



## How does self-esteem affect mobile phone addiction? The mediating role of social anxiety and interpersonal sensitivity



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### ABSTRACT

Low self-esteem is an important factor influencing mobile phone addiction, which has been well documented. However, little research focused on the mechanism underlying the association between self-esteem and mobile phone addiction. We hypothesized that social anxiety and interpersonal sensitivity may mediate the relationship between self-esteem and mobile phone addiction. Six hundred and fifty three (353 girls among them) college students with the mean age of 19.94 (SD = 1.34) were recruited for the study. Participants completed mobile phone addiction scale, Rosenberg self-esteem scale, the social anxiety questionnaire and interpersonal sensitivity subscale of SCL-90. The findings were as follows: 1) interpersonal sensitivity mediated the relation between self-esteem and mobile phone addiction. 2) social anxiety and interpersonal sensitivity sequentially mediated the relation between self-esteem and mobile phone addiction. The result reveals that self-esteem has indirect effect on mobile phone addiction, which is mediated by social anxiety and interpersonal sensitivity.

### 1. Introduction

Mobile phone use has increased dramatically in recent years, especially among youth in China. For example, 724 million people used mobile phones to surf the Internet at the end of June 2017, with an increase of 28.3 million over the year of 2016. Mobile phone users aged from 20 to 29 accounted for the largest group (29.7%), and most of them mainly used mobile phones for online communication (China Internet Network Information Center, 2017). Since spending much time on mobile phones, a large number of people encountered psychological and adaptive problems, such as mobile phone addiction (Choliz, 2010; Chen et al., 2016; Takao et al., 2009; Sapacz et al., 2016; Yen et al., 2009).

Mobile phone addiction, in previous studies, is also known as mobile phone dependence (Choliz, 2010; Gao et al., 2018) or problematic mobile phone use (Liu et al., 2017a,b). Although the evidence of mobile phone addiction for being a kind of behavioral addictions is still under debating (Billieux et al., 2015), many scholars prefer considering it as a behavioral addiction. Thus, mobile phone addiction is generally defined with typical addictive behaviors, such as cognitive salience, loss of control, mood modification, tolerance, withdrawal, conflict and relapse (Griffiths, 2005; Yen et al., 2009; Griffiths, 1995). The diagnostic criteria of mobile phone addiction were directly transposed from those

classifying and diagnosing other addictive behaviors such as the criteria for substance use and pathological gambling depicted in the fourth revised edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; Choliz, 2010; Billieux et al., 2015).

Prevalence studies have reported highly heterogeneous rates of mobile phone addiction ranging from just above 0% to more than 35% (Lopez-Fernandez et al., 2014; Smetaniuk, 2014; Ha et al., 2008; Yen et al., 2009). For example, a study found that the prevalence of problematic users among the British students (ages 11–18 years) was 10%. However, studies from multiple countries found that the occurrence rate of mobile phone addiction in adolescents was about 30% (He et al., 2012). A multitude of studies have documented that people with mobile phone addiction had social adaptation problems, such as poor sleep quality (Liu et al., 2017a,b), phantom communication experiences (Kruger and Djerf, 2017), and more negative emotions (Chen et al., 2016).

The number of studies on mobile phone addiction has increased in recent years, and previous studies mainly focused on the influencing factors of mobile phone addiction (e.g., Bianchi and Phillips, 2005). These studies have concluded that mobile phone addiction is proved to be an extremely important research topic and be associated with various factors (e.g., Chen et al., 2016), such as psychological characteristics (Hong et al., 2012; Billieux, 2012), loneliness (Bian and

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Leung, 2015), social networks intensity (Salehan and Negahban, 2013). It is necessary to clarify the factors influencing mobile phone addiction.

### 1.1. The effect of self-esteem on mobile phone addiction

Self-esteem is typically defined as one's overall sense of worthiness to be a person (Rosenberg, 1979). A large number of studies demonstrated the low self-esteem as a strong predictor of mobile phone addiction (e.g., Khang et al., 2013; Park and Lee, 2014; Jang and Park, 2009; Kim and Koh, 2018). Although there has been a clear relationship between low self-esteem level and mobile phone addiction, these studies brought about limited empirical comprehension of the psychological mechanisms involved (Billieux, 2012). Some researchers suggested that the effects of self-esteem on mobile phone addiction may be achieved through some mediating variables (Walsh et al., 2009).

