

Virtual Connection and Real Alienation: A Psychological Path Analysis of the Effect of Cell Phone Use Intensity on Loneliness - With Realistic Social Avoidance as a Mediating Variable

Yanfei Zhu *

School of Economics and Management, Jiangxi University of Traditional Chinese Medicine, Nanchang, 330000, China

* Corresponding Author Email: zhuyanfei@jxutcm.edu.cn

Abstract. As the penetration rate of smartphones continues to rise, the psychosocial issues stemming from cell phone dependency are becoming increasingly evident. Existing research has primarily concentrated on the influence of emotional factors, such as social anxiety, in the connection between the intensity of cell phone use and feelings of loneliness. Moreover, the mechanisms at the behavioral level have not been thoroughly examined. This study focused on the behavioral aspect of social avoidance, collecting data from 100 participants through a questionnaire and utilizing three scales to assess the core variables. The findings revealed that cell phone dependence significantly and positively predicted individual loneliness, with social avoidance partially mediating this relationship. The results indicate that cell phone dependency not only directly intensifies feelings of loneliness but also indirectly exacerbates loneliness by fostering social avoidance behaviors, thereby creating a negative cycle of "virtual connection leading to real alienation." Specifically, individuals' excessive reliance on cell phones may diminish social motivation, reduce opportunities for face-to-face interactions, and weaken their social support systems, ultimately deepening their sense of loneliness.

Keywords: Virtual Connection; Real Alienation; Loneliness; social avoidance; cell phone dependence.

1. Introduction

According to the 55th Statistical Report on the Development of China's Internet, as of December 2024, China's cell phone netizens reached 1.105 billion, an increase of 14.03 million compared with December 2023, and the proportion of netizens using cell phones to access the Internet was 99.7%. With the deepening of smartphones, people are facing the increasing problem of cell phone dependence while enjoying instant convenience. Cell phone dependence is a state of obsession in which individuals lose control of their cell phone use behavior, resulting in significant impairment of physiological, psychological, and social functions [1]. Early Compensatory Internet Use Theory pointed out that socially anxious individuals may compensate for real social deficits through online interactions, but over-dependence exacerbates psychological alienation [2]. Meanwhile, other studies have shown that individuals will satisfy their psychological needs that are blocked in the real world through other forms as mobile phone-dependent individuals have more interpersonal and avoidance of socialization problems [3, 4]. This study explores the current situation of cell phone dependence and its relationship with loneliness and social avoidance through relevant investigations, in order to help get rid of cell phone dependence and provide useful suggestions for its rational and correct use.

2. Literature Review

In recent years, the research on the psychological mechanisms of cell phone addictive behavior has shown a multidimensional development trend. Numerous studies have consistently shown that loneliness and social anxiety play an important mediating role in the formation of cell phone addiction [5]. However, there are differences in their specific paths of action due to differences in research perspectives and combinations of selected variables. The research results of Zhao howed that in the



college student group, social anxiety had a direct predictive effect on cell phone social media addiction, with a standardized regression coefficient β of 0.35; at the same time, social anxiety also indirectly affects cell phone social media addiction through loneliness, with a mediating effect accounting for 15.97%, which clearly presents the dual paths of social anxiety affecting cell phone addiction [6]. The study published by Tao Mengyang, on the other hand, verified the reverse path and found that cell phone addiction can predict anxiety and that loneliness plays a significant mediating role between cell phone addiction and anxiety, with the mediating effect accounting for 33.97%, a result that implies that there may be a bidirectional dynamic relationship between the variables [7]. Sun Yijing further introduced the communication posture theory and constructed a fourth-order chain mediation model of "loneliness \rightarrow ingratiating communication \rightarrow social anxiety \rightarrow cell phone addiction". The study verified the significance of each pathway by the Bootstrap method (5000 replicated samples) ($p < 0.05$) and found that the mediating effect value of ingratiating communication gestures between loneliness and social anxiety was 0.12 (95% CI [0.07, 0.18]). This finding reveals the bridging role of behavioral patterns in emotion transmission and opens up new dimensions for understanding the complex psychological mechanisms of cell phone addiction.

