



Intervention Effect of Mindfulness-Based Mental Health Education Therapy on Adolescents Mobile Phone Addiction and Cognitive Tendency

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Abstract

Background: Teenagers are more prone to mobile phone addiction than other age groups due to their lack of self-control. This addiction to mobile phones severely affects their physical and mental health, causing irreversible harm as they grow older. As such, exploring suitable psychotherapy for their physical and mental development needs is essential, in ways that effectively change teenagers' mobile phone addictive behaviors.

Methods: An experimental study was conducted on 910 teenage volunteers recruited from 5 communities in Gansu, Hebei, and Liaoning Provinces in China from May to July 2023. The participants were screened using the Mobile Phone Addiction Index Scale (MPAI). On the basis of the evaluation results, 56 individuals were selected based on the evaluation results and randomly divided into experimental and control groups, each comprising 28 individuals. The experimental group underwent an 8-week mindfulness-based mental health education therapy. Both groups were measured before and after the intervention.

Results: The mobile phone addiction score of the experimental group was significantly lower than that of the control group ($P < 0.001$). The cognitive tendency score and mental wellbeing score of the experimental group was significantly higher than those of the control group ($P < 0.001$).

Conclusion: Mindfulness-based mental health education therapy effectively alleviates teenagers' mobile phone addiction and improves their cognitive tendencies and mental health. This approach serves as a valuable reference for effectively preventing and managing mobile phone addiction among teenagers.

Keywords: Mental health education; Mobile phone addiction; Cognitive tendency; Mental health

Introduction

Over the last few decades, the communications industry has witnessed the mobile phone become an integral part of modern society, revolutionizing people's way of life and significantly influencing their social interactions, health, and cultural practices. However, this technology also has adverse effects on people's health, particularly fos-

tering mobile phone addiction. Mental health experts have predicted this addiction to be one of the leading behavioral addictions, with its potential risks already presenting a worldwide public health concern (1).

Mobile phone addiction, or mobile phone dependence, is characterized by an excessive use of



mobile phones, disrupting regular work, academics, and social interactions, leading to various psychological and behavioral problems (2). A survey in Canada, encompassing nearly 34,000 people across 24 countries, identified China ranking first globally in terms of mobile phone addiction (3). Furthermore, a survey by the China Internet Network Information Center indicated that as of December 2022, China's internet user population was around 1.067 billion, with nearly 200 million of them being youngsters (4).

Excessive or inappropriate use of mobile phones among younger individuals can cause permanent damage to their body systems, including reduced sleep quality (5), potential lens damage and immune system dysfunction (6), increased brain tumor risk, and various negative psychological problems (7). Teenagers have more likely to develop mobile phone addiction than adults, mainly due to their own physiological and psychological immaturity. Two important regions of the adolescent brain were in stark contrast to those of adults; that is, the rational brain region (frontal lobe) is still underdeveloped, whereas the pleasure center (nucleus accumbens) is significantly larger than that of adults (8). In other words, adolescents develop a stronger experience of pleasure triggered by mobile phones, but they lack the ability to control their behavior in a rational manner. Hence, research on the prevention and treatment of mobile phone addiction in teenagers is of utmost importance.

At present, the two interventions for teenagers' mobile phone addiction are psychological and exercise interventions. Group and individual counseling are two ways of implementing psychological interventions. Common treatments include cognitive behavioral therapy (9) and motivational interventions (10), such as mental health education courses, cognitive-behavioral group counseling, and inhibitory control training. Common exercise interventions include aerobic exercise (11) and outdoor activities (12). These approaches not only allow the highly excited nerve cells to fully rest but also promote physical wellbeing; prevent conditions such as cervical spine issues, lumbar spine problems, and myopia;

provide opportunities to relax; alleviate stress; reduce feelings of anxiety and depression; facilitate person-to-person communication; and enhance interpersonal relationships (12, 13).

Adolescents are in a critical period of rapid physiological and psychological development, with their self-perception and psychological conditions being easily influenced by the outside world. This susceptibility is even higher among mobile phone addicts, making them prone to various psychological problems. As a result, individuals need to have strong self-regulation ability to manage general developmental problems in the course of growing up. However, thus far, no self-help-based relief is available for teenagers' battling mobile phone addiction specific to their mental health. Moreover, schools do not provide personalized psychological support, often resorting to uniform mental health education models.

