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The chain mediating effect of self-respect and self-control on the relationship between parent-child relationship and mobile phone dependence among middle school students

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This study aims to examine the impact of parent-child relationship on smartphone dependence among middle school students and explore the mediating role of self-respect and self-control. A cross-sectional survey was conducted using the Parent-Child Relationship Scale, Smartphone Dependence Scale, Self-Respect Scale, and Self-Control Scale with a sample of 2,311 middle school students. Correlation analysis revealed positive correlations among parent-child relationship, self-respect, and self-control. Specifically, the parent-child relationship was positively correlated with self-respect ($r=0.454$) and self-control ($r=0.423$), and negatively correlated with smartphone dependence ($r=-0.380$). Smartphone dependence was negatively correlated with self-respect ($r=-0.409$) and self-control ($r=-0.629$). Self-respect was positively correlated with self-control ($r=0.519$). Structural equation modeling indicated that self-respect and self-control partially mediated the relationship between parent-child relationship and smartphone dependence. The mediation effect of self-respect was -0.0843 (effect size = 8.99%, 95% CI = -0.1303 to -0.0379), and the mediation effect of self-control was -0.3149 (effect size = 33.59%, 95% CI = -0.3802 to -0.2500). The total chain mediation effect of self-respect and self-control was -0.2499 (effect size = 26.66%, 95% CI = -0.2915 to -0.2119). Self-respect and self-control serve as a chain-mediated pathway between parent-child relationship and smartphone dependence among middle school students.

Keywords Parent-child relationship, Mobile phone dependence, Self-respect, Self-control

According to the 48th Statistical Report on the Development of China's Internet issued by the China Internet Network Information Center¹, as of June 2021, the number of Chinese netizens has reached 1.007 billion, of which mobile phone users aged 10–19 account for 12.3%. In recent years, many scholars have attached increasing importance to research on the issue of mobile phone dependence among young students^{2–4}. Mobile phone dependence, also known as mobile phone addiction or problematic mobile phone use, refers to an individual's loss of control over their mobile phone usage, leading to physical, psychological, and social impairments, and a state of obsession and dependence on their mobile phone⁵. Currently, as a comprehensive personal handheld terminal device integrating text messaging, telephone calls, network access, and entertainment, excessive use of mobile phones not only affects sleep quality^{6,7}, academic performance⁸, and cognitive abilities⁹, but also can lead to psychological problems such as depression and anxiety^{10–12}. Middle school students are in a critical period of growth and development, during which their physical and psychological development is not yet complete, and they have not yet formed fixed behavior patterns¹³, making them particularly susceptible to the influence of external environments. During their developmental stages, adolescents are particularly susceptible to external environmental influences. The vast amount of information received through mobile phones can lead to excessive usage among middle school students, which in turn may result in a dependency on these devices. In terms of usage purpose, students who are dependent on their mobile phones primarily seek to fulfill psychological needs,

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such as social interaction, entertainment, and escapism. These individuals tend to use their phones frequently and for extended periods. This dependence negatively affects their learning and daily lives by distracting them, disrupting their sleep, and reducing outdoor activities. Psychologically, those who are dependent may exhibit symptoms of anxiety and depression, whereas regular users tend to maintain stable mental states. Additionally, individuals with mobile phone dependency often demonstrate lower self-control, making them more susceptible to addiction, which can significantly impact the lives and studies of middle school students.

