



Smartphone Addiction Among University Students' During the Post-COVID-19 Era: The Role of Emotional Intelligence and Future Anxiety

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Objective Coronavirus disease-2019 (COVID-19) pandemic-related psychological symptoms can lead to smartphone addiction (SPA) risk and other behavioral disorders, thus impacting individuals' mental health and well-being. The present study aims to propose a mediation model to investigate the association between emotional intelligence (EI) and SPA, and the mediating role of future anxiety (FA) during the post-COVID-19 era.

Methods An online questionnaire including the Emotional Intelligence Scale, the Dark Future Scale, and the Smartphone Addiction Scale among university students from China, was conducted between September 14 and November 22, 2022. Finally, 1,154 valid questionnaires were collected. The reliability and confirmatory factor analysis results showed that all three scales had good reliability and validity.

Results Structural Equation Model demonstrated that EI significantly and negatively influenced SPA ($\beta=0.211$, $p<0.001$), university students' FA significantly and positively effected SPA ($\beta=0.315$, $p<0.001$), EI significantly predicted SPA in university students, and FA partially mediated the association between EI and SPA. The mediation effect of FA was 0.110, which accounted for 34.27% of the total effect. Bootstrap results furthermore tested the rigor of the mediating effect.

Conclusion These findings broaden our understanding regarding the relationship between EI and SPA and the mediating role of FA, providing new sights for educators on how to reduce the risk of SPA when confronting the ongoing and possible future pandemics.

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Keywords Post-COVID-19 era; Emotional intelligence; Future anxiety; Smartphone addiction; University students.

INTRODUCTION

Smartphone addiction (SPA), also known as “problematic smartphone use” or “smartphone use disorder,” refers to the maladaptive or excessive smartphone use accompanied by symptoms resembling substance-related dependence and associated functional impairment on the users.¹ Owing to its significant relations with academic performance,² mental health,^{3,4} and satisfaction with life,^{5,6} university students' SPA has gained much attention theoretically and practically. Many factors, such as personality traits, sociodemographic and psychological vari-

ables, could lead to SPA.⁷⁻⁹ Yet, with the outbreak of coronavirus disease-2019 (COVID-19), the frequency and dependence of university students on smartphones has being increased due to the COVID-19 related control measures (such as lockdowns, social distancing, and home quarantine), which might result in the risk of SPA.¹⁰⁻¹³ According to an online survey among 6,157 undergraduates in Jordan, the prevalence of SPA was 62.4% during COVID-19 quarantine.¹⁴ A recent systematic review and meta-analysis included 495 articles from 64 countries conducted by Meng et al.,¹⁵ found that among the digital addictions the prevalence estimates were 26.99% for SPA.

Past findings have suggested that the fear of COVID-19,¹⁶ COVID-19 phobia,¹⁷ anxiety regarding COVID-19 infection,¹⁸ perceived stress,¹⁹ and COVID-19 victimization experience²⁰ are all considered as significant positive predictors of SPA during the context of COVID-19 pandemic. For instance, in a sample of Türkiye 773 adults, Kayis et al.¹⁶ found that the fear of COVID-19 influenced mental well-being via loneliness and SPA. However, the potential implications in context of post-

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COVID-19 era remain largely unknown. Since December 6, 2022, Chinese government had changed its previous zero COVID policy, particularly no lockdown measures and no compulsory nucleic acid test, which means that everyone in China may contract the virus. In this sense, examining SPA and its potential mechanism is more urgent and important in the post-COVID-19 era.

Additionally, past research has also reported anxiety symptom severity and depression psychopathology are the chief determinants regarding addictive behavior of problematic smartphone users.²¹⁻²³ However, some research found different results. For example, in a sample of Italian college students, De Pasquale et al.²⁴ reported that anxiety and fear of COVID-19 were the predictors of perceived vulnerability to disease but not the predictors of risk of SPA. The conflicting results need further research with regard to the effects of anxiety on SPA, since these studies were conducted mainly before and during the outbreak of COVID-19. Considered the long-term influences of COVID-19 on economic, social, and individual mental health, it is necessary to examine the effect of anxiety on SPA in the long time perspective. As a kind of anxiety, recently, future anxiety (FA) and its effects on mental well-being and addictive behaviors is being inquired by some research.^{20,25} Consistent with this, the present study would further examine the influence of FA on SPA in the context of post-COVID-19.

