



Progress of Research on Psychological Intervention for Smartphone Addiction in Adolescents

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Abstract: With the rapid development of the Internet informationization era, the widespread popularity of smartphones, while providing many conveniences for adolescents, has also given rise to a new global mental health problem-smartphone addiction. The purpose of this paper is to review the literature related to smartphone addiction among adolescents, mainly from the concept of smartphone addiction among adolescents, influencing factors and psychological interventions, in order to provide reference for psychological interventions for smartphone addiction among adolescents and reduce the incidence of smartphone addiction in this group.

Keywords: Adolescents; Smartphone Addiction; Psychological Intervention; Review

1. Introduction

Smartphones are rapidly gaining popularity all over the world and are currently the largest Internet-using terminal. Data from the China Internet Network Information Center (CNNIC) show that as of June 2022, the size of China's cell phone Internet users reached 1.047 billion, accounting for 99.6% of the overall Internet users^[1]. Growing just as rapidly as smartphone use is the problem of smartphone addiction. Although the popularity of smartphones has changed the lifestyle of the general public, while enjoying this positive change, there is growing evidence that excessive use of cell phones may cause cell phone addiction. Research findings confirm the existence of smartphone addiction and its seriousness^[2]. Smartphone addiction can have a negative impact on individuals, leading to isolation and cognitive errors, and negatively affecting relationships, academic performance, and sleep quality^[3-4]. Relevant research data show that on average, more than 20% of college students in today's colleges and universities suffer from smartphone addiction^[5-6], which can cause serious damage to an individual's physical and mental health^[7]. Especially during major public health emergencies, colleges and universities are forced to conduct online teaching, which exacerbates smartphone addiction among adolescents. Thus, how to prevent and improve smartphone addiction among adolescents needs more attention from the whole society. Based on the existing literature at home and abroad, this paper summarizes and generalizes the influencing factors of adolescent smartphone addiction and the main psychological interventions, with a view to providing reference for the psychological intervention of adolescent smartphone addiction and reducing the incidence of smartphone addiction in this group.

2. Concept

Before the emergence of smartphones, there have been a number of studies on traditional non-smartphone addiction^[8-9]. With the popularization of smartphones, many scholars believe that smartphones have basically replaced traditional cell phones, represent the future development trend, and have their own unique characteristics, and have begun to pay attention to the increasingly prominent problem of smartphone addiction.

At present, scholars define smartphone addiction (hereinafter collectively referred to as "smartphone addiction" for the sake of narrative convenience) as non-addiction and addiction.

Some researchers define it as Compulsive Usage of Smartphone, which refers to the behavior of individuals who must carry their smartphones with them and frequently check them on important occasions such as social occasions, and this repetitive compulsive behavior will have a negative impact on the social and personal life of individuals^[10-11]. Shin et al. define it as Smartphone Addiction from the aspect of behavioral consequences, they define it as Problematic Use of Smartphone^[12], which refers to individuals' excessive and undesirable use of smartphones, thus negatively affecting their personal and social levels, such as impulsive use of cell phones or indifference to the surrounding environment, and psychological distress when they cannot use them. Some scholars in China have approached it from a similar perspective, though calling it smartphone dependence^[13]. However, more scholars draw on related concepts such as Internet addiction, and believe that excessive use of smartphones belongs to the category of behavioral addiction and technology addiction, and define it as Smartphone Addiction, which refers to the psychological dependence arising from the excessive use of smartphones by an individual, who



then loses control over the use of the smartphone and its related services, resulting in the disruption of daily life and the emergence of Psychological or behavioral problems^[14-18]. Lee et al. also pointed out in detail the clinical characteristics of smartphone addiction, namely tolerance, withdrawal symptoms, salience, mood changes, craving and loss of control^[15]. Chen et al. also defined six symptoms of smartphone addiction: salience, withdrawal, conflict, relapse and recovery, tolerance, and mood changes^[14].

