



Loneliness and mobile phone addiction among Chinese university students: The mediating role of interpersonal adaptation and its impact on psychological well-being

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ABSTRACT

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This study investigates the relationship between mobile phone addiction and loneliness among Chinese university students, with a specific focus on the mediating role of interpersonal adaptation and its influence on psychological well-being. A total of 230 students from normal and science/engineering universities across Guangdong, Henan, and Chongqing provinces participated in the study. Valid responses from 212 students (106 males and 106 females, aged 18–22) were analyzed using established instruments: the Smartphone Addiction Scale for University Students (SAS-C), the UCLA Loneliness Scale (Version 3), and the Chinese University Student Adaptability Inventory (interpersonal adaptation subscale). Statistical analyses, including correlation, regression, and mediation tests using SPSS 28, revealed a significant positive relationship between mobile phone addiction and loneliness. Furthermore, interpersonal adaptation was found to partially mediate this relationship, suggesting that lower adaptability exacerbates the impact of mobile phone addiction on feelings of loneliness. The findings underscore the importance of enhancing interpersonal skills to mitigate the psychological harm associated with excessive mobile phone use. These results contribute to a growing body of literature that links behavioral addiction to emotional and psychological outcomes among youth. The study highlights the need for integrated efforts from students, families, and educational institutions to improve interpersonal competencies and promote mental well-being. Future research should explore longitudinal effects and extend the investigation to diverse student populations to enhance the generalizability of findings.

Contribution/Originality: This study contributes to the existing literature by examining the mediating role of interpersonal adaptation between mobile phone addiction and loneliness among Chinese university students. It is one of the few studies investigating this relationship in China, documenting its impact on psychological well-being within higher education settings.

1. INTRODUCTION

In today's world, various technological products are constantly being created and updated, and the world's information can be disseminated and exchanged through the Internet and the use of electronic products, of which mobile phones are a very good medium. The popularity and increasing power of mobile phones have made them increasingly important in people's lives, work, and studies. According to the China Mobile Internet Development Report (2022) with the application and promotion of 5G technology, the number of mobile Internet users in China exceeded 1.2 billion in 2022, with the average monthly usage time and frequency reaching 177.3 hours and 2,633 times, respectively (Jiang et al., 2024). Among this huge group of mobile phone users, university students account for the highest proportion, as they are more likely to be addicted to mobile phones due to their abundant leisure time and fewer constraints from the external environment (Li, Feng, Xiao, & Zhou, 2021). However, a mobile phone is also a double-edged sword, which not only brings convenience to people's lives but also makes mobile phone addiction a social problem, troubling people. People are increasingly dependent on mobile phones and even lose self-control due to excessive use of mobile phones in daily life (Cho, Kim, & Park, 2017). From the game of "Travelling Frog" to "Glory of Kings" and "TikTok," everyone is glued to their mobile phones, developing in the direction of pathology, which is transforming into mobile phone addiction (Yang et al., 2023; Zhu et al., 2025). Mobile phone addiction is a behavioral addiction that is more widespread, insidious, and harmful to a person's physiology and psychology. Researchers show that mobile phone addiction is significantly associated with psychological and physical problems, including loneliness, anxiety, depressive symptoms, palpitations, and sleep problems (Karaoglan Yilmaz, Avci, & Yilmaz, 2023; Mei et al., 2023; Wider et al., 2023). It also leads to academic failure and relationship problems for university students (Chen et al., 2024; Dwyer, Kushlev, & Dunn, 2018; Wang et al., 2019; Yang, Wang, & Hu, 2020).