Also, few existing studies have found that emotional intelligence (EI) is a significant protective factors in decreasing the risk of SPA.²⁶⁻²⁸ Emotionally intelligent individuals normally have good relationships with others, are better able to deal with emergent events and daily stress, and are least risk of indulge in addictive smartphone and other social media use. To the best of our knowledge, however, no studies have investigated the interactive effects of EI and FA on SPA during the post-COVID-19 era. Therefore, the present study attempted to fill this gap. The findings of this empirical study could help understand the crucial factors affecting university students' SPA, providing new sights for educators on how to reduce the risk of SPA when confronting the ongoing and possible future pandemics.

EI and SPA

As a construct that captures individual differences in identifying, understanding, processing, and regulating their own and other's emotional experiences, EI can be assessed in two distinct methods: "trait" EI and "ability" EI.²⁹ The former is evaluated via self-report, while the latter through measures of maximal performance. The two conceptualizations of EI are complementary not conflicting. The present study will adopt the "trait" EI in which EI is considered as a distinct component of people's personality, including individual's perceived ability

to understand and regulate their emotions and to cope with stressful and emotional challenges occurring in their life.

Subsequent studies have largely reported that EI is a key determinant of physical and mental health, psychological adjustment, and quality of life in a variety of occupational settings.^{30,31} As to students, EI could negatively correlated with burnout and anxiety levels,³² and positively predict well-being.³³ In the field of addictive behavior, a systematic review conducted by Kun and Demetrovics³⁰ found that a lower level of EI is associated with more intensive smoking, alcohol use, and illicit drug use.

With respect to SPA, few studies have examined the role of EI. According to Beranuy et al.,²⁶ apart from psychological distress, perceived EI could significantly predict maladaptive use of Internet and mobile phone. Likewise, Van Deursen et al.²⁷ emphasized that self-regulated individuals who are able to understand emotions and regulate feelings are better adjusted psychologically, are more unlikely to adversely affected by SPA. Mascia et al.²⁸ suggested that adolescents' EI negatively influenced addictive smartphone behavior, which in turn influenced their well-being and quality of life. Overall, these facts suggest that university students with lower levels of EI may possess a higher risk of developing SPA.

Thus, based on the aforementioned findings, the present study proposed the first hypothesis as follows: Hypothesis 1, EI would exert a significant negative prediction effect on SPA.

The mediating role of FA

With the outbreak of COVID-19, extant studies have indicated that the COVID-19 related psychological symptoms, such as depression, distress, loneliness, insomnia, and anxiety, are all associated with SPA during the COVID-19 epidemic.³⁴⁻⁴⁰ Effectively, as regards to anxiety symptoms, which is the most prevalent psychological symptoms during the COVID-19 epidemic,^{41,42} different kinds of anxiety, such as social anxiety,^{43,44} attachment anxiety,⁴⁵ cyberchondria,⁴⁶ and online social anxiety,⁴⁷ were founded to have a significant and positive effect on SPA. According to previous studies, time perspective was also a important predictor of addiction behaviors.⁴⁸⁻⁵¹ For instance, one of these studies carried out by Przepiorka and Blachnio⁴⁹ among 756 Internet users suggested that time perspective was a predictor of two kinds of addiction: Internet addiction and Facebook addiction.

In this vein, time perspective should be put in addictive behaviors studies.^{52,53} In contrast to the concept of anxiety, which focuses on how people react to current events and personal experiences, FA involves a more remote personal future. FA refers to a state in which an individual feels uncertainty, fear, worry, and concern about what may happen in the future.⁵⁴ Studies have found that the COVID-19 pandemic has increased

anxiety regarding the future by considerably disrupting individuals' lives, exacerbating economic instabilities and social problems, and generating anticipatory fears, which in turn increases anxiety and uncertainty regarding the future.^{55,56} Therefore, in the post-COVID-19 era, the FA resulting from the COVID-19 related experience might be more urgent. For example, in a sample of 478 students in Poland, Przepiorka et al.⁵⁷ indicated that FA significantly and positively predicted problematic new media use. More recently, in a sample of 840 Chinese college students, Chen et al.²⁰ revealed that both FA and COVID-19 victimization experience was significantly related with mobile phone addiction. Thus, the present study proposed the second hypothesis as follows: Hypothesis 2, Higher levels of FA would significantly and positively predict SPA among university students.