3. Influencing Factors

Adolescent smartphone addiction is influenced by a variety of factors, mainly including the smartphone itself, individual factors and environmental factors.

3.1 Factors of smartphone itself

3.1.1 Aggregation of functions In addition to the basic functions of traditional cell phones, smartphones are equipped with a variety of functional APPs, thus realizing a high degree of aggregation of functions such as social interaction, entertainment, games, life, information and learning^[19]. Smartphones are extremely close to the daily life of adolescents, but it is easy for individuals to overuse them and become psychologically dependent on them, thus becoming addicted^[20].

3.1.2 Personalization and customization of content

Smartphones can provide a variety of apps for social, educational, entertainment, and gaming^[16], and adolescents can download and install apps according to their personal preferences and use their preferred functions, which realizes personal customization of content and functions in many ways; at the same time, individual mobility is greatly improved, and more pleasure and immersion can be experienced during the process of using the apps, which leads to more cell phone use behaviors^[11]. Therefore, this combination of active customization and personalized features allows individuals to continuously self-reinforce a certain behavioral pattern, which leads to addiction^[21].

3.1.3 Accessibility and Convenience

Smartphones are portable, and with the popularization of the Internet, smartphone adolescents can perform various activities, such as checking emails, shopping, or browsing social networking sites, at any time and place, which greatly improves the convenience of use^[20]. This characteristic allows individuals to achieve increased work and study efficiency and satisfaction with less effort during smartphone use, leading to greater increase and dependence on smartphone use, which is more likely to lead to addiction^[22].

3.2 Individual Factors

3.2.1 Demographic factors Studies have found that demographic variables such as gender, age, and education affect smartphone use.

Some studies have shown that girls have a higher propensity to become addicted to cell phones than boys [23], which may be related to the stronger social-emotional needs of girls. However, some studies have also found that male students are more likely to develop an overdependence on cell phones or the difference is not statistically significant in terms of gender^[24-25]. In addition, age is also one of the important factors influencing college students' cell phone addiction, and researchers have found that cell phone usage is relatively higher among younger students^[26], and that young people are more likely to be attracted to new electronic products than their seniors, but at the same time, the study by DEMIRCI [27] asserted that there is no age difference. This suggests that gender and age should be considered when preventing and intervening in college students' cell phone addiction, and the specific effects of both on college students' cell phone addiction need to be studied in depth. In addition, place of origin [28] and education^[19] may also make a difference.

3.2.2 Personality factors The use of smartphones is closely related to personality traits, and different personality traits will affect the degree of cell phone dependence of college students. In recent years, researchers generally agree on the Big Five model of personality, i.e., Openness, Responsibility, Extraversion, Sociability, and Neuroticism. 5 personality dimensions have different effects, such as Responsibility is negatively correlated with cell phone addiction, Neuroticism is positively correlated with cell phone addiction^[29], and Extraversion even positively predicts cell phone addictive behaviors [30], i.e., the degree of smartphone addiction is relatively higher among college students who have an extroverted personality and are good at socializing. That is to say, the degree of smartphone addiction will also be relatively mild, because the positive and active personality traits can well help college students to adapt to interpersonal interactions, so that they can find their self-worth in all kinds of social activities in reality, and are keen to interact with friends and classmates around them, and a fulfilling life will directly reduce the time individuals spend on smartphones. This suggests the need for appropriate responses based on the personality traits of the intervention target.

Some studies have found that individuals with innovative personalities are more likely to accept and purchase smartphones and download and use a variety of new apps, and are more likely to become addicted^[31], but some studies have not found this predictive effect^[32].