In previous studies, the predictive effect of self-esteem on mobile phone addiction was generally interpreted that individuals with low self-esteem usually faced troubles in interpersonal relationships in the real world, thus they often needed to obtain security in affective relationships (Billieux, 2012), while indirect communication of mobile phone satisfied their needs (e.g., text messaging satisfied a need for security and compensated for the fear of social loss; Bianchi and Phillips, 2005). Therefore, people with low self-esteem may excessively use the mobile phone. In addition, the pathways model of problematic mobile phone use (Billieux, 2012) suggested that insecure attachment style (e.g., social anxiety) caused by low self-esteem was a risky factor of dysfunctional relationship maintenance style (e.g., interpersonal sensitivity) which resulted in mobile phone addiction. These literatures indicated that social anxiety and interpersonal sensitivity may play an important role between self-esteem and mobile phone addiction. Therefore, the aim of this study was to explore the mediating mechanism of social anxiety and interpersonal sensitivity on the relationship between self-esteem and mobile phone addiction.

### 1.2. The mediating role of social anxiety

Social anxiety in this study is defined as anxiety resulting from the prospect or presence of personal valuation in real or imagined social situations (Schlenker and Leary, 1982). Researchers demonstrated that people would use mobile phones as a substitute for social contact when they felt anxious in a real environment (e.g., Ha et al., 2008). People with high social anxiety were more likely to use mobile phone to communicate with others (Reid and Reid, 2007), and experienced a high level of mobile phone addiction (Darcin et al., 2016).

Sociometer theory suggested self-esteem was a predictive factor of social anxiety (Leary et al., 1995). In addition, low self-esteem played a key role in the formation of social anxiety among college students (e.g., Kocovski and Endler, 2000). Improving self-esteem can help people reduce their social anxiety (Cheng et al., 2015). Individuals with low self-esteem tended to have negative self-evaluation and to be passive in interpersonal interaction (Baumeister et al., 2003), which made them suffer more social anxiety. Moreover, Li and Wu (2013) suggested individuals with low self-esteem tended to hold that the future scenario was negative, even coping with uncertain situation in a negative way, which led to increasing social anxiety. Given the above literature analysis, we can conclude that self-esteem has a predictive effect on social anxiety. Thus we hypothesize (H1): *social anxiety will mediate the relationship between self-esteem and mobile phone addiction.*

### 1.3. The mediating role of interpersonal sensitivity

Interpersonal sensitivity was defined as a psychological symptom, which referred to over-sensitivity when individuals felt self-depreciative in interpersonal contact (Davidson et al., 1989), especially when facing others' criticisms and rejections (Derogatis et al., 1976). The definition of interpersonal sensitivity also included the emotional

experiences as inferiority, personal inadequacy and poor morale (Lipman et al., 1979). People with high interpersonal sensitivity often showed interpersonal inferiority, uneasiness, obvious uncomfortableness and the negative expectation for interpersonal interaction (Lipman et al., 1979). ACE (Anonymity, Convenience, Escape) model of Internet addiction (Young, 1997) showed that characteristics of Internet such as anonymity, convenience and escaping from real life were the most important influencing factors on Internet addiction. These characteristics will help those who cannot establish or maintain relationships in real life gain more opportunities to interact with others. Thus, people with high interpersonal sensitivity are more likely to be addicted to mobile phones. Previous studies found interpersonal sensitivity was associated with several technology addiction behaviors. For example, interpersonal sensitivity could predict mobile phone addiction among college students (Babadi-Akashé et al., 2014). Korean adolescents with a higher level of interpersonal sensitivity would have higher level of Internet addiction (Yang, 2001). The longitudinal study of Taiwanese adolescents had deeply confirmed the effects of interpersonal sensitivity on Internet addiction (Ko et al., 2007).