Parent-child relationship refers to a type of interpersonal relationship established by family members, including parents and children, based on blood ties, through mutual interaction and communication. In the parent-child relationship, parents assume the roles of guides, educators, and supporters. Meanwhile, children gradually develop independent personalities through processes of imitation, learning, and socialization. A good parent-child relationship enables growing children to acquire basic knowledge and values, and promotes their successful development of various social relationships¹⁴. Conversely, a poor parent-child relationship can deprive children of their mental health and lead to problematic behavior, such as behavioral disorders, mental disorders, and criminal tendencies¹⁵. As the earliest social relationship that family members come into contact with, parent-child relationship has a significant impact on individual personality, social cognition, and psychological health development. As an important factor affecting adolescent growth, a good parent-child relationship may lead to a spoiling mentality and indulgence in the use of mobile phones, while a tense parent-child relationship may lead to psychological problems in adolescents, which may have a certain impact on the development of mobile phone dependence among middle school students. Therefore, it is particularly important to explore the impact of parent-child relationship on mobile phone dependence among middle school students.

Self-respect, also known as self-esteem or self-respect, is an emotional experience in which individuals respect, love, and value themselves based on self-evaluation, and require respect from others, collectives, and society. Research indicates that self-respect is negatively correlated with mobile phone dependence¹⁶, and low self-respect is more likely to lead to mobile phone dependence¹⁷. The sociometer theory of self-respect holds that self-respect plays a mediating role between interpersonal relationships and individual social behavior, and has a significant impact on the emotional, social adaptation, and cognitive development of adolescents¹⁸. Individual self-respect changes with the acceptance level of others in the family^{19,20}, and children living in high-quality parent-child relationships have significantly higher levels of self-respect than those living in low-quality parent-child relationships²¹. A good parent-child relationship can not only reduce anxiety and depression levels in left-behind children but also effectively prevent and reduce the occurrence of mental health problems among middle school students through the mediating role of self-respect^{22,23}. Self-control refers to the ability to regulate one's own thoughts, behavior, and emotions to inhibit and overcome original reactions²⁴. Self-control is a predictive variable for mobile phone dependence, as students with lower self-control are more likely to have higher levels of mobile phone dependence²⁵. Parent-child relationship is significantly positively correlated with self-respect and self-control²⁶, and low self-control is the main cause of adolescent problematic behavior according to the general theory of crime, with self-control mediating the effect of parent-child relationship on children's problematic behavior²⁷. Poor parent-child relationships can lead to lower self-control in children²⁴, which may in turn lead to problems such as mobile phone dependence. Self-respect and self-control are two interrelated concepts, with higher levels of self-respect helping individuals better control their behavior and emotions, and they play an important role in individual psychological development and behavior performance²⁸.

In summary, existing research has discussed the relationships between parent-child relationship, mobile phone dependence, self-respect, and self-control, but lacks an in-depth systematic analysis of the intrinsic relationships and interactions among the four variables. Following Wen Zhonglin's feature of questionnaire research method for determining variable order relations, this study aims to use middle school students as subjects, parent-child relationship as an independent variable, mobile phone dependence as a dependent variable, and self-respect and self-control as mediator variables to explore the relationship between parent-child relationship and mobile phone dependence, as well as the mediating roles of self-respect and self-control in the relationship between the two. Further clarification of the mechanism for the development of mobile phone dependence among middle school students is expected to provide ideas for intervention and correction of mobile phone dependence among them. Based on this, this study proposes the following hypotheses: H1: Middle school students' parent-child relationship can significantly negatively predict their mobile phone dependence; H2: Self-respect and self-control respectively play a mediating role in the relationship between parent-child relationship and mobile phone dependence; H3: Self-respect and self-control have a chain mediating effect in the relationship between parent-child relationship and mobile phone dependence. The preliminary model hypothesis is shown in Fig. 1.