3.2.3 Emotional experience Researchers have found that immersion experience directly affects smartphone addiction and mediates the relationship between convenience and smartphone addiction^[37]. The pleasure and satisfaction that individuals experience when using a smartphone makes it easy for individuals to become loyal fans

of smartphones, leading to addiction^[10,25]. Chen, et al. found in a comparative analysis of basic users (who mainly use the phone and text messaging functions) and advanced users (who mainly use the functions of the camera, social networking, music, and video) that advanced users obtain higher levels of pleasure than basic users, and the level of addiction is also higher^[14]. and higher levels of addiction^[39]. Meanwhile, one study found that the level of loneliness was effective in predicting smartphone addiction^[33]. However, there are other studies that did not find this predictive effect and it is still controversial^[10].

3.2.4 Motivation for use Studies have found that individuals with high communication needs and social integration motivation use SNS applications more, which increases the time and frequency of smartphone use and is more likely to become addicted^[17]. It has also been found that individuals who use smartphones for entertainment unconsciously increase their usage time and are prone to addiction^[34-35], and that using smartphones purely for pleasure is also prone to addiction^[36], whereas information seeking or learning does not lead to addiction^[44]. MATIC et al^[37] also analyzed the role of boredom tendency in cell phone addiction, and found that individuals with a high boredom tendency had a higher frequency of cell phone use. It was found that individuals with high boredom tendency used cell phones more frequently. Similarly, when college students feel bored, they will turn on their cell phones and flip through them to

When college students feel bored, they will also turn on their cell phones and flip through them to kill time^[38]. This kind of conditioned reflex action tends to deepen the penetration of cell phones into the daily life of individuals, and over time, they can no longer adapt to the days without cell phones, and once the cell phones are not around or keep the black screen, the impulsive desire to pay attention to and use the phone will be generated. Therefore, the cultivation of healthy and rational cell phone use cognition is very important for improving college students' cell phone addiction behavior, and it is also the most important part of the whole cell phone addiction intervention process that needs to be thought about and explored.

3.3 Environmental factors

Studies have found that smartphone addiction is closely related to environmental factors such as family. The more parents favor, refuse to deny, interfere and protect, the easier it is for adolescents to become addicted to smartphones^[25], while adolescents who are only children, whose families have a low economic level, and who are raised by their grandparents, are relatively more at-risk^[39]. Meanwhile, when the surrounding groups are using smartphones or their new features, together with the various discount packages offered by operators, individuals will be influenced to actively accept and promote smartphones, and some individuals may become addicted to them^[40].

4. Psychological interventions

4.1 Cognitive Behavioral Therapy

Cognitive-behavioral therapy is a therapeutic method with the richest empirical data and the widest field of application in the current academic world, covering a number of techniques in cognitive and behavioral therapy. Cognitive-behavioral therapy groups first guide group members to communicate and discuss from a cognitive perspective, and discover individuals' non-adaptive thinking and behavioral patterns at the cognitive level, and then set goals and formulate an intervention plan based on their existing level of dependence. LAN et al. ^[41] took 50 smartphone-addicted college students as the research subjects, and adopted cognitive-behavioral group psychological interventions for the experimental group, and finally found that the intervention group's smartphone addicts were more likely to have smartphone addiction than the experimental group after the return visit. KIM ^[42] also showed that cognitive behavioral therapy groups can provide effective help for college students suffering from long-term psychological distress due to smartphone addiction. Qing Zaihua et al. ^[43] analyzed the mechanism of cognitive behavioral therapy groups into three points: (1) improving college students' loneliness and interpersonal relationships; (2) improving college students' self-confidence and time management ability; (3) helping college students make career plans and change their cognition.