Mindfulness training can enhance mindfulness levels and positive psychologically resources while reducing negative emotions (9, 14). This approach effectively eases mental stress and consequently boosts life satisfaction and happiness. This form of psychotherapy is particularly suitable for the physical and mental development of adolescents. Mindfulness is the conscious and non-judgmental acceptance of one's feelings in the present moment (14). Although mindfulness-based therapy has shown effectiveness in cultivating mental resilience (15) and reducing psychological stress (16) in adolescents, research reports on its application to mobile phone addiction in teenagers are thus far unavailable. This gap does not favor researchers' efforts to assist adolescents with mobile phone addiction and improve their mental health.

On this basis, we aimed to test the role of intervening with adolescent mobile phone addiction within a school environment by applying mindfulness-based mental health education therapy to a group of mobile phone addicted teenagers. The effect of the therapy on the mental health of these addicts are then examined as a means of advancing the theoretical development of addiction treatment and intervention practice.

Materials and Methods

From May to July 2023, 910 teenage volunteers, all freshmen, were recruited from five communities selected in Lanzhou (Gansu Province), Handan (Hebei Province), and Shenyang (Liaoning Province) in China. The initial screening of anonymous on-site completion of the MPAI questionnaire resulted in 905 questionnaires being returned, with a recovery rate of 99.45%. After excluding 9 invalid questionnaires, 896 valid questionnaires were obtained (mean age: 18.9 ± 0.5 years old, 456 males and 440 females).

Next, 56 mobile phone teenager addicts (mean age: 19.1 ± 0.5 years, 28 males and 28 females) filtered by the questionnaire were equally divided into two groups of 28 based on age, gender, and degree of addiction. The mobile phone-addicted adolescents in the control group attended self-study classes as per the original teaching plan as other normal students in their grade. Mobile phone addicts screened out according to the questionnaire were evenly distributed into experimental and control groups according to their grade, gender, and degree of mobile phone addiction.

All volunteers were informed about the purpose, main content, and precautions of this intervention prior to their voluntary participation. The Ethics Committee granted approval for this research (2022-17).

Research tools

Mobile Phone Addiction Index Scale (MPAI): The MP AI (17), revised by Huang, was employed in this study. This scale contains 17 items and 4 subscales: Inability to Control Craving (individuals fail to control the use of mobile phones), Anxiety and Feeling Lost (individuals may experience maladjustment away from mobile phones), Withdrawal and Escape (individuals use mobile phones for the purpose of escaping from the real world), and Productivity Loss (individuals may experience low learning and work efficiency due mobile phone use). Each item of the MP AI was rated on a five-point Likert scale. The sub-

jects were defined as mobile phone addicts if they respond affirmatively to 5 out of 8 screening questions. The internal consistency coefficient of this scale in this study was 0.89. In addition, the internal consistency coefficients for the subscales of Inability to Control Craving, Anxiety and Feeling Lost, Withdrawal and Escape, and Productivity Loss were 0.83, 0.81, 0.86, and 0.76, respectively (17), with good reliability.

General Health Questionnaire (GHQ): The 12-item GHQ (GHQ-12) (18) was adopted to measure the mental health of individuals. It consists of 12 items, divided into 3 subscales: namely, depression and anxiety, social dysfunction and anhedonia, and loss of confidence. Items on the GHQ-12 are rated on a 4-point scale (from 0 to 3), representing “Never,” “Seldom,” “Sometimes,” and “Often,” each with a score of 1–4, respectively. The score was then used to generate a total score ranging from 0 to 36, with higher scores indicating worse conditions. The scale had good reliability and validity. In this study, the Cronbach’s α coefficients of the scale were 0.910 and 0.977 (18).

Cognitive Appraisal Orientation Test (CAOT): The CAOT was used to measure the level of cognitive orientation in addicts (19). It comprises ten items, of which three measure individuals’ tendency to anticipate negative outcomes (pessimism), four evaluate the tendency to predict positive outcomes (optimism). The remaining three items cover other aspects. A five-point Likert scale was used (0–4 points). A higher total score indicated a more positive cognitive disposition. The measured alpha coefficient of this scale in this study was 0.692 (19).

Intervention method

This study was a completely randomized experiment. The experimental and control groups were subjected to a pretest–posttest design. Repeated analysis of measurement variance was applied to measure the degree of mobile phone addiction, cognitive tendency, and mental health of the experimental and control groups before and after

the experiment. The participants were initially randomly divided into experimental and control groups. Then, the experimental and control groups were pretested for the degree of mobile phone addiction, cognitive tendency, and mental health. In the next step, the experimental group was subjected to the intervention of mindfulness-based mental health education, and the control group maintained their normal life and study.