The definition of mobile phone addiction varies depending on the perspective of the researcher. Some researchers focus on the fact that excessive use of mobile phones can bring about symptoms such as anxiety, maladjustment, and hallucinations, both psychologically and physically (Li et al., 2024; Liu & Baharudin, 2025). According to Tu, You, and Lu (2010) mobile phone addiction is the repetitive use of mobile phones, resulting in a chronic or cyclical state of obsession and a persistent and intense sense of dependence and need. This is the case with the mobile phone. A foreign researcher, Park (2005) classifies the motives for mobile phone use into habitual motives (pastime motives, escape) and instrumental motives (entertainment, arousal). It is noteworthy that in his outlook, Park points out that as mobile phone features are updated, mobile phone addiction follows suit. Tang (2018) found that mobile phones are a medium for stress and emotional release for university students, but a single way to vent stress and emotions can easily lead to over-dependence and addiction, causing university students to rely too much on their phones and thus waste their studies. As a result, they neglect the people and things around them, and over time, they easily develop a sense of loneliness and become more and more dependent on their mobile phones; thus, the cycle repeats itself, and the feeling of loneliness becomes stronger. Loneliness is a subjective state of social isolation, accompanied by a painful experience of personal perception of isolation or lack of contact with others, and some sources suggest that loneliness has become a common problem in modern times (Kabadayi, 2024). Loneliness can also be influenced by factors such as personality, weak social skills, family environment, and previous social trauma.

Chen (2003) has discussed interpersonal adaptability from the perspective of personality. He believes that interpersonal adaptability is a personality trait that individuals should possess and display in the process of interpersonal adaptation, also known as interpersonal characteristics, which can be expressed through some basic components: sociability, cooperation, trust, and altruistic tendencies (Lyu, Cao, & Jiao, 2024; Wang et al., 2025). The quality of parent-child communication directly influences junior high school students' peer relationships, and their mothers' attitudes towards communication and the occasions they choose to communicate have a significant impact on peer relationships (Summerfeldt, Parker, & Smith, 2006; Wang & Zhang, 2010).

This study aims to investigate the relationship between university students' tendency toward mobile phone addiction, loneliness, and interpersonal adjustment, based on their current mobile phone usage characteristics.

Additionally, it seeks to explore the mediating effect of interpersonal adjustment between mobile phone addiction and loneliness. The study will also provide suggestions to address issues related to interpersonal adaptation among university students, offering a reference for improving interpersonal relationships, reducing loneliness, and fostering a healthy physical and mental self among students. The specific objectives include: (1) exploring the correlation between mobile phone addiction, loneliness, and interpersonal adjustment among university students; (2) examining the mediating role of interpersonal adaptability in the relationship between mobile phone addiction and loneliness.

2. RESEARCH METHODOLOGY

2.1. Sampling Method

A total of 230 university students, aged between 18 and 22, and representing all four academic levels (Freshmen to seniors), were recruited for this study. The sample included an equal number of male and female students. Participants were selected from three major institutions across China: South China Normal University (Guangdong Province), Zhengzhou University (Henan Province), and Chongqing University of Posts and Telecommunications (Chongqing Municipality). These universities represent a mix of normal (teacher-training), comprehensive, and science/engineering institutions, ensuring a diverse academic and cultural background among the respondents. After eliminating responses with incomplete or extreme values, 212 valid questionnaires were retained for analysis (106 male and 106 female participants), resulting in a response validity rate of 92.17%.

2.2. Research Instruments

2.2.1. SAS-C Smartphone Addiction Scale for University Students

The SAS-C Smartphone Addiction Scale has 22 entries and contains 6 factors of withdrawal behavior, emergent behavior, social appeasement, negative affect, app use, and app update (Su et al., 2024). The Cronbach's alpha coefficient for the total scale was 0.88, and the Cronbach's alpha coefficients for the six factors were 0.81, 0.71, 0.50, 0.85, 0.44, and 0.68, respectively. The retest reliability for the total scale was 0.93, and the retest reliability for the six factors was 0.82, 0.72, 0.77, 0.74, 0.73, and 0.74, respectively. The scale was scored on a 5-point scale, with 1 = very unlikely to meet; 5 = very likely to meet. All indicators on the scale met the measurement criteria.