4.2 Exercise interventions

MURPHY et al ^[44] put forward the idea that exercise can be an effective treatment for addictive psychological disorders by secreting more catecholamines and endorphins, which reduces the body's anxiety. KIM ^[45], on the other hand, emphasized the importance of systematic exercise interventions for the treatment of smartphone addiction. Research has evolved to the point where exercise interventions have become an important intervention for smartphone addiction, which is widely recognized by academics. The study by AZAM et al ^[46] systematically reviewed the recent literature involving physical activity involvement in smartphone addiction interventions for student populations, and the results achieved consistent positive impacts, suggesting that a wide range of educational institutions should use physical education and sports as an intervention strategy to address cell phone dependence among college students, and that the use of physical activity as an intervention strategy to address cell phone dependence among college students should be encouraged. Additionally, more intervention professionals committed to the field of behavioral addictions were encouraged to join in the treatment of smartphone addiction, contributing to the quality and rigor of future interventions. In fact, the effect of systematic exercise on smartphone addiction There are two main mechanisms, firstly, exercise can most intuitively reduce the time an individual uses a smartphone, and secondly, the dopamine and endorphins produced by the body during exercise can make people

feel physically and mentally pleasurable, and this kind of human body rewarding effect can be very good to play a reinforcing role, which can reduce the frequency of smartphone use to a certain extent. Whether it is open-ended motor skills such as basketball and soccer (motor skills that change according to changes in external contexts) or closed-ended motor skills such as running and jumping rope (motor skills that do not need to be performed in reference to changes in external contexts), both can effectively reduce the level of smartphone addiction among college students [47].

4.3 Mindfulness

Mindfulness is the process by which an individual pays intentional, non-judgmental attention to the experience of the here and now [48]. The practice of mindfulness resists scattering and drifting of the mind, maintains awareness when the mind drifts, and gently draws attention back to what is most salient and important to the person [49]. Studies have found that positive mindfulness levels are significantly negatively correlated with smartphone addiction [50] and depression [51-52], while depression is significantly positively correlated with smartphone addiction [53]. It has been suggested that positive thoughts can enable individuals to remain aware and disassociated when using cell phones and generating emotions, reduce habitual cell phone use, and avoid immersing themselves in the emotions generated by cell phone use, thus reducing dependence on cell phones [54]. In addition, an individual's level of positive thinking can be increased through positive thinking training, which can effectively intervene in an individual's depressed mood [55]. Based on these perspectives and research evidence, the author hypothesized that individuals' level of positive thinking has the potential to guard against smartphone addiction through lower negative emotions.

4.4 Attentional bias training

Smartphone addiction is significantly and positively correlated with psychological problems such as depression, anxiety, and loneliness [56]. Hu et al. found that smartphone addicts have a stronger attentional bias toward negative stimuli compared to positive and neutral information [57]. And the transitional attention and processing of negative information is an important cause of psychological problems such as anxiety, depression, and loneliness [58]. Individuals with such psychological problems in turn have weaker attentional control [59], which makes it difficult to shift attention away from negative information, thus leading to the maintenance of their psychological problems. Thus, it is clear that attentional bias toward negative information is an important cause of the development and maintenance of psychological problems such as depression, anxiety, and loneliness in cell phone addicts.

Since cell phone addicts have an attentional bias toward negative information and lead to psychological problems such as depression, anxiety, and loneliness. It becomes possible to increase cell phone addicts' attentional bias toward positive information through attentional bias training to alleviate their symptoms of depression, anxiety, and loneliness and to improve cell phone addictive behavior. According to the emotion-cognition theory, emotions are linked to specific cognitions and goals, and emotions can change an individual's cognition and trigger corresponding behavioral responses [60]. Negative emotions, such as depression, anxiety, and loneliness, can affect an individual's cognition and make the individual pay more attention to negative information. Then, through attentional bias training, the attentional bias to positive information is increased in cell phone addicts to form a processing advantage for positive information, thus alleviating the symptoms of depression, anxiety, and loneliness in cell phone addicts. At the same time, reducing attention to and processing of negative information regulates negative emotions and stress responses, which in turn alleviates the individual's cell phone addiction symptoms, forming a virtuous cycle.