In related studies, multiple moderating and mediating factors have been introduced in addition to the core variables. Based on the core variables, researchers gradually introduced multidimensional moderating variables with composite mediating paths [8]. Kwon, Fang-Ying, used structural equation modeling (SEM) in their study ($N=826$) and found that Fear of Negative Evaluation (FNE) affected problematic cell phone use through the sequential mediating effect of "Interaction Anxiety \rightarrow Feeling of Loneliness " (Indirect Effect Value 0.21, $p < 0.001$). The study specifically controlled for demographic variables such as grade and gender, and verified the cross-group stability of the model through multi-group analyses, providing strong evidence for the theory of cumulative effects of emotions [9]. The study by Zhang Xiaozhou ($N=1215$), on the other hand, focused on protective factors and found that mindfulness indirectly improves the tendency of cell phone addiction by reducing social anxiety (mediating effect 22.72%). The study used the MAAS Positive Mindfulness Scale (Brown & Ryan, 2003) with the Revised Mobile Phone Addiction Index Scale (MPAI-R), and controlled for interfering variables, such as socioeconomic status, through latent variable analysis, to provide a theoretical basis for a positive mindfulness-based intervention program [10, 11]. Chu Tsao Yuan 's study ($N = 683$) of rural middle school students revealed the moderating role of the family environment. The study found that Parental Attachment Avoidance influenced cell phone dependence through social anxiety ($\beta=0.31$, $p < 0.01$) and that family financial difficulties significantly moderated the relationship between social anxiety and cell phone dependence (moderating effect value 0.14, $p < 0.05$). This result highlights the critical influence of social contextual variables in cell phone addiction [12].

Despite the different conclusions reached by the various studies, most of them recognized the prevalence of the mediator model in cell phone addiction research. The research disagreement mainly focuses on the direction and weighting of the variables. Based on stress coping theory, Zhao Xinwei emphasized the driving role of social anxiety as an antecedent variable [6,13], whereas Tao Mengyang, from behavioral reinforcement theory, focused on the inverse effect of cell phone addiction on emotional states [7]. This difference essentially reflects the competition between the two theoretical paradigms of "psychologically driven" and "behavioral feedback" [2]. The studies of Yijing Sun and Fangying Quan both involve multi-mediated chains but with different theoretical entry points. The former explored the conductive role of behavioral patterns based on communication theory, while the latter analyzed the cumulative effect of negative emotions from cognitive appraisal theory. This difference suggests that researchers need to pay attention to the theoretical-logical associations among variables and avoid mere statistical model stacking. In addition, differences in sample characteristics, such as different groups of college students and junior high school students, as well as differences in measurement tools, like the use of different versions of the loneliness scale, may affect the comparability of the study results.

Most of the existing studies have focused on using emotional factors such as social anxiety as mediating variables to explore issues related to cell phone use. The present study, however, shifted the focus to social avoidance as a behavioral variable to explore its mediating role between cell phone use intensity and loneliness. Social avoidance, as a behavioral manifestation, is related to social anxiety but fundamentally different from it. By analyzing the influence of cell phone use intensity on loneliness from the behavioral level, this study can provide fresh ideas and perspectives for research in this field. Furthermore, this approach compensates for the shortcomings of previous studies that relied solely on emotional-level analyses, thereby enriching the research framework on the relationship between cell phone use and loneliness. Ultimately, these advancements are expected to offer a more targeted theoretical basis for developing evidence-based intervention measures.

3. Research Questions and Hypotheses

Research question: cell phone dependence affects loneliness, with social avoidance playing a mediating role

Hypothesis:

Hypothesis 1: Cell phone dependence can positively influence an individual's level of loneliness

Hypothesis 2: Social avoidance may mediate the relationship between cell phone dependence and loneliness

4. Methodology

4.1. Subjects

In order to obtain first-hand data information, this study utilized questionnaires. The study was designed to cover the avoidance subscale of the UCLA Loneliness Scale, the Smartphone Addiction Scale (Cronbach's alpha coefficient of 0.88), and the Social Avoidance and Distress Scale (SAD) (Cronbach's alpha coefficient of 0.87). The questionnaire consisted of single choice and scale questions. Subsequently 110 samples from different age groups were selected through random sampling for the survey. A total of 110 questionnaires were distributed and 100 valid questionnaires were recovered, with a valid recovery rate of 90%. The questionnaire data were analyzed using the statistical software SPSS for descriptive statistics, correlation analysis, and mediation analysis to reveal that cell phone dependence significantly affects loneliness and that social avoidance mediates the relationship between the two.