The grouping should have been based on the total scale score, with those scoring in the top 33% classified as the high group and those scoring in the bottom 33% classified as the low group.

2.2.2. UCLA Loneliness Scale (3rd Edition)

Developed by psychologist Russell (1996) there are 20 items, each with a 4-point frequency scale: 4 = always feel this way, 3 = sometimes feel this way, 2 = rarely feel this way, 1 = never feel this way. Nine of the items were scored in reverse order, with higher scores associated with higher levels of loneliness. Internal consistency is accepted and understood by the participants. Since its introduction, the scale has been widely used by overseas scholars in the fields of psychology, education, and medicine.

2.2.3. CSAI Chinese University Student Adaptability Scale

In this study, the University Student Adaptability Inventory (USAI), a 66-item questionnaire developed by Lu (2003), was used to measure the level of adaptation of university students across seven dimensions: academic adaptation, interpersonal adaptation, role adaptation, career readiness, life self-management adaptation, overall environmental identity/evaluation, and physical and psychological symptom performance. In this study, only the Interpersonal Adaptability subscale was utilized. Based on the principle of 27% of the highest and lowest scores, a score of 30 or less was designated as the low adaptation group, while a score of 47 or more was classified as the high adaptation group. The options were based on a five-point Likert scale, with questions divided into positive and

negative items; scoring was conducted using traditional equidistant scoring. The Cronbach's alpha coefficient for the scale was 0.8978. A higher score on the scale indicates greater adaptability.

2.3. Data Analysis

The statistical methods used were all analyzed using IBM SPSS Statistics 28. This experiment employs within-subject repeated measures, and the data will be analyzed using SPSS software for correlation, regression, ANOVA, and chi-square tests. A significance level of 0.05 was used for all analyses.

Table 1. Descriptive statistical results of loneliness and mobile phone addiction.

Variables	N	Minimum	Maximum	Mean	Std. deviation	F
Loneliness	212	20.00	66.00	43.93	8.35	69.67
Mobile phone addiction	212	22.00	110.00	61.43	15.33	235.00

3. RESULTS

3.1. Distribution and Descriptive Characteristics of Mobile Phone Addiction and Loneliness among University Students

The results of the descriptive statistics for each of the minimum, maximum, mean, standard deviation, and variance of mobile phone addiction among university students can be observed in Table 1. It can be observed that both variables exhibit two extreme values, large and small, with significant differences in both scores and total scores of mobile phone addiction and loneliness among university students. The first 33% of university students' mobile phone addiction scores were classified as the low group, comprising 70 students, while the last 33% were classified as the high group, also comprising 70 students. Regarding loneliness scores, the high group was defined as having scores above 48 (including 48), and the low group as having scores below 48, with 78 students in the high group and 134 in the low group.

3.2. Statistical Association between Mobile Phone Addiction and Loneliness among University Students

The relationship between mobile phones addiction, as well as loneliness among university students, was analyzed using multiple regression in SPSS software. According to the scatter plot, it was found that there was a linear relationship between mobile phone addiction and loneliness among university students in the overall analysis, and the data could then be further analyzed using multiple regression. See Table 2 for more details.

Table 2. Correlation analysis of mobile phone addiction scores and loneliness scores among university students.

Variables		Mobile phone addiction	Loneliness
Mobile phone addiction	Pearson correlation	1	0.42**
	Sig.		0.000
	N	212	212
Loneliness	Pearson correlation	0.42**	1
	Sig.	0.000	
	N	212	212

Note: **Significant value at the 0.01 level (bilateral).

Table 2 shows that the mobile phone addiction score and the loneliness score of the university students were significant at the 0.01 level, indicating a positive relationship between the two.

Table 3. Summary of mobile phone addiction tendencies and loneliness scores model for university students.

Model	R	R-square	Adjusted R-square	Std. Error
1	0.43	0.17	0.17	7.61

Note: a. Predictor variable: (constant), mobile phone addiction score.
b. Dependent variable: loneliness score.
c. Rounded numbers for all figures.