4.5 Other Interventions

Considering the complexity of the formation mechanism of smartphone addiction, in addition to the mainstream intervention methods mentioned above, other researchers have chosen reading therapy, music therapy and other methods for intervention. Reading therapy is a therapeutic method that uses books or other written materials as a medium to soothe individuals' negative emotional distress through guided reading, and then restore physical and mental balance. Tan Ping [61] selected college students from a university in Chongqing as the research subjects, and the results showed that both low-moderate and severe smartphone addiction improved in the intervention group. Reading can effectively provide spiritual nourishment for smartphone addicted college students, help them cultivate themselves, divert their attention, reshape their behavioral patterns, consciously improve their bad cognitive attitudes and behaviors towards cell phones, and gradually eliminate their dependence. Music therapy emerged in the United States in the mid-20th century, and has developed into an important branch of psychotherapy. The inherent physiological and psychological effects of music can bring about multiple sensory stimuli and experiences, and thus produce therapeutic effects. BONG et al. [62] arranged immersion sessions such as playing, chanting, and improvisation in the intervention, and verified that music therapy can significantly improve adolescents' behavioral disorders such as cell phone addiction, anxiety, and impulsivity. In China, some scholars used the five elements of music therapy in traditional Chinese medicine to test college students, and found that as the number of interventions in the experimental group increased, the index of smartphone addiction decreased significantly, and the long-term effect of the treatment was significantly better than the short-term [63]. Thus, it is necessary to actively and boldly try multiple methods for the treatment of smartphone addiction in adolescents,

break through the traditional entry point of intervention, and build a multi-faceted, comprehensive and innovative program.

5. Results and Discussion

Smartphone addiction research is on the rise, and researchers have carried out a lot of work around cell phone dependence, especially the investigation and analysis of the current situation and practical intervention, but there are still the following problems: the lack of mature theoretical foundations, which will result in the lack of scientific and reasonable theoretical guidance for the design of psychological intervention programs; the lack of long-term feedback tracking, which makes it difficult to ensure that adolescents' smartphone addiction will not recur; the lack of clear and unified intervention test standards or measurement tools, and the universality of the program needs to be improved. There is a lack of clear and unified intervention test standards or measurement tools, and the generalizability of the program needs to be improved. More in-depth research is needed in these areas in the future.

In summary, although the research on smartphone addiction among adolescents has made great progress, there are still many deficiencies in psychological interventio

