mobile phone dependence, self-efficacy, time management disposition, and academic procrastination in college students, Iran, J. Public Health 50 (2021) 2263–2273.
[33] M.R. Gottfredson, T. Hirschi, A General Theory of Crime, Stanford University Press, 1990.
[34] B.J.C. Claessens, W. van Eerde, C.G. Rutte, R.A. Roe, A review of the time management literature, Pers. Rev. 36 (2007) 255–276.
[35] Y. Qian, L. Zhang, X. Zheng, H. Wang, Y. Zhou, J. Sun, Cell phone addiction and apps activities among Chinese medical students: prevalence and risk factors, J. Mens Health 16 (2020) E27–E38.
[36] R. Jessor, J.E. Donovan, F.M. Costa, Beyond Adolescence: Problem Behavior and Young Adult Development, Cambridge University Press, New York, NY, US, 1994.
[37] M. Wu, J. Yang, Y. Yuan, Y. Zhang, College students' time management disposition, self-esteem and mobile phone addiction: a moderate mediation model, Int. J. Phys. Act. Health 1 (2022) 10.
[38] D.M. Gezgin, C. Mihci, S. Gedik, The effect of free time management skills upon smartphone addiction risk in university students, J. Educ. Sci. Environ. Health 7 (2021) 354–366.
[39] K.J. Anstey, S.M. Hofer, Longitudinal designs, methods and analysis in psychiatric research, Aust. N. Z. J. Psychiatry 38 (2004) 93–104.
[40] J. Xiong, Z.-K. Zhou, W. Chen, Z.-Q. You, Z.-Y. Zhai, Development of the mobile phone addiction tendency scale for college students, Chin. Ment. Health J. 26 (2012) 222–225.
[41] Y. Wang, Y. Lu, Y. Cao, Q. Huang, J. Chen, The application of latent profile analysis in screening for mobile phone addiction among college students, chin, J. Ergonomics 27 (2021) 66–70.
[42] D. Gao, A. Bullock, J. Liu, Cross-lagged panel analyses of maternal psychological control and young adolescents' emotion regulation, J. Adolesc. 87 (2021) 52–62.
[43] P.M. Podsakoff, S.B. Mackenzie, J.Y. Lee, N.P. Podsakoff, Common method biases in behavioral research: a critical review of the literature and recommended remedies, J. Appl. Psychol. 88 (2003) 879–903.
[44] Y. He, K. Yuan, L. Sun, Y. Bian, A cross-lagged model of the link between parental psychological control and adolescent aggression, J. Adolesc. 74 (2019) 103–112.
[45] S. Champely, C. Ekstrom, P. Dalgaard, J. Gill, S. Weibelzahl, A. Anandkumar, C. Ford, R. Volcic, H. De Rosario, Pwr: Basic Functions for Power Analysis, 2017.
[46] H. Kang, Sample size determination and power analysis using the G*Power software, J Educ Eval Health Prof 18 (2021), 17-17.
[47] M. Moshagen, E. Erdfelder, A new strategy for testing structural equation models, Sturct. Equ. Modeling A Multi. J. 23 (2016) 54–60.
[48] C. Li, Y. Zheng, W. Tang, F. Yang, X. Xie, J. He, Mobile phone addiction levels and negative emotions among Chinese young adults: the mediating role of interpersonal problems, Comput. Hum. Behav. 55 (2016) 856–866.
[49] W.-J. Gao, Y. Hu, J.-L. Ji, X.-Q. Liu, Relationship between depression, smartphone addiction, and sleep among Chinese engineering students during the COVID-19 pandemic, World J. Psychiatr. 13 (2023) 361–375.
[50] M. Bian, L. Leung, Linking loneliness, shyness, smartphone addiction symptoms, and patterns of smartphone use to social capital, Soc. Sci. Comput. Rev. 33 (2014) 61–79.
[51] X. Chen, J. Jing, L. Jiang, Correlation between mobile phone use behavior,mobile phone dependence syndrome,and sleep quality in medical college students, Mod. Prev. Med. 43 (2016) 3957–3960, 3982.
[52] Y. Tian, W. Li, J. Guo, W. Yue, P. Chen, Y. Li, Longitudinal associations among cumulative ecological risk, maladaptive cognitions and smartphone addiction in Chinese university freshmen: a two-wave study, Comput. Hum. Behav. 149 (2023) 107921.
[53] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders (DSM-5®), American Psychiatric Pub, 2013.
[54] World Health Organization, International Classification of Diseases 11th Revision, World Health Organization, Geneva, 2018.
[55] B. Chen, X. Sun, Cross-temporal changes of college students' time management disposition in the mainland of China during 1999~2020, Adv. Psychol. Sci. 30 (2022) 1968–1980.
[56] X. Yang, H. Hu, C. Zhao, H. Xu, X. Tu, G. Zhang, A longitudinal study of changes in smart phone addiction and depressive symptoms and potential risk factors among Chinese college students, BMC Psychiatr. 21 (2021) 252.
[57] Y. Wang, Y. Lu, J. Chen, X. Tian, A longitudinal study of the relationship between perceived stress and mobile phone addiction tendency in college students, Chin. Ment. Health J. 37 (2023) 813–818.
[58] J. De-Sola Gutiérrez, F. Rodríguez de Fonseca, G. Rubio, Cell-phone addiction: a review, Front. Psychiatry 7 (2016).
[59] S.S. Alavi, M. Ferdosi, F. Jannatifard, M. Eslami, H. Alaghemandan, M. Setare, Behavioral addiction versus substance addiction: correspondence of psychiatric and psychological views, Int. J. Prev. Med. 3 (2012) 290.
[60] B. Verplanken, S. Orbell, Attitudes, habits, and behavior change, Annu. Rev. Psychol. 73 (2022) 327–352.
[61] O. Rogeberg, The theory of rational addiction, Addiction 115 (2020) 184–187.
[62] T.A. Klimstra, J. Akse, W.W. Hale, Q.A.W. Raaijmakers, W.H.J. Meeus, Longitudinal associations between personality traits and problem behavior symptoms in adolescence, J. Res. Pers. 44 (2010) 273–284.
[63] S. Lee, I.M. McDonough, J.S. Mendoza, M.B. Brasfield, T. Enam, C. Reynolds, B.C. Pody, Cellphone addiction explains how cellphones impair learning for lecture materials, Appl. Cogn. Psychol. 35 (2021) 123–135.
[64] F. Zheng, P. Gao, M. He, M. Li, C. Wang, Q. Zeng, Z. Zhou, Z. Yu, L. Zhang, Association between mobile phone use and inattention in 7102 Chinese adolescents: a population-based cross-sectional study, BMC Publ. Health 14 (2014) 1–7.
[65] C. Paasche, S. Weibel, M. Wittmann, L. Lalanne, Time perception and impulsivity: a proposed relationship in addictive disorders, Neurosci. Biobehav. Rev. 106 (2019) 182–201.
[66] J. Billieux, P. Maurage, O. Lopez-Fernandez, D.J. Kuss, M.D. Griffiths, Can disordered mobile phone use Be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research, Curr. Addict. Rep. 2 (2015) 156–162.