Boyce and Parker (1989) proposed that self-esteem affects interpersonal sensitivity as psychological stress changes. A large number of empirical studies indicated self-esteem had a negative effect on interpersonal sensitivity (e.g., Garaigordobil and Bernaras, 2009). A meta-analysis study showed that self-esteem is moderately ( $r = -0.34$ ) related to interpersonal sensitivity among college students (Gao et al., 2015). Therefore, the present study hypothesizes (H2): *interpersonal sensitivity has a mediating role between self-esteem and mobile phone addiction.*

### 1.4. The sequential mediation model

Previous studies reported people with high social anxiety usually felt inadequate in social situations, which might lead to interpersonal sensitivity (e.g., Alden et al., 1995). The effect of social anxiety on interpersonal sensitivity had also been supported by empirical studies (Beck et al., 1985) and theoretical perspective (Billieux, 2012). For example, people with higher level of social anxiety were more sensitive to interpersonal relationships (Ezoe et al., 2009). Interpersonal sensitivity may play a mediating role among self-esteem, social anxiety and mobile phone addiction. Given that, we hypothesize (H3): *social anxiety and interpersonal sensitivity have a sequential mediation effect on the relationship between self-esteem and mobile phone addiction.*

In summary, due to the high frequency of mobile phone use, lots of empirical studies focused on exploring the predictive factors of mobile phone addiction among college students (e.g., Liu et al., 2017a,b). Thus, college students were selected in this study to test the influencing mechanism of self-esteem on mobile phone addiction. This study aimed to examine the meditative roles of social anxiety and interpersonal sensitivity between self-esteem and mobile phone addiction, to deepen our understanding about how self-esteem is associated with mobile phone addiction and provide valuable insights for mobile phone addiction interventions.

## 2. Methods

### 2.1. Participants

With a convenient sampling method, we recruited college students from universities located in Wuhan (a developed city in central China). A total of 688 college students participated in the survey. Among them 653 (including 353 females) participants completed the survey. All participants were 17–25 years old, with the mean age of 19.94 ( $SD = 1.34$ ); 151 freshmen, 222 sophomores, 190 juniors and 90 senior students constituted the sample. 63.9% of the participants' fathers and 57.9% of the participants' mothers finished high school or higher education; and 10.8% of students reported that monthly household

income was less than ¥2000, 33.4% was from ¥2000 to ¥4999, 30.6% was from ¥5000 to ¥7999, and 25.2% earned more than ¥8000. All participants indicated that they had never been hospitalized with psychiatric symptoms in the past two years. Only a few of them (< 2% of the total sample) reported they consulted psychologists in the past two years for very mild problems, such as academic difficulties and slight sleep problem. Thus, no participants were excluded due to psychiatry history reports.

2.2. Measurement

2.2.1. Mobile phone addiction

Mobile phone addiction was assessed by mobile phone addiction scale (Xiong et al., 2012). As a self-report questionnaire, this scale consisted of 16 items with four dimensions, including withdrawal symptoms, prominent behavior, social comfort and mood change. A representative item was “if I didn't use mobile phones for a long time, I would feel uncomfortable”. Items were answered on a 5-point scale from 1 = totally disagree to 5 = totally agree. The mean of the 16 items was calculated, and the higher the score, the higher level of mobile addiction was. Participants whose scores were equal or higher than 3.2 were regarded as mobile phone addiction (Zu et al., 2017). This scale has been demonstrated with high reliability among Chinese college students in previous researches (e.g., Li et al., 2017), and the Cronbach's alpha was 0.89 in present study.

2.2.2. The Rosenberg self-esteem scale (SES)

Self-esteem was assessed by the Rosenberg self-esteem scale (Rosenberg, 1965). This scale evaluates general self-esteem with 10 statements that refer to global feelings of self-evaluation (e.g., “In general, I am satisfied with myself”), 5 of which were worded positively and the other 5 negatively. Respondents were requested to read the statements and rate the degree to which each one can be self-applied, on a 4-point scale (ranging from 1 = totally agree to 4 = totally disagree). The reliability of this scale has been extensively reported in literatures. The validity of the scale as a unidimensional measure of self-esteem has also been verified in various studies (Rosenberg, 1965). The scale was also widely used among Chinese people and was verified with good validity and reliability (Schmitt and Allik, 2005). In this study, the Cronbach's alpha for the scale was 0.85.

2.2.3. Social anxiety

The six-item social anxiety subscale of the Self-consciousness scale (Fenigstein et al., 1975) was used to assess social anxiety. A representative item was “I feel anxious when I speak in front of a group”. In this scale, participants were asked to respond on a 4-point scale (from 0 = “not at all” to 3 = “extremely”). Social anxiety subscale had good validity, good internal consistency and good test-retest reliability among Chinese college students (Shek, 1994). It was found that this scale could effectively distinguish undergraduates with a high level of social anxiety from the low ones (Hope et al., 1990). In this study, the

Cronbach's alpha for the scale was 0.77.