Additionally, several researchers have also examined the potential link between EI and anxiety.^{58,59} Prior studies have posited that lower levels of EI are significantly associated with anxiety, stress, and depression, and may impact on subsequent development of social and emotional issues.^{26,60,61} In this vein, when facing stressful situations and challenging events, individuals with low levels of EI are more likely to use maladaptive coping strategies and to face challenges negatively.³⁰ In the academic context, Fiorilli et al.⁶² founded that students with lower levels of EI were more likely to experience anxiety when dealing with challenging school events, which in turn enhanced their overall risk of school burnout. By contrast, Mavroveli et al.⁶³ have found that adolescents with higher levels of EI are generally less predisposed to developing depressive or somatic symptoms, and are more likely to successfully cope with difficult events. Overall, these results support the status of EI as a fundamental antecedent variable with a strong effect on students' school adjustment outcomes and cognitive behaviors. Specifically, individuals with high EI levels tend to express positive and optimistic evaluations of their future situations compared to their low emotionally intelligent peers.

Moreover, previous research has suggested that anxiety or FA often plays an essential mediating role. For example, Romano et al.⁶⁴ posited that students' anxiety performed as a mediator between alexithymia and academic burnout. Similarly, Fiorilli et al.⁶² founded that academic anxiety mediated the association between trait EI and school burnout. Zhan et al.⁴⁷ suggested that both online social anxiety and cyber danger belief mediated the influence of personality on cellphone addiction during the COVID-19 outbreak. Hao et al.⁶⁵ indicated that anxiety mediated the association between academic burnout and problematic smartphone use during the COVID-19 pandemic. Paredes et al.²⁵ found that FA had a mediating effect between the perceived threat of COVID-19 and mental well-being. A recent study conducted by Przepiorka

et al.⁵⁷ with 478 students in Poland reported that FA partially mediated the link between procrastination and mobile phone addiction. More recently, Chen et al.²⁰ revealed that FA fully mediated the association between COVID-19 victimization experience and mobile phone addiction. Similarly, Ma et al.⁶⁶ found that depression, anxiety, and stress could mediate the relationship between resilience and mobile phone addiction among 1,751 Chinese adolescents. Therefore, Hypothesis 3 was proposed as follows: Hypothesis 3, FA would have a mediating effect on the relationship between EI and SPA among university students.

The present study

Based on the above literature discussion, the present study will construct a mediated model to examine the relationship between EI and SPA during the post-COVID-19 era, which is shown in Figure 1.

METHODS

Participants

The Ethics Committee of the Zhoukou Normal University approved the present study (2022ZKNU0912). The procedure of study was conducted in accordance with the Declaration of Helsinki,⁶⁷ and all participants voluntarily filled out questionnaires. The data were collected and analyzed anonymously.

A questionnaire survey was conducted at two universities from China, one in Zhoukou city, and the other in Shenyang city between September 14 and November 22, 2022. Participants were enrolled by means of convenience sampling with the help of four assistants. Before the formal survey, the training was given to the four assistants, and the scientific purpose, voluntariness and anonymity of the research were told to the participants. During the break, questionnaires were distributed on the online through Wechat. Since no questionnaire was submitted until all items were completed, so there was no uncompleted questionnaire, and 1,223 questionnaires were gathered. The entire questionnaire took about 15 minutes. After excluding 69 invalid questionnaires, because the answering time was too low (i.e., completed in lower than 120 s), finally 1,154

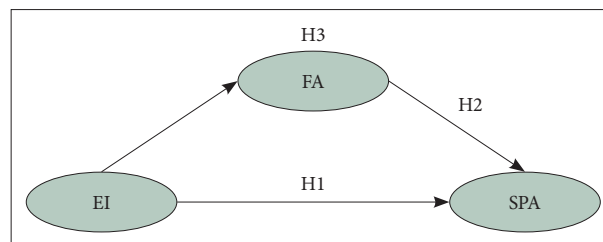


Figure 1. The proposed mediation model. EI, emotional intelligence; FA, future anxiety; SPA, smartphone addiction; H, hypothesis.

valid questionnaires were collected, with an effective rate of 94.36%.