Table 3 shows that the R square=0.17 and the adjusted R square=0.17 of the regression model established between mobile phone addiction and loneliness scores among university students are moderately valid, and the model can be further analyzed.

Table 4 shows that the ANOVA of Table 3 between university students' mobile phone addiction and loneliness scores, $F=43.85$, is greater than the critical value, $p<0.01$, which means that there is a very significant difference between the two.

Table 4. ANOVA on the propensity for mobile phone addiction and loneliness scores among university students.

Models ^{a,b}		Sum of squares	df	Mean square	F	Sig.
1	Regression	2539.35	1	2539.35	43.85	0.000
	Residual error	12161.72	210	57.91		
	Total	14701.08	211			

Note: a. Dependent variable: loneliness score.
b. Predictor variable: (constant), mobile phone addiction score.

Table 5. Coefficients of mobile phone addiction tendency and loneliness scores among university students.

Models ^a		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	30.03	2.16		13.88	0.000
	Mobile phone addiction	0.23	0.03	0.42	6.62	0.000

Note: a. Dependent variable: loneliness score.

Table 5 shows that the residual of the regression equation between university students' mobile phone addiction and loneliness score is 30.03, with a coefficient of 0.23. The regression equation is $Y=30.03+0.23X$, which means that for every 0.23 increase in university students' mobile phone addiction score, the loneliness score will increase by $30.03+0.23$.

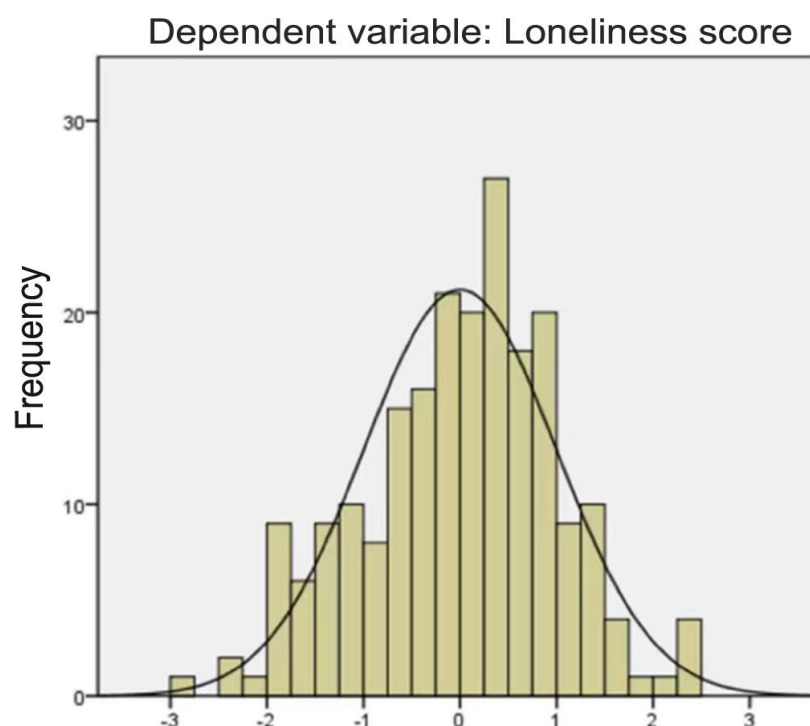


Figure 1. Standardized histogram of residuals for mobile phone addiction and loneliness among university students.