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REFERENCES

- [1]. China Internet Network Information Center releases the 50th 《Statistical Report on the Development of the Internet in China》 [J] . Journal of the National Library of China, 2022, 31 (5) : 12.
- [2]. Kwon M, Kim DJ, Cho H, et al. The smartphone addiction scale: development and validation of a short version for adolescents. PloS One, 2013, 8(12): e83558.
- [3]. Hadlington LJ. Cognitive failures in daily life: Exploring the link with Internet addiction and problematic mobile phone use. Computers in Human Behavior, 2015, 51: 75-81
- [4]. Li J, Lepp A, Barkley JE. Locus of control and cell phone use: Implications for sleep quality, academic performance, and subjective well- being. Computers in Human Behavior, 2015, 52: 450-457
- [5]. THAPA K, LAMA S, POKHAREI R, et al. Mobile phone dependence among undergraduate students of a Medical College of Eastern Nepal: A descriptive cross-sectional study [J] .J Nepal Med Associat, 2020, 58 (224) : 234.
- [6]. ALHAZMI A A, ALZHRANI S H, BAIG M, et al. Prevalence and factors associated with smartphone addiction among medical students at King Abdulaziz University, Jeddah [J] .Pakistan J Med Sci, 2018, 34 (4) : 984.
- [7]. XIE H, TAO S, ZHANG Y, et al. Impact of problematic mobile phone use and insufficient physical activity on depression symptoms: A college-based follow-up study [J] .BMC Public Health, 2019, 19 (1) : 1-7.
- [8]. Cholz M. Mobile phone addiction: a point of issue. Addiction, 2010, 105(2): 373-374.
- [9]. Wang HH, Wang MC, Wu SQ. The effects of different cell phone addiction types on college students' interpersonal relationships and loneliness relationships and loneliness based on latent profile analysis (In English). language). Chinese Journal of Clinical Psychology, 2015, 23(5):881-885
- [10]. Park BW, Lee KC. The effect of users' characteristics and experiential factors on the compulsive usage of the smartphone. In Ubiquitous computing and multimedia applications. Springer Berlin Heidelberg, 2011. 438-446
- [11]. Zhang K, Chen C, Zhao S, et al. Compulsive Smartphone Use: The Roles of Flow, Reinforcement Motives, and Convenience. Proceedings of the 35th International Conference on Information Systems, 2014
- [12]. Shin C, Dey AK. Automatically detecting problematic use of smartphones. In Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing. ACM, 2013. 335-344
- [13]. Wang, Junke. A Study on the Relationship between College Students' Personality Traits, Coping Styles and Smartphone Dependence. Master's thesis, Shanghai Normal University, 2014
- [14]. Chen C, Zhang ZK, Zhao SJ. Examining the Effects of Perceived Enjoyment and Habit on Smartphone Addiction: The Role of User Type. In E-Technologies. Springer International Publishing, 2015. 224-235
- [15]. Lee H, Ahn H, Choi S, et al. The SAMS: Smartphone addiction management system and verification. Journal of Medical Systems, 2014, 38(1): 1-10
- [16]. Lin YH, Chang LR, Lee YH, et al. Development and validation of the smartphone addiction inventory (SPAI). PloS One, 2014, 9(6): e98312
- [17]. Salehan M, Negahban A. Social networking on smartphones: When mobile phones become addictive. Computers in Human Behavior, 2013, 29(6): 2632-2639
- [18]. Won-jun L. An Exploratory Study on Addictive Use of Smartphone: Developing SAUS (Smartphone Addictive Use Scale). Journal of Convergence Information Technology, 2013, 8(12): 403
- [19]. Kwon M, Lee JY, Won WY, et al. Development and validation of a smartphone addiction scale (SAS). PloS One, 2013, 8(2): e56936