Object and method

Participates

From May to June 2023, a multi-stage random stratified cluster sampling method was employed to select the study participants. The process involved three stages as follows: In the first stage, a lottery method was used to randomly select four cities (or prefectures) including Xiangxi Tujia and Miao Autonomous Prefecture, Enshi Tujia and Miao Autonomous Prefecture, Tongren City, and Chongqing City from the Wuling Mountain area of Hunan Province, Hubei Province, Guizhou Province, and Chongqing Municipality. In the second stage, two schools (consisting of one junior high school and one senior high school) were randomly selected using a random number table method from each city (or prefecture), resulting in a total of eight schools. In the third stage, one class was randomly selected by lottery from each grade (from 7th to 12th grade) of the selected schools, resulting in a total of 48 classes. All students in the selected classes who met the survey requirements were included as the survey participants. A total of 2,434 questionnaires were distributed, and 2,311 valid responses were collected, yielding a response rate of 94.94%. A total of 2,311 middle school students were surveyed in this study, including 1,162 males (50.2%) and 1149 females (49.8%). Among them, 1194 students were in junior high school, with

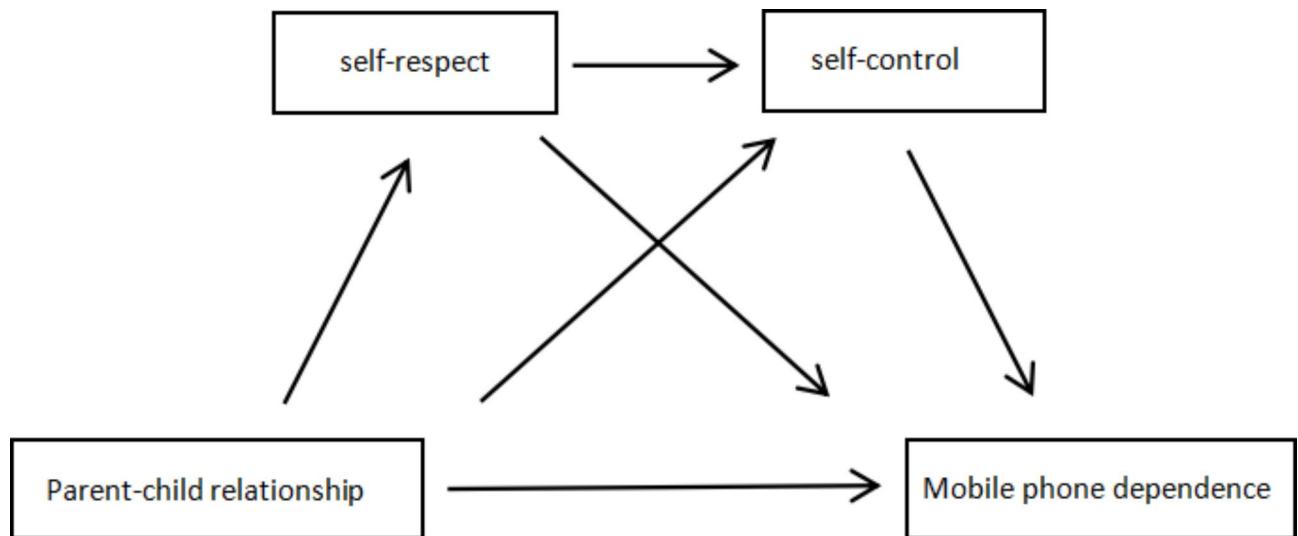


Fig. 1. A hypothesized chain mediation model of self-respect and self-control between parent-child relationship and mobile phone dependence.

403 students in the first year (17.4%), 386 students in the second year (16.7%), and 402 students in the third year (17.4%). As for high school students, A total of 1,117 high school students were surveyed, comprising 404 students in the first year (17.5%), 388 students in the second year (16.8%), and 328 students in the third year (14.2%).

Prior to the dissemination of the questionnaire, all investigators underwent rigorous training to ensure a standardized approach. Upon official distribution, the investigators meticulously briefed participants on the survey's objectives and components, emphasizing the confidentiality and anonymity of their responses. They clarified the ultimate destination and utilization of the collected data, ensuring transparency and trust. The survey was conducted on a voluntary basis, with participants contributing without any form of compensation, and they were granted the autonomy to withdraw their participation at any juncture. The entire survey was designed to be concise, with the completion time estimated at approximately 20 min, thereby balancing thoroughness with respect for the participants' time. Informed consent forms were signed by all participants. Ethical approval was obtained from the institutional medical ethics committee before commencement. The study was conducted in accordance with the Declaration of Helsinki.