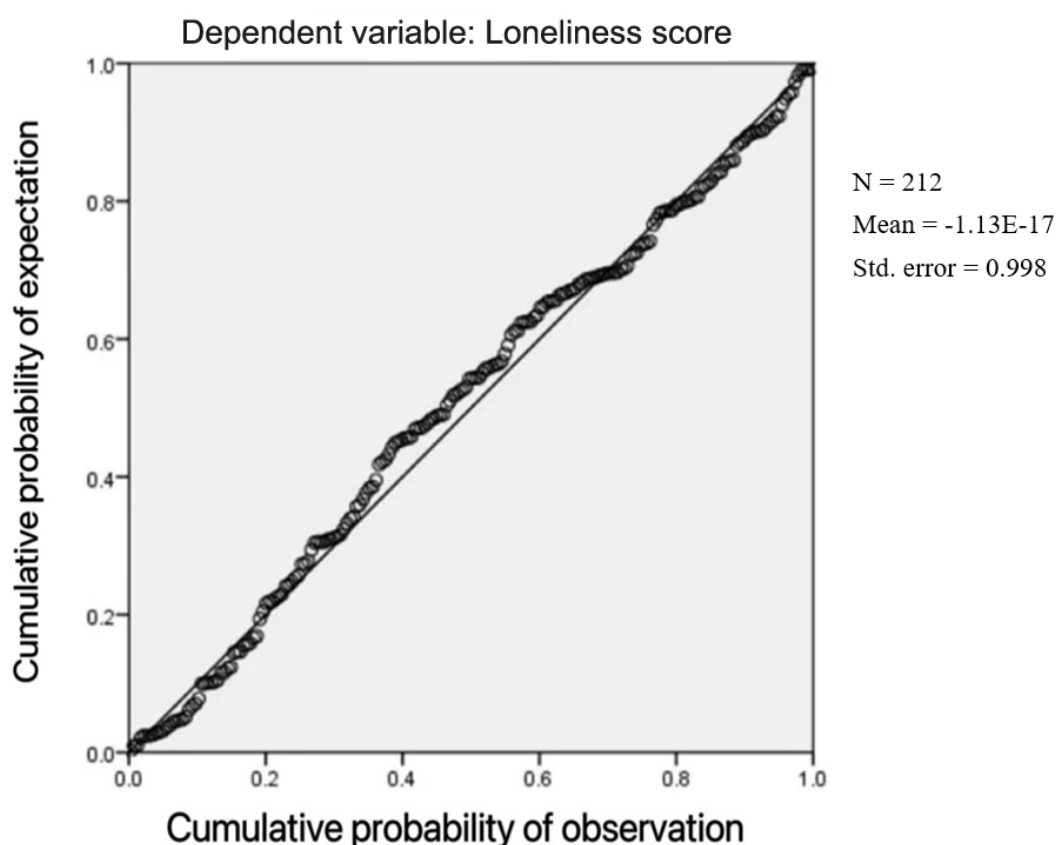


Figure 2. P-P plot of regression standardized residuals for mobile phone addiction and loneliness among university students.

Figures 1 and 2 show that the residuals of the regression equation between mobile phone addiction and loneliness scores are normally distributed, and the residuals fluctuate above and below the line of the established regression equation, showing a good trend, again indicating that the regression equation between mobile phone addiction and loneliness scores among university students is valid.

Table 6. Descriptive statistics of interpersonal adjustment of university students.

	N	Minimum	Maximum	Mean	Std. deviation	F
Interpersonal adaptation	212	15.00	99.00	43.29	20.01	400.23
Valid N (Listwise)	212					

3.3. A Test of the Mediating Effect of Interpersonal Adaptability in the Tendency to Become Addicted to Mobile Phones and Loneliness

As can be seen from Table 6, the maximum value, minimum value, the standard deviation, and the variance of the interpersonal adaptability of the subject university students. It can be seen that there is a large difference between the great and the very small values, implying that among the university students, their interpersonal adjustment ability varies greatly, and there is an imbalance. There is a phenomenon of the well-adjusted and the maladjusted, pole to pole, in the interpersonal adjustment of the university student group.

Table 7. Relationship between interpersonal adjustment and loneliness among university students.

Models ^{a,b}	Sum of squares	df	Mean square	F	Sig.
1 Regression	2038.97	1	2038.97	33.82	0.000
Residual error	12662.10	210	60.30		
Total	14701.08	211			

Note: a. Dependent variable: loneliness score.
b. Predictor variable (constant), interpersonal adjustment score.