- [20]. Ahn J, Jung Y. The common sense of dependence on smartphone: A comparison between digital natives and digital immigrants. *New Media & Society*, 2016, 18: 1236-1256
- [21]. Jeong SH, Kim HJ, Yum JY, et al. What type of content are smartphone users addicted to?: SNS vs.games. *Computers in Human Behavior*, 2016, 54: 10-17
- [22]. Hsiao CH, Chang JJ, Tang KY. Exploring the influential factors in continuance usage of mobile social Apps: Satisfaction, habit, and customer value perspectives. *Telematics and Informatics*, 2016, 33(2): 342-355
- [23]. YANG Z, ASBURY K, GRIFFITHS M D. An exploration of problematic smartphone use among Chinese university students: Associations with academic anxiety, academic procrastination, self regulation and subjective well being [J]. *Int J Mental Health Addict*, 2019, 17 (3) : 596-614.
- [24]. Xie Jinyan, Wang Xiaogang. Relationship between college students' tendency to cell phone addiction and temperament type [J]. *China Journal of Health Psychology*, 2015, 23(6):896-899
- [25]. AL-BARASHDI H S, BOUAZZA A, AL-ZUBAIDI A Q. Psychometric properties of smartphone addiction questionnaire (SPAQ) among sultan qaboos university undergraduate students [J]. *JEPS*, 2014, 8 (4) : 637-644.
- [26]. MATAR BOUMOSLEH J, JAALOUK D. Depression, anxiety, and smartphone addiction in university students - A cross sectional study [J]. *PLoS One*, 2017, 12 (8) : e0182239.
- [27]. DEMIRCI K, ORHAN H, DEMIRDAS A, et al. Validity and reliability of the Turkish Version of the Smartphone Addiction Scale in a younger population [J]. *Klin Psikofarmakol B*, 2014, 24 (3) : 226-234.
- [28]. Wang P, Sun JH, Wang YG. College students' cell phone addiction and loneliness, parenting Relationship Study of Parenting Style. *Contemporary Education Science*, 2015, 1: 56-58
- [29]. MARENGO D, SINDERMANN C, HACKEL D, et al. The association between the Big Five personality traits and smartphone use disorder: A meta-analysis [J]. *J Behav Addict*, 2020, 9 (3) : 534-550.
- [30]. BILLIEUX J. Problematic use of the mobile phone: A literature review and a pathways model [J]. *Curr Psychiatry Rev*, 2012, 8 (4) : 299-307.
- [31]. Putzer GJ, Park Y. The effects of innovation factors on smartphone adoption among nurses in community hospitals. Perspectives in health information management/AHIMA, American Health Information Management Association, 2010, 7:1b
- [32]. Park N, Kim YC, Shon HY, et al. Factors influencing smartphone use and dependency in South Korea. *Computers in Human Behavior*, 2013, 29(4): 1763-1770
- [33]. Bian M, Leung L. Linking loneliness, shyness, smartphone addiction symptoms, and patterns of smartphone use to social capital. *Social Science Computer Review*, 2015, 33(1):61-79
- [34]. Zhang K, Chen C, Zhao S, et al. Compulsive Smartphone Use: The Roles of Flow, Reinforcement Motives, and Convenience. *Proceedings of the 35th International Conference on Information Systems*, 2014
- [35]. Jeong SH, Kim HJ, Yum JY, et al. What type of content are smartphone users addicted to?: SNS vs.games. *Computers in Human Behavior*, 2016, 54: 10-17
- [36]. Zhang KZ, Chen C, Lee MK. Understanding the Role of Motives in smartphone Addiction. In *proceedings of the 18th Pacific Asia Conference on Information Systems*, 2014. 131
- [37]. MATIC A, PIELOT M, OLIVER N. Boredom -computer interaction : Boredom proneness and the use of smartphone [J]. *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 2015, 837-841.
- [38]. BOZACI I. The effect of boredom proneness on smartphone addiction and impulse purchasing : A field study with young consumers in Turkey [J]. *J Asian Finance, Econom Bus*, 2020, 7 (7) : 509-517.
- [39]. Lee, Chang-ho. A Survey on Smartphone Usage among Korean Adolescents. *China Youth Research*, 2014, 2: 9-15
- [40]. Wang S.Y., Wu A.C.. Causes of college students' cell phone addiction behavior and its countermeasures. *Journal of Chongqing University of Posts and Telecommunications: Social Science Edition*, 2012, 24(1): 40-43.
- [41]. LAN Y, DING J E, LI W, et al. A pilot study of a group mindfulness based cognitive -behavioral intervention for smartphone addiction among university students [J]. *J Behav Addict*, 2018, 7 (4) : 1171-1176.
- [42]. KIM D. Cognitive behavioral therapy for college students with smartphone addiction [J]. *Int J Adv Cul Technol*, 2021, 9 (4) : 29-39.
- [43]. Qing Zaihua, Wu Caihong, Cao Jianping. Effectiveness of cognitive-behavioral group counseling on college students' cell phone addiction intervention [J]. *Results Research [J]. Journal of Mudanjiang Normal College (Social Science Edition)*, 2019(2):126-131.
- [44]. MURPHY B L, ARNSTEN A F T, JENTSCH J D, et al. Dopamine and spatial working memory in rats and monkeys: Pharmacological reversal of stress-induced impairment [J]. *J Neuroscience*, 1996, 16 (23) : 7768-7775.
- [45]. KIM C J. The journal of exercise rehabilitation starts as the international journal [J]. *J Exerc Rehabil*, 2013, 9 (6) : 495.
- [46]. AZAM M, ALI A, MATTIULLAH J, et al. Physical activity, sports participation, and smartphone addiction in adolescent students: A systematic review [J]. *J Evid Based Psychoth*, 2020, 20 (1) : 25-41