Tools

Parent-child relationship scale

The Parent-Child Relationship Scale was used in this study, which was developed by RAJA et al.²⁹ and includes three dimensions: trust, communication, and alienation. For this survey, the trust and communication dimensions were used, comprising a total of eight items. A 5-point Likert scale was employed for scoring, with "1" indicating "strongly disagree," "2" indicating "disagree," "3" indicating "neutral," "4" indicating "agree," and "5" indicating "strongly agree." The total score ranged from 8 to 40, with higher scores indicating better parent-child relationships. In this survey, the Cronbach's α coefficient for the scale was 0.83.

Mobile phone dependency scale

The Mobile Phone Addiction Index (MPAI)³⁰ was employed to assess mobile phone dependency. This scale consists of 17 items, covering four aspects: withdrawal, loss of control, inefficiency, and escapism. It utilizes a five-point rating scale, with responses ranging from 1 (never) to 5 (always). The total score for the 17 items ranged from 17 to 85, with higher scores indicating a greater degree of mobile phone dependency. The Cronbach's α coefficient for this scale in the current survey was 0.90.

Self-respect scale

The questionnaire developed by Rosenberg³¹ in 1965 was used to measure self-respect. It consists of 10 items rated on a four-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). The total score ranged from 10 to 40, with higher scores indicating higher levels of self-respect. The Cronbach's α coefficient for this scale in the current survey was 0.82.

Self-control scale

The Self-Control Scale (SCS), developed by Tangney et al.³² and revised by Tan Shuhua and Guo Yongyu, was utilized in this study. The scale comprises 19 items rated on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α coefficient for this scale in the current survey was 0.83.

Variable	N(%)	Parent-child relationship score		Mobile phone dependency score		self-respect score		Self-control score	
		M \pm SD	t	M \pm SD	t	M \pm SD	t	M \pm SD	t
Gender									
Boys	1162(50.3)	25.85 \pm 6.193	3.405**	39.78 \pm 15.336	-2.476*	28.23 \pm 5.271	6.314**	61.23 \pm 13.977	2.715**
Girls	1149(49.7)	24.98 \pm 6.066		41.34 \pm 14.942		26.82 \pm 5.463		59.70 \pm 13.210	
Grade									
Junior high school	1194(17.4)	26.22 \pm 6.591	6.537**	37.05 \pm 15.911	-11.560**	28.04 \pm 5.722	4.710**	63.97 \pm 14.774	13.245**
Senior high school	1117(16.7)	24.56 \pm 5.504		44.31 \pm 13.329		26.99 \pm 5.005		56.73 \pm 11.113	
Only child									
Yes	331(14.3)	24.96 \pm 6.422	2.161	42.87 \pm 14.953	9.038*	27.77 \pm 5.796	0.735	59.26 \pm 13.767	3.027
no	1980(85.7)	25.5 \pm 6.095		40.17 \pm 15.162		27.49 \pm 5.346		60.67 \pm 13.588	

Table 1. Descriptive analysis of parent-child relationship, mobile phone addiction, self-respect, self-control.Note: * $P < 0.05$, ** $P < 0.01$.

Variable name	M \pm SD	Parent-child relationship	Mobile phone dependence	self-respect	self-control
Parent-child relationship	25.42 \pm 6.144	-			
Mobile phone dependence	40.56 \pm 15.158	-0.380**	-		
Self-respect	27.53 \pm 5.412	0.454**	-0.409**	-	
Self-control	60.47 \pm 13.619	0.423**	-0.629**	0.519**	-

Table 2. Correlation analysis matrix. Note: **: $p < 0.01$.