As can be seen from Table 7, the ANOVA $F=33.82$ for the scores of interpersonal adjustment and loneliness among university students is greater than the critical value, $p<0.01$, meaning that there is a very significant and significant relationship between the two. Based on the significant relationship between university students' interpersonal adaptability and loneliness, a mediating model was developed for university students' propensity to mobile phone addiction. University students' interpersonal adaptability and loneliness, i.e., university students' propensity to mobile phone addiction, was modeled with university students' interpersonal adaptability as the mediating variable for loneliness.

According to the mediation effect test procedure proposed by Wen, Chang, Hau, and Liu (2004) the three variables of university students' propensity for mobile phone addiction, loneliness, and interpersonal adaptation were analyzed. As seen in step 3, interpersonal adjustment played a partially mediating role in the relationship between mobile phone addiction and loneliness. The steps to test for mediating effects are outlined, and Figure 3 illustrates the mediating model showing that interpersonal adaptability partially mediates the relationship between mobile phone addiction and loneliness among university students. This indicates that higher mobile phone addiction is associated with lower interpersonal adaptability, which in turn contributes to increased feelings of loneliness.

Table 8. A test of the mediating role of interpersonal adaptability between the propensity for mobile phone addiction and loneliness among university students.

Steps	Standardized regression equation	Regression coefficient test
Step 1	$y=0.23x$	$t=6.62^{***}$
Step 2	$m=-0.98x$	$t=-16.33^{***}$
Step 3	$y=0.17x-0.06m$	$t=3.30^{***}$ $t=-1.48$

Note: *** indicates t value > 1.67 .

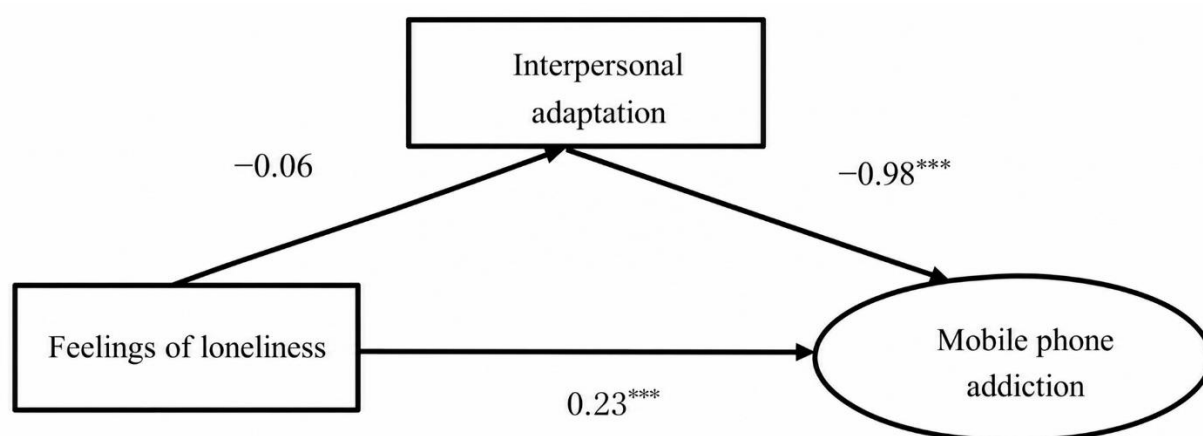


Figure 3. Model of the mediating effect of interpersonal adaptability between mobile phone addiction tendencies and loneliness among university students.

Note: *** $p<0.001$.