4.2. Measurement

4.2.1. Loneliness Scale.

The University of California at Los Angeles Loneliness Scale, revised by Wang Dengfeng et al. was used to assess the level of loneliness in individuals. The scale consists of 18 items and is scored on a 4-point scale, with 1 being "never" and 4 being "often". When scoring, items with negative loadings (1, 4, 5, 6, 8, 9, 14, 15, 16, 18) are reversed, and then the total score of all items is calculated, which is the loneliness measure, and the higher the score, the higher the loneliness level of the individual. The scale has good reliability and validity, and the Cronbach's alpha coefficient for the scale in this study was 0.92.

4.2.2. Smartphone Addiction Scale.

The questions related to the three factors of "withdrawal behavior", "salient behavior" and social appeasement" in the Smartphone Addiction Scale for College Students compiled, with a total of 13 entries and a 5-point scale, with scores ranging from 1 to 5, from "very inconsistent" to "very consistent", respectively. "A total of 13 items were scored on a 5-point scale from 1 to 5, with higher

scores indicating higher levels of cell phone addiction. The Cronbach's alpha coefficient of the questionnaire in this study was 0.88.

4.2.3. Avoidance subscale of the Social Avoidance and Distress Scale (SAD).

The avoidance subscale of the Social Avoidance and Distress Scale (SAD) developed by Watson and Friend was used, which consists of 14 items and is scored using a "yes/no" response format. Items with negative loadings (2, 4, 6, 8, 10, 12, 14) were scored inversely, with higher scores reflecting higher levels of social avoidance. The Cronbach's alpha coefficient for the questionnaire in this study was 0.87.

4.3. Statistical Processing

Descriptive statistics and correlation analysis were performed using SPSS 25. Mediation effects were tested using model 6 of the PROCESS program, and mediation effects were tested by taking 5000 samples to estimate the mediation effects bootstrap 95% confidence intervals.

5. Analysis of Results

5.1. T-test Analysis between Gender and Core Variables

According to the results of t-test analysis, the samples do not show significant differences in loneliness, social avoidance, and cell phone dependence among individuals of different genders. (See Table 1 for details)

Table 1. t-test analysis

	Your gender: (mean± standard deviation)		t	p
	Male (n=24)	Female (n=76)		
loneliness	42.21±9.73	44.21±10.40	-0.834	0.406
social avoidance	19.50±3.79	20.92±4.03	-1.526	0.130
cell phone dependence	34.33±8.24	35.07±9.69	-0.334	0.739

* p<0.05 ** p<0.01

5.2. Correlation Analysis

After controlling for demographic variables, the results of the correlation analysis of the two-by-two correlation of the variables showed that there was a strong positive correlation between loneliness and social avoidance (correlation coefficient of 0.430, which suggests that individuals with higher loneliness may be more socially avoidant. In addition, there was a moderate positive correlation between cell phone dependence and social avoidance (correlation coefficient of 0.307**), which may imply that socially avoidant individuals may be more dependent on cell phones. However, the correlation between loneliness and cell phone dependence was weak (correlation coefficient of 0.386), suggesting that the direct link between these two may not be as strong as the relationship between the other two. To summarize, loneliness was significantly and positively correlated with cell phone dependence and social avoidance. Cell phone dependence was significantly and positively correlated with social avoidance. (See Table 2 for details)

Table 2. results of correlation analysis

	1	2	3
1 Loneliness	1		
2 Cell phone dependency	0.386**	1	
3 Social Avoidance	0.430**	0.307**	1

5.3. Mediation Analysis of Social Avoidance between Cell Phone Dependence and Loneliness

The results showed that the direct effect of cell phone dependence on loneliness was significant with an effect size of 0.316 (95% CI:0.119~ 0.513), and the mediating effect of social avoidance in cell phone dependence and loneliness was significant with an effect size of 0.114 (95% CI:0.034~ 0.187), which accounted for 26.544% of the total effect size. for partial mediation. (See Table 3 & 4 for details)

Table 3. Summary of the results of the mediating role test

term (in a mathematical formula)	c Total effect	a	b	a*b value of the mediating effect	a*b (Boot SE)	a*b (z-value)	a*b (p-value)	a*b (95% BootCI)	c' direct effect	Test Conclusion
Cell phone dependence => social avoidance => loneliness	0.430**	0.130**	0.877**	0.114	0.039	2.933	0.003	0.034 ~ 0.187	0.316**	intermediary

Remarks:

* p<0.05 ** p<0.01

bootstrap type = percentile bootstrap method

Table 4. Summary of results for mediating effect sizes

classifier for principles, items, clauses, tasks, research projects etc	Test Conclusion	c Total effect	a*b intermediary effect	c' direct effect	Effectiveness ratio formula	efficiency ratio
Cell phone dependence => social avoidance => loneliness	intermediary	0.430	0.114	0.316	a * b / c	26.544%

6. Discussion

The results of this study suggest that, first, cell phone dependence can positively influence an individual's level of loneliness. Hypothesis one is valid. According to the theory of loss of compensation, in order to fill the gap in interpersonal relationships and reduce the degree of loneliness, individuals often socialize on the Internet to obtain psychological support and satisfaction, seek the desired real social feelings, and avoid the psychological deficit caused by loneliness [14, 15].