2.2.4. Interpersonal sensitivity

The nine-item Interpersonal sensitivity (IS) subscale was extracted from the revised symptom checklist (SCL-90-R; Derogatis, 1983). A representative item was “your feelings being easily hurt”. Respondents used a 5-point scale (0 = no problem to 4 = very serious) to measure the extent to which they had experienced the listed symptoms in the last seven days. Higher scores indicated higher levels of social anxiety. Participants whose scores were equal or higher than 2.0 were regarded as experiencing social anxiety (Fan et al., 2011). The scale was widely used among Chinese university students and was verified with good validity and reliability (Xin et al., 2012). The Cronbach's alpha for the scale in our sample was 0.85.

2.3. Procedure and statistical analysis

This study was conducted complying with the Code of Ethics of World Medical Association (Declaration of Helsinki). Approval was sought from the university's ethical committee and participants provided their oral assent before participation. Trained graduate students administered self-report measurements during regular school hours in the classroom. Researchers told the participants the purpose of this investigation and assured the participants' answers were confidential, and gave instructions on each measurement at the same time.

In previous studies, a family's socio-economic status (SES) can be measured by parents' financial position and education level (Van de Werfhorst et al., 2001). Following this method, SES in this research was assessed by parents' education and monthly household income. The education level of parents was measured by three levels (1 = Junior high school and lower, 2 = high school or technical school, 3 = college, university and higher); the monthly household income in the previous year was measured by four levels (1 = less than ¥2000, 2 = ¥2000 to ¥4999, 3 = ¥5000 to ¥7999, 4 = equal or more than ¥8000). Subsequently, the SES was calculated by the total scores of parents' education and monthly household income. SES, age (in years) and gender (1 = male, 0 = female) were sociodemographic control variables in the analysis. This study took two steps to analyze the data: 1) adopting descriptive statistical analysis and correlation analysis; 2) using the Mplus 7.0 to test and verify the serial mediation model.

3. Results

3.1. Primary analysis

Descriptive analysis revealed that 21.59% (80 male, 61 female) college students in the present study were regarded as mobile phone addiction and 18.68% (67 male, 53 female) were regarded as interpersonal sensitivity. The prevalence rate of mobile phone addiction in this study was consistent with the rate of previous literatures (e.g., He et al., 2012). The results of descriptive statistics and correlation

**Table 1**  
Descriptive statistics and correlations for all variables.

	Mobile phone addiction	Interpersonal sensitivity	Social anxiety	Self-esteem	SES	Gender	Age
Mobile phone addiction	1						
Interpersonal sensitivity	0.32**	1					
Social anxiety	0.18**	0.40**	1				
Self-esteem	-0.14**	-0.35**	-0.36**	1			
SES	0.06	-0.09*	-0.18**	0.03	1		
Gender	-0.13**	0.09*	0.00	-0.01	0.05	1	
Age	0.03	0.10*	0.01	-0.01	0.00	0.09*	1
M ± SD	2.73 ± 0.69	1.33 ± 0.64	1.42 ± 0.59	2.98 ± 0.43	6.36 ± 2.04	0.46 ± 0.50	19.91 ± 1.58

\* p < 0.05,

\*\* p < 0.01, male = 1, female = 0.

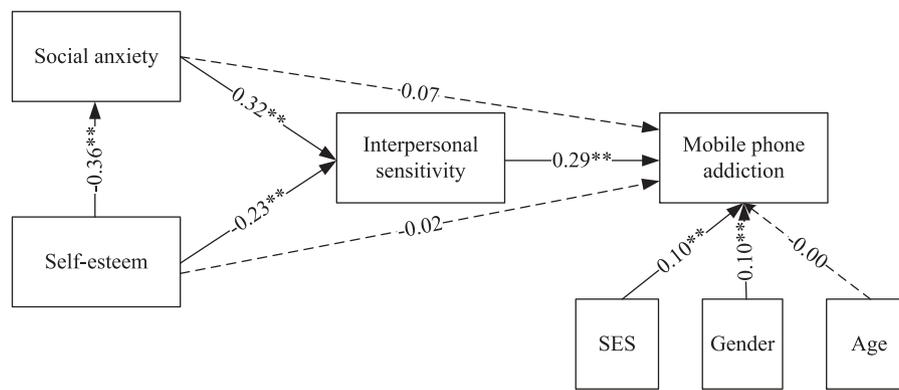


Fig. 1. The hypothesized model. Dashed lines indicate nonsignificant paths ( $p > 0.05$ ). All path coefficients were standardized. \*  $p < 0.05$ , \*\*  $p < 0.01$ .

matrix of variables were shown in Table 1.