4. ANALYSIS AND DISCUSSION

4.1. Interpretation of the Association Between Mobile Phone Addiction and Loneliness Among University Students

This study obtained a significant relationship between university students' tendency to be addicted to mobile phones and loneliness, and more precisely, a positive relationship between the two; loneliness increases with university students' tendency to be addicted to mobile phones. On the other hand, this experiment also validates the results of domestic researchers who found that the tendency of university students to be addicted to mobile phones is related to loneliness (Liu & Yu, 2011). This clearly shows that university students are caught in a deadly cycle: the more addicted they are, the lonelier they become, and the lonelier they become, the more addicted they become, which will greatly damage the physical and psychological health of university students, thus affecting people's daily lives. In extreme cases, this can lead to irreparable mistakes. From the perspective of the popularity of mobile phones and

the updating of their functions, mobile phones are an interesting and all-round product that can meet the needs of university students in almost all aspects of daily communication, entertainment, study, and work. University students are the generation of the new century and have gained the priority of using electronic products and the skills to master their use flexibly. Additionally, young people are full of curiosity about all kinds of things in the world, and mobile phones can precisely meet the needs of university students with the least amount of resources. This is the right time, the right place, and the right people, which has led to students becoming more and more dependent on their mobile phones and even abandoning their studies. In terms of Erikson's theory of gradual homogeneity in developmental psychology, university students between the ages of 18 and 25 have not reached their developmental task of gaining a sense of intimacy, overcoming loneliness, and experiencing the realization of love and friendship. The experience of love and friendship contributes to the shared sense of living intimacy, which otherwise produces self-focus and leads to a sense of isolation. This leads to turning to mobile phones (entertainment features, internet, etc.) to reduce and compensate for one's sense of loneliness. All of this gives rise to a deepening of the relationship between the tendency to addiction to mobile phones and feelings of loneliness among university students.

4.2. The Relationship Between University Students' Propensity for Mobile Phone Addiction and Interpersonal Adaptability

In this experiment, university students were divided into those with low interpersonal adjustment and those with high interpersonal adjustment, and then a linear regression analysis was conducted on the two groups with interpersonal adjustment as the dependent variable and university students' propensity to become addicted to mobile phones as the independent variable. The results found that there was a correlation between interpersonal adjustment and university students' propensity to become addicted to mobile phones, and the regression equation was derived: $y = -0.98x$.

When university students first enter school, they face the problem of adapting to a new living, learning, and social environment, from familiar to unfamiliar, from a small social circle to a large social circle, from simple freedom to complex limitations. These different degrees of change may make university students momentarily unprepared to carry out interpersonal adaptation well and unable to establish new and stable interpersonal relationships. Then, at this time, due to real-life challenges, students may experience a decline in self-esteem. The students may avoid or forget their current anxieties and turn to mobile phone chatting software to expand their social space and thus satisfy their social needs. Research has shown that family parenting styles are divided into authoritative, democratic, and permissive, and that different parenting styles have different effects, with authoritative and permissive parenting styles hindering the development of interpersonal adaptability. The latter is characterized by capriciousness, childishness, selfishness, brutality, impoliteness, poor independence, self-respect, and rudeness, i.e., students have no concept or method of socializing with others and turn to using mobile phones to satisfy their needs; the current examination-based education model is also an important influence, with school education focusing excessively on subject knowledge and systematic education, without special teaching and practical practice of students' adaptability and interaction skills. Moreover, schools restrict students from playing with mobile phones and sometimes confiscate them as punishment when they are found, so that when students become university students, they will lose their self-control and become addicted to mobile phones and ignore people around them because of the novelty of mobile phones and the lack of restrictions from their elders, and they also throw away the best period of interpersonal adaptation, thus aggravating their addiction to mobile phones. Therefore, there is a correlation between the tendency of university students to become addicted to mobile phones and their interpersonal adaptability.

4.3. The Relationship Between Mobile Phone Addiction Tendencies, Loneliness, and Interpersonal Adjustment Among University Students

From the results of this study, it can be found that, in addition to directly influencing loneliness, university students' tendency to become addicted to mobile phones also has a certain effect on loneliness through interpersonal

adaptability. The study found that there was a correlation between mobile phone addiction, loneliness, and interpersonal adaptability, and that mobile phone addiction and loneliness were significant predictors of interpersonal adaptability.