The intervention program was made up of 10 parts: Introduction to mindfulness, Playing with attention, Soothing the impulsive heart, Recognizing mobile phone anxiety, Creating the future in the present moment, Observing activities in mindfulness, Discovering beautiful things, Being friendly to mobile phones, Time management, and Accepting yourself. The mindfulness-based mental health education course, held once a week for 40–45 min, was taught by two instructors who had already received training in the program. On weekdays, the lecturer guided the experimental group to perform mindfulness exercises on the corresponding topic once a day, which lasted 10–15 min. In addition to the collective practice in class, students in the experimental group were encouraged to partake in self-practice during break time, complete the exercise manual, and record their feelings after completing the daily training.

At the end of the intervention cycle, the experimental and control groups were underwent a posttest on the degree of mobile phone addiction, cognitive tendency, and mental health. Finally, the pretest and posttest data were analyzed with the help of statistical software to explore whether the effect was significant after the intervention.

Statistical methods

The data were analyzed using SPSS 22.0 statistical software (IBM Corp., Armonk, NY, USA). Quantitative information was expressed as a mean \pm standard deviation, and comparison between two groups was performed by independent samples *t*-test or paired *t*-test. Qualitative information was expressed as number of cases, and comparison between groups was performed by

chi-square test. $P < 0.05$ was considered statistically significant.

Results

Analysis of factors associated with mobile phone addiction

The results are shown in Table 1. The detection rate of mobile phone addiction in male students was higher than that in female students, with a statistically significant difference ($\chi^2=4.472$, $P=0.034$). A longer daily use of mobile phones implied higher prevalence of mobile phone addiction, with a statistically significant trend ($\chi^2=85.833$, $P < 0.001$). A better household income was related to lower prevalence of mobile phone addiction, although no statistical significance was found ($\chi^2=3.300$, $P=0.509$). The detection rate of mobile phone addiction was the highest in rural areas, followed by urban areas, and the lowest in cities, with a statistically significant difference ($\chi^2=6.492$, $P=0.039$). The detection rate of mobile phone addiction in only children was lower than that in non-only children, and the difference was statistically significant ($\chi^2=12.956$, $P < 0.001$).

Comparison of mobile phone addiction scores between experimental and control groups before and after intervention

Table 2 illustrates that no statistical difference was found between the total score and each subscale score of mobile phone addiction in the two groups before the intervention. After the intervention, the total scores and scores of each subscale decreased in both groups. However, in comparison with the control group, the mobile phone addiction score in the experimental group decreased to a greater extent. Although the total score and each subscale score of the control group declined, the difference with the pre-intervention was not statistically significant, suggesting that the intervention effect of the experimental group was better than that of the control group.

Table 1: Analysis of factors associated with mobile phone addiction among freshmen

Demographic information		Total number of people	Number of people detected	Detection rate	χ^2	P
Gender	M	456	255	55.92%	4.472	0.034
	F	440	215	48.86%		
Time spent on mobile phone per day	<2h	30	3	10.00%	85.83 3	<0.001
	2 - 4h	200	73	36.50%		
	5 - 6h	384	194	50.52%		
	7 - 8h	162	106	65.43%		
	>9h	120	94	78.33%		
Household income	Very low	150	85	56.67%	3.300	0.509
	Low	200	108	54.00%		
	Medium	300	158	52.67%		
	High	148	74	50.00%		
	Very high	98	45	45.92%		
Home location	Rural	280	160	57.14%	6.492	0.039
	Urban	293	158	53.92%		
	City	323	152	47.06%		
Only child or not	N	452	264	58.41%	12.95 6	<0.001
	Y	444	206	46.40%		
Total		896	470	52.46%		

Table 2: Comparison of mobile phone addiction scores between intervention and control groups before and after intervention