- [47].LIU S , XIAO T , YANG L , et al.Exercise as an alternative approach for treating smartphone addiction : A systematic review and meta-analysis of random controlled trials [J] .Int J Environ Res Pub Health, 2019, 16 (20) : 3912.
- [48].KABAT-ZINN J. Mindfulness-based interventions in context: past, present, and future[J]. Clin Psychol Sci Pract, 2003, 10 (2) : 144-156.
- [49].KILLINGSWORTH M A , GILBERT D T. A wandering mind is an unhappy mind [J]. Science , 2010 , 330 (6006) : 932.
- [50].KIM K , MILNE G R , BAHL S. Smart phone addiction and mindfulness: an intergenerational comparison[J]. Int J Pharm Healthc Mark, 2018, 12 (1) : 25-43.
- [51].CHAHAR MAHALI S , BESHAI S , WOLFE W L. The associations of dispositional mindfulness , self - compassion , and reappraisal with symptoms of depression and anxiety among a sample of indigenous students in Canada[J]. J Am Coll Health, 2021, 69 (8) : 872-880.
- [52].ZIMMER-GEMBECK M J , CLEAR S J , CAMPBELL S M. Peer relationships and stress: indirect associations of dispositional mindfulness with depression , anxiety and loneliness via ways of coping[J]. J Adolesc , 2021 , 93: 177-189.
- [53].KIL N , KIM J , MCDANIEL J T , et al. Examining associations be-tween smartphone use , smartphone addiction , and mental health outcomes: a cross-sectional study of college students[J]. Health Promot Perspect , 2021 , 11 (1) : 36-44.
- [54].Yang XJ , Fan CY , Zhou ZK , et al. The relationship between positive thoughts and the tendency of cell phone addiction: the roles of boredom tendency and the role of future time insight [J]. Psychological Development and Education, 2021, 37(3): 419-428.
- [55].YUAN Xin-Yun, JIA Shu-Yi, FU Shi-Rui. Effects of positive thinking training on sleep and anxiety and depression in college students [J]. The effect of positive thinking training on sleep and anxiety and depression in university students[J]. Chinese School Health, 2021, 42(11): 1655-1659.
- [56].Gao Tr , Li JM , Han Z , et al. The influence of alexithymia on mobile phone addiction: the role of depression , anxiety and sn-ess [J] . J Affect Disord , 2017 , 225: 761-766. doi: 10. 1016/i. iad. 2017. 08. 020.
- [57].Hu Y , J Guo , J Min , et al . Investigating the attentional bias and information processing mechanism of mobile phone addicts towards emotional information [J] . Comput Hum Behav , 2020 , 110: 106378.
- [58].Lichtenstein . Vidne L , okon . Singer H , Cohen N , et al . Attentional bias in clinical depression and anxiety: the impact of emotional and non-emotional discting information [J] . BiolPsychol , 2017 , 122: 4-12.
- [59].Eysenck MW , Deral(shall N . New perspectives in attentional conffier [J] . PersIndivid Differ , 2011 50(7): 955-960.
- [60].Chen Yan . Yu Xianping . An experimental study of positive attention bias training to alleviate senior vocational students' tendency to cell phone addiction[J]. Vocational Education Forum, 2017,(35):74-78.
- [61].Tan Ping . An intervention study of college students' cell phone dependence based on reading therapy [J] . Preventive Medicine Intelligence Journal, 2019, 35(6):549-552, 558.
- [62].BONG S H , WON G H , CHOI T Y.Effects of cognitive-behavioral therapy based music therapy in Korean adolescents with smartphone and internet addiction [J] .Psychiatry Invest , 2021 , 18 (2) : 110.
- [63].Xiong Sicheng. Research on the influence mechanism and intervention of qi deficiency and qi depression quality on college students' cell phone addiction [D]. Changsha: Hunan University of Traditional Chinese Medicine, 2019.