Statistical analysis

Harman's single-factor test was conducted to examine potential common method biases. Pearson correlation analysis was employed to explore the associations between variables. The SPSS macro PROCESS 3.4.1 Model 6 developed by Haynes was used to test the chain mediation effect, and the significance of the mediation effect was evaluated using bootstrap estimation with 5000 resamples. The significance level was set at $\alpha = 0.05$.

Quality control

The survey was conducted under the supervision of researchers from the School of Sports Science at Jishou University. Questionnaires were distributed on a class basis, following a standardized instruction. Questionnaires were administered and collected on-site, with invalid responses removed from the analysis.

Results

Common method deviation test

The Harman's single-factor test was utilized in this study to examine the presence of common method bias. The results indicated that there were 21 factors with eigenvalues greater than 1, among which the first factor had an eigenvalue of 11.266, explaining 15.462% of the variance, which was less than 40%. Therefore, this study did not suffer from severe common method bias.

Basic information of research objects

There were statistically significant differences in parent-child relationships, self-respect, and self-control scores across different genders and grades. Additionally, there were statistically significant differences in smartphone dependency scores among different genders, grades, and only-child status. Please refer to Table 1.

Correlation analysis of parent-child relationship, mobile phone addiction, self-respect and self-control

Pearson correlation analysis revealed significant positive correlations between parent-child relationships, self-respect, and self-control ($P < 0.01$). Moreover, smartphone dependency exhibited negative correlations with parent-child relationships, self-respect, and self-control ($P < 0.01$). Specifically, parent-child relationships were positively correlated with self-respect ($r = 0.454$) and self-control ($r = 0.423$), while negatively correlated with smartphone dependency ($r = -0.380$). Smartphone dependency was negatively correlated with self-respect ($r = -0.409$) and self-control ($r = -0.629$). Additionally, self-respect showed a positive correlation with self-control ($r = 0.519$). Please refer to Table 2.

Analysis of the chain mediating effect of self-respect and self-control on parent-child relationship and mobile phone dependence

Based on the correlation analysis and the mediation effect test method proposed by Wen et al.³³ this study conducted regression analysis with gender, grade, and only-child status as covariates, parent-child relationships

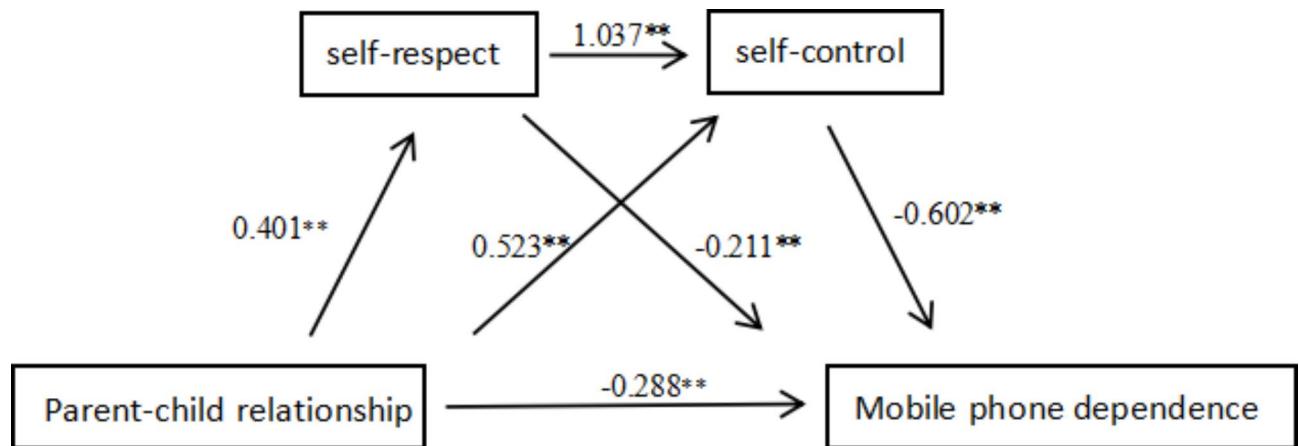


Fig. 2. A chain-mediated model of self-respect and self-control between parent-child relationship and mobile phone dependence.