Variable	Group	Pre-intervention	Post-intervention	Difference between pre- and post-intervention	P-value for intragroup comparison
Total score	Intervention group (n=28)	57.32±5.46	44.68±6.35	12.64±4.10	<0.001
	Control group (n=28)	56.86±5.64	55.25±5.58	1.61±4.81	0.088
	<i>t value</i>	0.313	6.621	10.933	
	<i>P value</i>	0.755	<0.001	<0.001	
Inability to Control Craving	Intervention group (n=28)	22.11±2.47	17.93±2.88	4.18±1.76	<0.001
	Control group (n=28)	21.61±2.42	20.93±3.20	0.68±2.23	0.119
	<i>t value</i>	0.765	3.690	6.899	
	<i>P value</i>	0.448	0.001	<0.001	
Anxiety and Feeling Lost	Intervention group (n=28)	13.64±2.51	10.11±3.02	3.54±1.55	<0.001
	Control group (n=28)	13.79±2.28	13.36±3.00	0.43±1.79	0.217
	<i>t value</i>	0.223	4.041	6.934	
	<i>P value</i>	0.825	<0.001	<0.001	
Withdrawal and Escape	Intervention group (n=28)	10.86±1.8	8.46±2.05	2.39±1.34	<0.001
	Control group (n=28)	10.89±1.66	10.54±1.60	0.36±1.13	0.106
	<i>t value</i>	0.077	4.223	6.140	
	<i>P value</i>	0.939	<0.001	<0.001	
Productivity Loss	Intervention group (n=28)	10.71±1.96	8.18±2.29	2.54±1.20	<0.001
	Control group (n=28)	10.57±1.69	10.43±1.97	0.14±1.01	0.460
	<i>t value</i>	0.292	3.937	8.075	
	<i>P value</i>	0.771	<0.001	<0.001	

Analysis of mental health scores of experimental and control groups before and after intervention

As shown in Table 3, prior to the intervention, no statistically significant difference was found between the experimental and control groups in terms of mental health scores. After the intervention, the mental health scores of both groups im-

proved in different ways, and the differences were statistically significant ($P < 0.001$) compared with those before intervention. From the score of the two groups after intervention and the difference before and after intervention, the intervention effect of the experimental group was better than that of the control group, and the difference was statistically significant ($P < 0.05$).

Table 3: Comparison of mental health scores before and after intervention

<i>Group</i>	<i>Pre-intervention</i>	<i>Post-intervention</i>	<i>Difference between pre- and post-intervention</i>	<i>P-value for intragroup comparison</i>
Intervention group (n=28)	21.50±5.01	26.46±5.82	4.96±2.59	<0.001
Control group (n=28)	21.57±5.56	22.79±5.82	1.21±1.26	<0.001
<i>t value</i>	-0.051	-2.593	6.894	
<i>P value</i>	0.96	0.012	<0.001	

Comparison of cognitive tendency scores between experimental and control groups before and after intervention

As shown in Table 4, no statistically significant difference was found between the scores of the experimental and control groups in the two subscales of cognitive tendencies before the intervention. After the intervention, the optimistic disposition score of the experimental group

greatly increased, whereas the pessimistic disposition score dramatically decreased, with a statistically significant difference ($P < 0.05$). Although the control group demonstrated some changes, these contrasts compared with the pre-intervention results were not statistically significant. Thus, the intervention effect of the experimental group was better than that of the control group.

Table 4: Comparison of cognitive tendency scores before and after intervention

<i>Variable</i>	<i>Group</i>	<i>Pre-intervention</i>	<i>Post-intervention</i>	<i>Difference between pre- and post-intervention</i>	<i>P-value for intragroup comparison</i>
Optimistic disposition	Intervention group (n=28)	10.18±2.8	12.68±3.28	2.5±1.26	<0.001
	Control group (n=28)	10.11±3.37	10.82±2.71	0.71±1.86	0.053
	<i>t value</i>	0.086	2.311	5.099	
	<i>P value</i>	0.932	0.025	<0.001	
Pessimistic disposition	Intervention group (n=28)	6.14±2.03	4.61±1.85	1.54±1.77	<0.001
	Control group (n=28)	6.32±1.85	5.68±2.07	0.64±1.83	0.075
	<i>t value</i>	-0.344	-2.039	2.247	
	<i>P value</i>	0.732	0.046	0.029	

Discussion

The present survey revealed that the detection rate of mobile phone addiction among adolescents was 52.46%. This result is above the average level, which is basically consistent with the findings of other studies (20, 21). Most of the addicts use mobile phones 5–6 hours a day, accounting for 50.52% of the total, and 94 people (78.33%) turn on their phones 24 hours a day. Fewer people use mobile phones mainly for study. Conversely, more people use them for entertainment and social purposes. The reason for the high detection rate in this study may be related to the sample selection. Generally, university freshmen are new to the academic environment. The demanding nature of their chosen field and the unique learning setting in the university contribute to increased stress and social anxiety. Given the limited time and ways for freshmen to release their emotions, they often turn to mobile phones as a way to unwind. Studies have shown that the main application of mobile phones among freshmen is entertainment and social interaction. Specifically, the vast array of entertainment and social interaction applications in mobile phones ameliorates teenagers' problems to a great extent by providing a way to release their emotions, relieve their anxiety, and foster interpersonal communications (22).