Measures

The Smartphone Addiction Scale

To measure SPA, the shorten version of Smartphone Addiction Scale (SAS-10) developed by Kwon et al.⁶⁸ was used. The responses are rated on a 5-point Likert scale ranging from 1 (not at all) to 5 (always), with higher scores indicating higher levels of SPA. The sample item is: "I won't be able to stand not having a smartphone."

The Emotional Intelligence Scale

EI was assessed with Wong and Law's Scale (WLEIS-16).⁶⁹ The Chinese version has shown satisfactory psychometric properties.⁷⁰ This scale is a 16 items self-report measure with a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (completely agree), with higher scores suggesting higher levels of EI, including four dimensions: self-emotion appraisal, others' emotion appraisal, use of emotion, and regulation of emotion. The sample item is: "I am a good observer of others' emotions."

Future Anxiety Scale

To measure FA, the Dark Future scale developed by Zaleski et al.⁷¹ was used. This single dimension scale consists of five items. The responses are rated on a 5-point Likert scale, with scores ranging from 1 (decidedly false) to 5 (decidedly true), and higher scores indicates higher degrees of FA. The sample item is: "I am afraid that in the future my life will change for the worse."

Procedure and data analysis

The statistical procedure for this study ran as follow. First, Harman's single factor was used to test the common method variance (CMV).⁷² Then, participants' profile, descriptive statistics and correlation analysis was used with IBM SPSS 21.0 (IBM Corp., Armonk, NY, USA). Second, confirmatory factor analysis (CFA) was performed to test the structural validity of the measurement model.⁷³ Then the fit and path coefficients of the hypothesized mediation model were assessed by the Structural Equation Model (SEM) with AMOS 21.0 (IBM Corp., Armonk, NY, USA), not least since it can test associations between many factors simultaneously.⁷⁴ Finally, to further test the rigor of mediating effect, the bias-corrected nonparametric percentile bootstrap method with 5,000 times resampling was used. According to Preacher and Hayes,⁷⁵ compared with the traditional causal steps, the method of bootstrapping shows greater statistical power.

CMV Test

Before formal analysis, since all variables were measured with self-reported scale among the same participants, there may be the CMV problem. In order to cope with this problem, Harman's one-factor test was used. More specifically, the Bartlett's test of sphericity reached significance ($p < 0.001$), and unrotated factor analysis indicated that the Kaiser–Meyer–Olkin was 0.907 (more than 0.8). Furthermore, a total of 7 factors were extracted from the factor analysis, and the explanatory power of the first factor was 27.067%, without passing 50% threshold,⁷² indicating that the CMV problem did not affect the study results.

RESULTS

Participants' profile

A total of 1,154 participants were enrolled in this study, the results of participants' profile were shown in Table 1. As shown, 525 (45.5%) were male students and 629 (54.5%) were female students. As to age, 40 (3.5%) were 17-year-old, 369 (32.0%) were 18 years, 328 (28.4%) were 19 years, and 417 (36.1%) were 20 years. As regard to grade, the sample included 561 (48.6%) freshmen, 281 (24.4%) sophomores, 282 (24.4%) juniors, and 30 (2.6%) seniors. In terms of major, 425 (36.8%) were arts and humanities, 320 (27.7%) were science, and 409 (35.4%) were engineering.

Table 1. Demographic profile of participants

Variable	Value (N=1,154)
Gender	
Male	525 (45.5)
Female	629 (54.5)
Age	
17 yr	40 (3.5)
18 yr	369 (32.0)
19 yr	328 (28.4)
20 yr	417 (36.1)
Grade	
Freshman	561 (48.6)
Sophomore	281 (24.4)
Junior	282 (24.4)
Senior	30 (2.6)
Major	
Arts and Humanities	425 (36.8)
Science	320 (27.7)
Engineering	409 (35.4)

Values are presented number (%).