According to the correlation analysis, mobile phone addiction had a significantly negative correlation with self-esteem, and had significantly positive correlations with social anxiety and interpersonal sensitivity. In addition, self-esteem was significantly negatively correlated with interpersonal sensitivity and social anxiety, and interpersonal sensitivity had a significantly positive correlation with social anxiety.

### 3.2. Sequential mediation model analysis

Fig. 1 illustrates the findings from the full structural equation model used to analyze the hypotheses of this study, and presents the standardized estimates. The hypothesized model provided a good fit to the data,  $\chi^2(6) = 36.13$ ,  $p < 0.01$ , CFI = 0.91, RMSEA = 0.09 (90% CI [0.06, 0.12]), SRMR = 0.04. The hypothesized model accounted for 12.7% of variance in mobile phone addiction. In the hypothesized model the direct path between self-esteem and mobile phone addiction was insignificant ( $B = -0.02$ ,  $p > 0.05$ ), and the direct path between social anxiety and mobile phone addiction was not significant either ( $B = 0.07$ ,  $p > 0.05$ ).

The bootstrap procedure is an appropriate method to test the significance level of the indirect effects in mediation models (Mallinckrodt et al., 2006; Shrout and Bolger, 2002). According to previous studies (Liao et al., 2015), we tested the hypothesized model (see Fig. 1) with 5,000 bootstrap samples to compute bias-corrected 95% confidence intervals (BC 95% CIs) for indirect effects. Random sampling with replacement was used in Mplus to create bootstrap samples from the original sample. An indirect effect was statistically significant at the 0.05 level if its CI did not include zero (Shrout and Bolger, 2002).

The results indicated that the mediating effect of interpersonal sensitivity on the relationship between self-esteem and mobile addiction was significant (indirect effect =  $-0.11$ ,  $p < 0.05$ ; 95% CI [ $-0.16$ ,  $-0.06$ ],  $\beta = -0.23 \times 0.29 = -0.07$ ). In addition, the sequential mediating effect of social anxiety and interpersonal sensitivity on the relationship between self-esteem and mobile phone addiction was also significant (indirect effect =  $-0.05$ , 95% CI [ $-0.08$ ,  $-0.03$ ],  $\beta = -0.36 \times 0.32 \times 0.29 = -0.03$ ).

## 4. Discussion

### 4.1. The sequential mediation model

The present study indicated that self-esteem was negatively associated with mobile phone addiction. The findings of this research were consistent with previous studies' (e.g., Park and Lee, 2014; Kim and Koh, 2018). Moreover, consistent with our hypothesis, the results of this study supported the sequential mediation model, showing that the self-esteem only exerted indirect effect on mobile phone addiction through

social anxiety and interpersonal sensitivity. On the one hand, self-esteem was significantly associated with interpersonal sensitivity, which affected mobile phone addiction in turn. On the other hand, the impact of self-esteem on mobile phone addiction was sequentially mediated through social anxiety and interpersonal sensitivity. It is worth noting that the mediating effect of social anxiety on the relation between self-esteem and mobile phone addiction was not significant. This result revealed the effect of self-esteem on mobile phone addiction was made through the mediating of social anxiety and interpersonal sensitivity, which also means that the interpersonal sensitivity is more important in the mediating mechanism.

This finding was not only supported by the results from prior studies, but also could be explained by the pathways model of problematic mobile phone use (Billieux, 2012; Billieux et al., 2015). Billieux and his Colleagues (2012, 2015) suggested that individuals with low self-esteem usually have distorted cognitions and maladaptive emotion regulation, which resulted in higher social anxiety and being more sensitive to evaluations of interpersonal relationship. These people have to use the mobile phone excessively to obtain reassurance in affective relationships.