As shown in Table 2, after the test, the total score of mobile phone addiction and the scores of all subscales of the experimental group decreased compared with those of in the pretest. These significant differences demonstrate that mindfulness-based mental health education therapy plays an ameliorating effect on mobile phone addiction. Upon analysis, this finding seems to be linked with several factors. Mindfulness-based mental health education intervention is a long-term, subtle training process where addicts are expected to gradually change their misconceptions and establish new, objective to counteract inappropriate mobile phone usage behaviors (23). The training process adopts the model of group mutual assistance, that is, group members can

deepen their understanding of positive beliefs and internal views in the course of communication, thereby improving the efficiency of training. During the discussion, questions are to be answered and mistakes are to be corrected, which boosts addicts' motivation to self-control.

According to the results in Table 3, the experimental group receiving mindfulness-based mental health education therapy performed better than the control group in terms of tolerance, time management, and withdrawal symptoms. A statistically significant difference in the effects between the two groups was found, and addictive behavior gradually decreased over time. Thus, the therapy managed to promote individuals' levels of positive emotions and cognitive dispositions. Studies have shown (15-17) that individuals with mobile phone addiction are more susceptible to emotional distress. Such individuals often seek to stimulate the hot emotional system while inhibiting the cold emotional system, thereby leading to negative emotions and withdrawal symptoms (24). During the training of mindfulness-based mental health education, the re-experiencing and re-comprehending of life events can generate positive emotions, such as senses of happiness, achievement, and trust in others, as well as negative emotions, such as senses of guilt and sin. The benign interaction between emotion and cognition stabilizes people's emotions and behaviors. As a result, individuals can objectively and calmly deal with adverse emotions, such as anxiety and irritability, caused by mobile phone addiction, increasing their level of positive psychological resources and cognitive dispositions.

The findings in Table 4 indicate significant differences in the level of mental health between the two groups ($P < 0.05$). Social problems, such as dissatisfaction and sensation-seeking, are psychological triggers of mobile phone addiction (25). Mindfulness-based mental health education training, recognizing automatic thinking training, guides subjects to reflect and think about their behaviors, correct irrational cognition, and rebuild rational cognitive frameworks, in an effort to eliminate the sense of loneliness in confusing and inapplicable interpersonal relationships.

By transforming irrational beliefs, modifying self-perception, and improving self-evaluation, addicts can establish a stable and healthy social support system to improve their self-esteem and sense of identity, as well as enhance their communication with the outside world. In doing so, it promotes the addicts' interpersonal relationships and boost their mental health.

Conclusion

By combining the characteristics of mindfulness-based mental health education therapy and group therapy model, this study enhances the treatment of adolescent mobile phone addiction. This easy-to-implement, cost-effective research method, devoid of adverse effects, may benefit from further validation and promotion. The findings of this study are as follows. Mindfulness-based mental health education therapy could greatly improve adolescent mobile phone addiction behaviors, enhance their cognitive tendencies, increase positive emotions, and maintain mental health levels. Future research should address the small sample size in this study and implement targeted intervention for all mobile phone addiction subscales.

Journalism Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors declare that there is no conflict of interests.