Reliability and validity assessment of measurement model

The Smartphone Addiction Scale

The results of CFA of the SAS-10 was displayed in Table 2. As shown, the factor loadings of SAS-10 were ranging from 0.474 to 0.716, the composite reliability (CR) value was 0.848 (more than 0.7), and the average variance extracted (AVE) value was 0.361. Even though the AVE is less than the threshold of 0.5, however, according to Fornell and Larcker,⁷⁶ if the CR value is greater than 0.6, the convergent validity of the scale is still acceptable. The Cronbach's α was 0.845, greater than 0.7, indicating the good reliability.⁷⁶

The Emotional Intelligence Scale

The results of CFA of the WLEIS-16 was displayed in Table 3. As shown, the factor loadings of WLEIS-16 were ranging from 0.628 to 0.885 (more than 0.5), the CR values were ranging from 0.850 to 0.891 (more than 0.7), and AVE values were ranging from 0.589 to 0.673 (more than 0.5). All the values exceeded the standard value, indicating the high convergent validity. The Cronbach's α of each dimension was between 0.845 and 0.888, greater than 0.7, indicating the good reliability.⁷⁶

Future Anxiety Scale

Table 4 presents the results of CFA of the Future Anxiety Scale (FAS-5). The standardized factor loadings ranged from 0.740 to 0.865 (more than 0.5), indicating satisfactory validity. The CR value was 0.896 (more than 0.7), and the AVE value was 0.634 (more than 0.5), indicating satisfactory convergent validity. The Cronbach's α of the FAS-5 was 0.896 (more than 0.7). These values indicated an acceptable fit of the measurement model to the observed data.⁷⁶

Table 2. CFA results of SAS-10

Dimension	No.	Factor loading	CR	AVE	Cronbach's α
Smartphone addiction	1	0.527	0.848	0.361	0.845
	2	0.610			
	3	0.540			
	4	0.571			
	5	0.703			
	6	0.716			
	7	0.594			
	8	0.474			
	9	0.652			
	10	0.575			

CFA, confirmatory factor analysis; SAS-10, shorten version of Smartphone Addiction Scale; CR, composite reliability; AVE, average variance extracted

Discriminant validity

According to Fornell and Larcker,⁷⁶ the square root of AVE was used to test the discrimination validity. As displayed in Table 5, the square root of AVE of each dimension was greater than the correlation coefficient of each dimension, indicating the high discriminant validity.

Descriptive statistics and correlation analysis of main variables

Descriptive statistics and correlation analysis were shown in Table 6. The statistical results showed that university students had a high or mean level of EI (mean=3.592), FA (mean=2.759), and SPA (mean=2.869). In addition, the results indicated that EI negatively and significantly correlated with SPA ($r=-0.259$, $p<0.001$); EI negatively and significantly correlated with FA ($r=-0.286$, $p<0.001$); and FA positively and significantly correlated with SPA ($r=0.348$, $p<0.001$).

Table 3. CFA results of WLEIS-16

Dimension	No.	Factor loading	CR	AVE	Cronbach's α
Self-emotion appraisal	1	0.717	0.865	0.617	0.862
	2	0.828			
	3	0.862			
	4	0.726			
Others' emotion appraisal	1	0.776	0.891	0.673	0.888
	2	0.885			
	3	0.874			
	4	0.738			
Use of emotion	1	0.628	0.850	0.589	0.845
	2	0.815			
	3	0.810			
	4	0.801			
Regulation of emotion	1	0.798	0.881	0.650	0.880
	2	0.821			
	3	0.767			
	4	0.837			

CFA, confirmatory factor analysis; WLEIS-16, Wong and Law Emotional Intelligence Scale; CR, composite reliability; AVE, average variance extracted

Table 4. CFA results of FAS-5

Dimension	No.	Factor loading	CR	AVE	Cronbach's α
Future anxiety	1	0.762	0.896	0.634	0.896
	2	0.842			
	3	0.865			
	4	0.764			
	5	0.740			

CFA, confirmatory factor analysis; FAS-5, Future Anxiety Scale; CR, composite reliability; AVE, average variance extracted