The results of this study provide empirical research evidence for this theory. Boursier et al. believe that due to the ability of social media to stimulate an individual's behavioral reward feedback loop, after experiencing the satisfaction brought by social media, the individual will spend more time on the network [16]; and the individual's overuse of social media may lead to the aggravation of real interpersonal distress, bringing a stronger sense of loneliness, causing a vicious circle and making him or her more dependent on the online socialization, forming mobile social media dependence [17]. As a result, individuals' dependence on social media increases thus leading to an increase in their own loneliness. Second, cell phone dependence affects the degree of loneliness of individuals through the mediating role of social avoidance, and Hypothesis 2 is supported. Individuals may be overly reliant on cell phone social media to seek virtual social connections thus leading to real-world social avoidance. This frequent use behavior is reinforced in the avoidance mood, further deepening the

individual's degree of loneliness [6]. In summary, cell phone dependence not only directly affects individuals' degree of loneliness, but may also indirectly affect loneliness by enhancing social avoidance.

There are still many limitations in this study, first of all, the 100 effective sample size is small, especially when multivariate mediation analysis is involved, which may reduce the statistical validity leading to the undetected mediation effect that really exists. Cell phone dependence, social avoidance, and loneliness data were collected at the same time, which did not allow for validation of the temporal relationship between the variables. For example, it is possible that individuals with high loneliness actively choose to socialize on cell phones, or that there are third-party variables that exacerbate both cell phone dependence and loneliness. The model includes an insufficient number of variables and paths only a single mediating pathway of social avoidance was tested, and chained multiple mediators (e.g., cell phone dependence → social skill degradation → social avoidance → loneliness) or moderated mediating effects (e.g., extroverted personality may buffer the effect of cell phone dependence on social avoidance) were not considered. Finally, the way the questionnaire was collected may have led to situations where individuals did not answer truthfully because of social desirability effect.

In order to address the problems posed by these factors, this study argues that future changes need to be made in three directions: social, personal, and research. The first step is constructing a public intervention mechanism from a social perspective. For example, it promotes cooperation between the government and enterprises to develop cell phone application norms (mandatory break reminders to reduce the impact of passive information overload on social skills). Promote social training courses on campus or in the workplace to teach non-verbal communication, empathic expression, and other skills weakened by digital media. At the individual level, strengthen self-awareness training, e.g., through positive thinking meditation to reduce dependence on cell phones and enhance emotional tolerance in real-life social situations. At the research level, exploring positive research utilization of technology. For example, research on how cell phones can be transformed into social enhancement tools through algorithmic optimization (e.g., recommendation systems that promote offline activities) to further reduce loneliness, rather than a substitute for socialization.

7. Conclusion

This study focuses on the effect of mobile phone use intensity on loneliness, and explores realistic social avoidance as a mediating variable. A sample of 110 individuals of different ages was selected by questionnaire survey method, and data were collected using the UCLA Loneliness Scale, Smartphone Addiction Scale, and the Avoidance subscale of the Social Avoidance and Distress Scale, and descriptive analysis, correlation analysis, and mediation analysis were carried out by SPSS. It was found that mobile phone dependence can positively affect individual loneliness, and social avoidance plays a partial mediating role in the relationship. Mobile phone dependence not only directly affects loneliness, but also indirectly deepens loneliness by enhancing social avoidance. In terms of recommendations and insights, the society can build a public intervention mechanism at the social level, such as promoting cooperation between government and enterprises to formulate mobile phone application norms and promote social training courses; at the individual level, people should strengthen self-awareness training, reduce mobile phone dependence with the help of positive meditation, and increase the tolerance level of real-life social emotions; and at the research level, researchers can explore the use of positive technology to transform mobile phones into social enhancement tools. This study analyzes the influence of mobile phone use intensity on loneliness from the perspective of behavioural variables, which makes up for the inadequacy of previous analyses from the emotional perspective only, enriches the relevant research system, and provides a targeted theoretical basis for intervening in mobile phone dependence and alleviating loneliness.

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