The interpersonal adaptability of university students is an issue worthy of consideration, as it not only affects students' lives and studies but also their lifelong development. The qualities and abilities that students develop at university can last a lifetime. It is possible to reduce the degree of mobile phone addiction and loneliness to improve interpersonal relationships. From the results of the mediating effect test, interpersonal adaptability acts as a partial mediating variable between the tendency to be addicted to mobile phones and loneliness among university students.

This is in line with the previous hypothesis three: interpersonal adaptability has a mediating effect between the tendency to become addicted to mobile phones and loneliness among university students.

4.4. Recommendations

For university students themselves: individuals should strengthen self-monitoring, develop a clear understanding of themselves, and improve self-monitoring; develop a reasonable and scientific university life, work, and life planning, constantly enrich their lives, cultivate a wide range of hobbies, actively build good interpersonal relationships with classmates, relatives, and teachers, expand their social circles and interaction spheres in life, to overcome this undesirable status quo. University students' efforts play a decisive role. There is a need to consciously cultivate positive emotions, such as optimism, enthusiasm, cooperation, etc., to strengthen students' awareness and resistance to the concept of addiction to mobile phones.

For the family: parents should support their children more mentally and encourage them to participate in more club activities to enrich their spare time; respect their children and encourage them; cultivate a good parent-child relationship to prevent their children from becoming addicted to mobile phones and to avoid real-life disconnection. They should communicate with their children on an equal footing and encourage them to participate in healthy activities to make them feel relaxed and happy. They should pay more attention to their children and find out about their recent studies, life, and emotional exchanges so that they can communicate with them on time.

For schools: Teachers should guide students to avoid being addicted to mobile phones, enrich campus cultural life, give full play to the work of various student associations, increase the sense of collective belonging and identity of university students in interactive activities, and help university students to recognize mobile phone addictive behavior and find effective ways to get rid of it. The school should also pay attention to the provision of campus mental health education courses and psychological counselling, and regularly conduct psychological tests for students to improve their mental health.

To sum up, the various psychological conditions of university students require the cooperation and efforts of students themselves, schools, and parents to build a complete moral personality of university students.

4.5. Outlook of the Study

In terms of the selection of samples, for reasons of time and experience, this study only randomly selected subjects from two universities to conduct the questionnaire survey. Although the number of male and female participants in this study was balanced, it was not representative of the majority of university students, and there were limitations in terms of representativeness. Thus, future research could be extended to explore university students in other provinces at major universities.

In terms of research content, the study of mobile phone addiction in society today generally focuses on the addict, often ignoring the impact on potential addicts, who can become addicts if not well controlled. Therefore, further research could be conducted on potential addicts.

In terms of the population studied, this study analyzed contemporary university students. However, nowadays there are various groups of subjects who are addicted to mobile phones, and the effects of mobile phone addiction in other groups can be explored based on this study.

5. CONCLUSION

The following conclusions were drawn from this experiment:

1. There is also a significant correlation between university students' tendency to be addicted to mobile phones and their feelings of loneliness.
2. There is a significant correlation between university students' tendency to be addicted to mobile phones and interpersonal adaptability.
3. Interpersonal adaptability partially mediates the relationship between the tendency to be addicted to mobile phones and loneliness among university students.
4. There is a significant difference between the tendency to be addicted to mobile phones and loneliness among university students of different genders.
5. There is a significant difference between the tendency of mobile phone addiction and loneliness among university students of different grades.

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Institutional Review Board Statement: This study was approved by the Ethical Committee of Universiti Malaya, Malaysia under protocol number [UMREC 2024/0874], dated [1 October 2024].

Informed Consent Statement: Verbal informed consent was obtained from all participants prior to their participation in the study. All collected data were anonymized to ensure participant confidentiality.

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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