Table 5. Discriminant validity of main variables

Dimension	M	SD	1	2	3	4	5	6
1. EI-SEA	3.684	0.660	0.785 [†]					
2. EI-OEA	3.642	0.684	0.510 ^{***}	0.820 [†]				
3. EI-UOE	3.534	0.704	0.545 ^{***}	0.474 ^{***}	0.767 [†]			
4. EI-ROE	3.506	0.723	0.485 ^{***}	0.386 ^{***}	0.506 ^{***}	0.806 [†]		
5. FA	2.759	0.939	-0.227 ^{***}	-0.141 ^{***}	-0.262 ^{***}	-0.264 ^{***}	0.796 [†]	
6. SPA	2.869	0.691	-0.181 ^{***}	-0.165 ^{***}	-0.219 ^{***}	-0.244 ^{***}	0.348 ^{***}	0.601 [†]

N=1,154. ***p<0.001; [†]numbers are the square root of the average variance extracted (AVE), numbers in the lower diagonal denote the correlation coefficients. M, mean; SD, standard deviation; EI-SEA, self-emotion appraisal; EI-OEA, others' emotion appraisal; EI-UOE, use of emotion; EI-ROE, regulation of emotion; FA, future anxiety; SPA, smartphone addiction

Table 6. Descriptive statistics and correlation analysis of main variables

Variable	M	SD	EI	FA	SPA
EI	3.592	0.542	1		
FA	2.759	0.939	-0.286 ^{***}	1	
SPA	2.869	0.691	-0.259 ^{***}	0.348 ^{***}	1

N=1,154. ***p<0.001. M, mean; SD, standard deviation; EI, emotional intelligence; FA, future anxiety; SPA, smartphone addiction

Structural model

Prior studies have reported that age might a potential variable that could relate with SPA.⁸ Thus, before examining the proposed mediation model, the single factor analysis of variance was used to analyze the SPA in different age groups. The results showed that there was no significant difference in SPA among university students in different age groups (F=1.897, p>0.05). Therefore, age is not a variable associated with SPA in the present study. To test the proposed mediation model in Figure 1, SEM analysis was conducted. Specifically, the selected absolute, incremental and parsimonious model-fit indices, i.e., root mean square of error approximation=0.069, goodness of fit index=0.911, comparative fit index=0.907, normed fit index=0.891, Tucker-Lewis index=0.893, and chi-square/degree of freedom=6.235, all satisfied the criteria, indicating a good fit of the proposed model.⁷⁴

The results of the structural relationships were displayed in Figure 2. As shown, EI could significantly and negatively predict SPA ($\beta=-0.211$, p<0.001); FA could significantly and positively predict SPA ($\beta=0.315$, p<0.001); and EI significantly and negatively predicted FA ($\beta=-0.349$, p<0.001). The result suggested that FA exerted a partially mediating effect between university students' EI and their levels of SPA.

To examine the stability of the mediation model results, the bias-corrected nonparametric percentile bootstrap method with 5,000 times resampling was further performed. The bootstrap results were shown in Table 7. The results suggested that the indirect effect, i.e., EI → FA → SPA was -0.110 with 95% confidence interval (CI, -0.148 to -0.079), indicating a signifi-

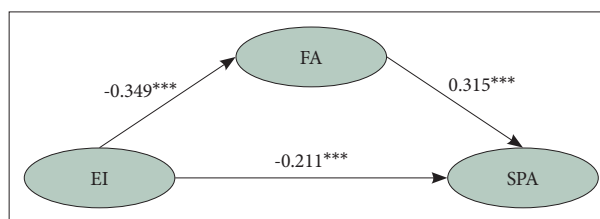


Figure 2. The mediation model. ***p<0.001. EI, emotional intelligence; FA, future anxiety; SPA, smartphone addiction.

Table 7. The results of bootstrap with 5,000 times resampling

Path	Estimate	95% confidence interval
Indirect effect	-0.110	-0.148 to -0.079
Direct effect	-0.211	-0.301 to -0.125
Total effect	-0.321	-0.404 to -0.238

cant mediating effect. While the direct effect of EI on SPA was -0.211, with 95% CI (-0.301 to -0.125), indicating a partial mediating effect. Furthermore, the total effect value, i.e., the sum of the indirect effect and the direct effect, was -0.321 with 95% CI (-0.404 to -0.238). The mediation effect accounted for 34.27% of the total effect.