More specifically, Boyce and Parker (1989) suggested interpersonal sensitivity was directly influenced by self-esteem. People with low self-esteem were more sensitive to socially relevant cues, because they didn't experience being included, being accepted and socially integrated (Leary et al., 1995). Thus these people possibly suffered high interpersonal sensitivity (Lipman et al., 1979), which might lead to poor interpersonal relationship in reality (Liu and Gu, 2015). In addition, people with low self-esteem were afraid of negative evaluations from the others, which would result in high social anxiety (Fenigstein et al., 1975). Therefore, they would be oversensitive to other's criticism and rejection which brought about a high level of interpersonal sensitivity. This explanation could be supported by sociometer theory of self-esteem. Sociometer theory (Leary et al., 1995) suggested that low self-esteem people expressed higher social anxiety (Leary et al., 1995). They tended to feel more risks from devalued relationships when communicating with others face to face. Thus, they were more sensitive to interpersonal relationships and vulnerable in establishing good relationships, which gave rise to the psychological tendency of escaping from reality (Gyurak and Ayduk, 2007), especially the fear to meet face to face with others in the real world (e.g., Ezoë et al., 2009). To sum up, low self-esteem brought about more social anxiety and interpersonal sensitivity, making it difficult for people to establish good relationships in real world. Thereby these people had the psychological tendency to escape from reality.

Nowadays, mobile phones become tools that allow the involvement in a wide range of activities, going far beyond their medium functions of traditional oral and written communication (including SMS) among individuals, such as social networks (Billieux et al., 2015). With abundant applications, mobile phones had provided their users with

Internet-based communication (e.g., social networks, Mok et al., 2014). Low self-esteem people were more willing to regain their self-esteem in a safer place and adopted less risky social contacts. As the most accessible devices, mobile phones were convenient for individuals with low self-esteem to escape from the realistic world, obtain interpersonal support and meet their psychological demands of avoiding bad experience caused by face-to-face interaction (e.g., interpersonal sensitivity and social anxiety). Consequently, these people were more susceptible to excessive or pathological use of mobile phones (Billieux, 2012). Generally, the privileged ways for people with low self-esteem are calls, SMS, emails, and social networks (Billieux et al., 2015).

#### 4.2. Strengths, limitations and implications

This study focused on the mediating role of social anxiety and interpersonal sensitivity between self-esteem and mobile phone addiction. The results demonstrated that self-esteem only had indirect predictive effect on mobile phone addiction through the mediation of social anxiety and interpersonal sensitivity. To our knowledge, this study was the first to demonstrate the influencing mechanism of self-esteem on mobile phone addiction. This finding supported the pathways model of problematic mobile phone use (Billieux, 2012; Billieux et al., 2015) and clarified that the dysfunctional relationship maintenance style was a direct influencing factor of mobile phone addiction.

Nevertheless, this study did have some limitations. First, it was not possible to infer causality due to the cross-sectional nature of the present study, though future longitudinal studies might be developed to reveal the causal relationship among these variables. Second, most of the participants of this study were college students in central China, thus the sample could not be viewed as representative. Further studies should recruit participants from diverse age groups.

Despite limitations in this study, the findings had a positive impact on the intervention and prevention of mobile phone addiction. First, consistent with previous studies, this study confirmed the impact of self-esteem on mobile phone addiction, suggesting that boosting self-esteem can help college students reduce mobile phone addiction. Then, the pathways model of problematic mobile phone use (Billieux, 2012; Billieux et al., 2015) suggested that the dysfunctional relationship maintenance style affected by low self-esteem was one of the most important factors affecting mobile phone addiction. We found that the impact of self-esteem on mobile phone addiction was exerted by interpersonal sensitivity, which supported our model, and enlightened us to concern about the effect of interpersonal sensitivity on mobile phone addiction.

In order to avoid the tendency to addiction, there is a need to develop preventive interventions, including counseling and media education for students with particularly low self-esteem, high social anxiety and interpersonal sensitivity. Trainings in coping with interpersonal rejection and criticism may be beneficial. To reduce interpersonal sensitivity, it is also necessary to emphasize identification and modification of key cognitive beliefs, affective and behavioral reactions to interpersonal situations. For individuals with high interpersonal sensitivity, cognitive and emotional interventions through games, group communication, role playing and other group counseling were suggested (Lipman et al., 1979; Clarke et al., 2015). Integrated intervention model would be more effective rather than interventions only from family or school. Moreover, the severity of mobile phone addiction should be emphasized during intervention.

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