References

1. Metulini R, Carpita M (2021). A spatio-temporal indicator for city users based on mobile phone signals and administrative data. *Soc Indic Res*, 156(2-3): 761-781.
2. Sahu M, Gandhi S, Sharma M K. (2019). Mobile phone addiction among children and adolescents: a systematic review. *J Addict Nurs*, 30(4): 261-268.
3. Zhou N, Wang SF, Zhu XC, et al. (2022). Cell-phone usage and addiction among Chinese children and adolescents and related factors. *Chinese J School Health*, 43(8): 1179-1184.
4. Lu G L, Ding Y M, Zhang Y M, et al. (2021). The correlation between mobile phone addiction and coping style among Chinese adolescents: a meta-analysis. *Child Adolesc Psychiatry Ment Health*, 15(1):60.
5. Soni R, Upadhyay R, Jain M (2017). Prevalence of smart phone addiction, sleep quality and associated behaviour problems in adolescents. *Int J Res Med Sci*, 5(2): 515-519.
6. El-Gohary OA, Said MAA (2017). Effect of electromagnetic waves from mobile phone on immune status of male rats: possible protective role of vitamin D. *Can J Physiol Pharmacol*, 95(2): 151-156.
7. Noaman AA (2019). Impact of mobile phone usage on some health aspects of children and adolescents: Evidence based review article. *J Med Res*, 5(4): 159-61.
8. Noel X, Brevers D, Bechara A (2013). A neurocognitive approach to understanding the neurobiology of addiction. *Curr Opin Neurobiol*, 23(4): 632-638.
9. Lan Y, Ding JE, Li W, et al. (2018). A pilot study of a group mindfulness-based cognitive-behavioral intervention for smartphone addiction among university students. *J Behav Addict*, 7(4): 1171-1176.
10. Shen X, Ran GM (2018). The influence of social anxiety on excessive smartphone use: The mediating effect of loneliness and motivation. *Psychol Res*, 11(6): 570-576.
11. Zhou J, Wang L (2022). Differences in the effects of reading and aerobic exercise interventions on inhibitory control of college students with Mobile phone addiction. *Front Psychiatry*, 13: 797780.
12. Zheng YN (2019). Feasibility study on the inter-

- vention of physical exercise on mobile phone addiction symptoms among vocational college students. *Contemp Sports Technol*, 9(6): 222-223.
13. Zhong W, Wang Y, Zhang G (2021). The impact of physical activity on college students' mobile phone dependence: the mediating role of self-control. *Int J Ment Health Ad*, 19: 2144-2159.
 14. Tang W, Xiao RL, Huang HF, et al. (2022). Effectiveness of mindfulness in mental health education on reducing psychological stress in middle school students: Mediating by psychological resilience. *China J Health Psychol*, 30(6): 921-925.
 15. Teal C, Downey LA, Lomas JE, et al. (2019). The role of dispositional mindfulness and emotional intelligence in adolescent males. *Mindfulness*, 10: 159-167.
 16. Cortazar N, Calvete E (2019). Dispositional mindfulness and its moderating role in the predictive association between stressors and psychological symptoms in adolescents. *Mindfulness*, 10: 2046-2059.
 17. Huang H, Niu LY, Zhou CY (2014). Reliability and Validity of Mobile Phone Addiction Index for Chinese College Students. *Chinese J Clinl Psychol*, 22(5): 835-838.
 18. Hu Y, Stewart-Brown S, Twigg LIZ, et al. (2007). Can the 12-item General Health Questionnaire be used to measure positive mental health?. *Psychol Med*, 37(7): 1005-1013.
 19. Zhang Y, Li HF, Zhang YL, et al. (2006). Reliability and Validity of Cognitive Appraisal Orientation Test for Adolescents with Emotional Disorders. *Chinese J Clinl Psychol*, 14(5): 445-447.
 20. Liu QQ, Yang XJ, Hu YT, et al. (2020). Peer victimization, self-compassion, gender and adolescent mobile phone addiction: Unique and interactive effects. *Child Youth Serv Rev*, 118: 105397.
 21. Zhang A, Xiong S, Peng Y, et al. (2022). Perceived stress and mobile phone addiction among college students: The roles of self-control and security. *Front Psychiatry*, 13: 1005062.
 22. Hew JJ, Lee VH, Ooi KB, et al. (2015). What catalyses mobile apps usage intention: an empirical analysis. *Ind Manage Data Syst*, 115(7): 1269-1291.
 23. Zheng YL, Lei L, Chen JJ, et al. (2023). A Randomized Controlled Study on Improving Psychological Resilience of Middle School Students by Mindfulness-Based Mental Health Education. *Adv Psychol*, 13(1): 217-223.
 24. Goswami V, Singh DR (2016). Impact of mobile phone addiction on adolescent's life: A literature review. *Int J Home Sci*, 2(1): 69-74.
 25. Bouffard S, Giglio D, Zheng Z (2022). Social media and romantic relationship: Excessive social media use leads to relationship conflicts, negative outcomes, and addiction via mediated pathways. *Soc Sci Comput Rev*, 40(6): 1523-1541.