DISCUSSION

Main findings

Drawing upon previous research, in a sample of 1,154 university students in China, the aim of the present study was to investigate the role of EI and FA in forming university students' SPA during the post-COVID-19 era.

First, as is illustrated in Figure 2, the present findings confirmed Hypothesis 1, supporting that EI are negative stimuli that have a significant predictive effect on SPA. This result is consistent with previous studies reporting that EI correlated negatively with burnout and anxiety levels,³² that EI could significantly predict maladaptive use of Internet and mobile phone,²⁶ and that lower levels of EI are associated with addictive disorders.³⁰ Aligning with those results, the present study

further found the significant relationship between EI and SPA among university students during the post-COVID-19 era.

The COVID-19 pandemic has been exacerbating economic and social problems, leading to increased clinical, psychological and social unfavorable outcomes among different groups, which in turn increases the risk of SPA.^{39,40,77-79} As to university students, since their limited social relationships and lifestyle,⁸⁰⁻⁸⁴ when they experience psychological problems and mental disorders, they are more likely to use smartphones or other social medias to escape negative emotions and traumatic events. Moreover, extant studies have revealed that increased EI could decrease the risk of burnout, depression, and psychological distress.^{31,32} In this sense, although individuals with psychological symptoms tend to overuse their smartphones frequently, the levels of SPA could be decreased by enhancing their EI abilities. Indeed, emotionally intelligent students, who are more capable of knowing how to appraise their own and others' emotions consistently and deal with emotional problems effectively, are less vulnerable to developing addictive behaviors.

Second, our results indicated that FA was positively related to SPA, thus supporting Hypothesis 2. Like other psychological symptoms, this result is in line with previous studies reporting that depression was positively associated with SPA,^{37,85} anxiety was positively associated with SPA,^{35,86} anxiety disorders was positively associated with substance use disorders,^{38,87} and psychological distress was positively associated with internet addiction.⁸⁸ Based on previous studies, the present study furthermore add up time perspective as a significant predictor of addictive behaviors.^{48,49} That is, university students with a higher level of FA may exhibit stronger tendencies to become addicted so as to find consolation for their anxiety or worry.

The results of the present study can be explained in the light of the uses and gratifications theory,⁸⁹ which postulates the recipient's active role and selection of social media for the gratification of specific needs. That is, the effect of the social media depends on the user's subjective intentions and characteristics. During the post-COVID-19 era, the ongoing pandemic has been disrupting university students' normal lives. In particular, increased interpersonal alienation levels has result in increased time spent with social medias and problematic lifestyles.¹³ Anxious university students may have repetitive negative thinking regarding the future and low sense of self-control.⁹⁰⁻⁹² Smartphone could create a virtual world full of interactivity, demasification, and hypertextuality, which might satisfy their safety and self-actualization needs. In this vein, smartphone use may relieve their negative mood, which in turn may enhance addictive tendencies. Moreover, negative attitude towards the future is related to avoidant coping strategies, which may also increase the tendency to use their smartphones to escape re-

ality into the online world in problem situations.⁸⁸

Third, supporting Hypothesis 3, the results indicated that FA played a mediating role between EI and SPA. That is, EI could indirectly affect the university students' levels of SPA through FA. The results are in agreement with those of previous studies indicating that FA mediated the association between the perceived threat of COVID-19 and mental well-being,⁶⁵ between procrastination and mobile phone addiction,⁵⁷ and between COVID-19 victimization experience and mobile phone addiction.²³ Similarly, the mediating role of past negative and present fatalistic time perspective orientations was found in the relationship between attention-deficit hyperactivity disorder symptoms and addictive Facebook use.⁵¹ Consistent with the future time perspective, the present study further broadens the mediating role of FA between EI and SPA, showing that the effects of university students' EI on their SPA could be partially compromised by their high levels of FA.

Regarding the nature of mediating of FA in the contest of SPA, past studies reported different views. For example, according to Przepiorka et al.,⁵⁷ FA partially mediated the link between procrastination and mobile phone addiction among 478 students in Poland; while Chen et al.²⁰ revealed that FA fully mediated the association between COVID-19 victimization experience and mobile phone addiction among 840 Chinese college students. Using a sample of 1,154 university students in China, the present study reported the partial mediating role of FA in the EI-SPA link. The different mediating role of FA in relation to SPA could attribute to the individuals' changing knowledge and information regarding the COVID-19 during the different phase of pandemic. At least in the post-COVID-19 era, although the effects of COVID-19 are profound, anxiety symptoms resulted from the COVID-19, such as FA, are not last forever, in particular for individuals who have enhanced levels of EI.

Speculatively, these results could be explained by the fact that individuals with higher levels of EI have better self-awareness, paying attention to oneself and others' emotions, and using them to manage their relationships and improve adaption coping mechanisms such as problem-solving and stress management. All these strategies could be conducive to reduce the risk of anxiety and SPA.⁵⁸ By contrast, individuals with lower levels of EI would tend to think about the future negatively, feel uncertain about what may happen to them in future, find no meaning in life, and are more likely to escape into smartphone or indulge in others social medias.⁹³ Using these new social medias might relieve their negative feelings about future tasks and decisions. Thus, the present study significantly extends the findings of earlier research by considering FA in explaining SPA.

Practical implications

The present study could provide some practical reference for education administrators and instructors to respond to emergency public health events such as COVID-19. First, considered that university students' EI could decrease their levels of SPA, it is suggested that instructors should integrate EI training programs into mental health courses so as to improve university students' EI ability and minimize the vulnerability of university students to develop SPA.

Second, instructors should guide university students to properly confront COVID-19 epidemic and develop an proper understanding. For instance, education administrators should hold lectures on COVID-19 knowledge, scientifically interpret the current development of the epidemic, guide university students to accurately understand the threat to health and to have reasonable thinking in similar public health events, so as to alleviate students' anxiety regarding the future.

Limitations and future research

Like other studies, some limitations should be noted so that future research could address them. First, since the present study was cross-sectional, the sample using the convenience sampling method was merely collected among the Chinese university students, it might have inferential limitations. To generalize the results, thus, a longitudinal cross-cultural study should be conducted, the sampling method should be improved, and range of participants, particularly populations with cultural differences must be considered.

Second, this study used a self-report questionnaire to measure the variables, which could have resulted in socially-desirable answers. This might especially be important in relation to EI. A note for further research is to measure EI with other methods, such as performance-based method.

Third, this study used a 5-point Likert self-reported scale to measure SPA without distinguishing different types of use, and one factor loading and AVE value were low than 0.5. For future studies, to measure smartphone use more precisely, different types of smartphone use, e.g., process use and social usage, should be taken into account;^{3,94} to improve the validity of data, a particular application that can track smartphone screen time could also be employed.⁹⁵

Forth, as extant studies showed many factors could influence university students' levels of SPA, the present study only examined the mediating role of FA in the association between EI and SPA among university students, considered the long-term effects of COVID-19 on individuals' anxiety symptom, further studies should examine the role of other mediators, such as fear of missing out, self-regulation, and positive mental health,⁹⁶⁻⁹⁸ in the link between FA and SPA.

Conclusion

The COVID-19 has been changing people's lives in many aspects profoundly. As for university students, the frequency and dependence on smartphones has been increased due to the COVID-19 related control measures, thus researchers should pay more attention to examine the factors and mechanism influencing university students' SPA in the post-COVID-19 era. Based on prior studies, the present study constructed a mediation model. As expected, a significant correlation was observed among EI, FA, and SPA. SEM analysis showed that EI had a significant negative predictive effect on SPA and FA could significantly and positively predict university students' levels of SPA. Moreover, FA mediated the link between EI and SPA. Taken together, the findings could theoretically enrich our understanding and knowledge regarding the risk of SPA, i.e., EI considered as a protective variable, FA considered as a risk variable, and the predictive effect of EI on SPA could partially mediated by FA. To design intervention measures to decrease university students' SPA, educators and policy makers should design EI training programs in public health courses and guide university students to accurately understand the COVID-19 and similar public affairs. In the post-COVID-19 era, considering everyone has the potential risk of becoming the victims of COVID-19, more COVID-19 related symptoms and its interactive effects in relation to EI on smartphone or other social media addiction risk should be carried out in future studies.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

The author has no potential conflicts of interest to disclose.

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