Effect	Path	Effect size	Effective dose	Se	95%CI	
					Upper limit	Lower limit
Total effect	Parent-child relationship→Mobile phone dependence	-0.9374	100.00%	0.0475	-1.0305	-0.8443
Direct effect	Parent-child relationship→Mobile phone dependence	-0.2883	30.76%	0.0455	-0.3775	-0.1991
Indirect effect	Parent-child relationship→ self-respect→Mobile phone dependence	-0.0843	8.99%	0.0235	-0.1303	-0.0379
Indirect effect	Parent-child relationship→ self-control→Mobile phone dependence	-0.3149	33.59%	0.0330	-0.3802	-0.2500
Indirect effect	Parent-child relationship→ self-respect→self-control→Mobile phone dependence	-0.2499	26.66%	0.0201	-0.2915	-0.2119

Table 3. The pathway and effect decomposition of self-respect and self-control in the chain mediation model between parent-child relationship and mobile phone dependence.

as the independent variable (X), smartphone dependency as the dependent variable (Y), and self-respect (M1) and self-control (M2) as the mediating variables. Please refer to Fig. 2.

The research findings indicate that the total effect size of parent-child relationships on smartphone dependency was -0.9574, with a direct effect of -28.83 and an effect size of 30.76% ($P=0.001$). Self-respect and self-control partially mediated the relationship between parent-child relationships and smartphone dependency, with a mediation effect size of -0.0843 and an effect size of 8.99% for self-respect, and a mediation effect size of -0.3149 and an effect size of 33.59% for self-control. The chained mediation effect size of self-respect and self-control was -0.2499, with an effect size of 26.66%. The 95% confidence intervals of all paths did not include zero, indicating that all mediating effects were significant ($P<0.05$). Please refer to Table 3.

Discussion

Descriptive analysis of parent-child relationships, mobile phone addiction, self-respect, and self-control

This study reveals that male students score significantly higher than female students in terms of parent-child relationships, self-respect, and self-control. Conversely, female students exhibit a higher level of mobile phone dependency compared to their male counterparts. These gender differences may stem from traditional cultural expectations regarding gender roles³⁴, the distribution of family responsibilities, and societal standards for male success. Collectively, these factors contribute to males demonstrating greater self-respect³⁵ and self-control³⁶. In contrast, females may exhibit higher mobile phone dependency due to social evaluations, the socialization of emotional expression, and specific needs related to mobile phone usage. To mitigate these differences, it is recommended that families, schools, and society work collaboratively to create an environment that promotes gender equality in development. Additionally, enhancing digital literacy education can help reduce mobile phone dependency and foster the holistic development of adolescents.

Moreover, junior high school students demonstrate higher scores in parent-child relationships, self-respect, and self-control than high school students, who, in turn, show greater mobile phone dependency. These discrepancies may be attributed to high school students facing more complex academic pressures and college entrance challenges³⁷, which can lead to reduced family communication and negatively impact their parent-child relationship scores. In contrast, junior high school students receive more parental attention, which helps maintain their self-respect and self-control levels³⁸. The fluctuations in self-respect among high school students may be related to the exploration of self-identity and social pressures, while their self-control abilities could be influenced by greater temptations and the experience of increased independence. The differences in

mobile phone dependency among high school students may be linked to academic stress, social needs, and the availability of more leisure time and resources³⁹. Future research should investigate the impacts of family, school, and societal factors on adolescent development to inform the creation of effective intervention strategies.

Correlation analysis between parent-child relationship and mobile phone dependency

The research results indicate a significant negative correlation between parent-child relationship and mobile phone dependency, supporting hypothesis H1, which is consistent with a study by Tang et al.⁴⁰. Ecological Systems Theory proposes that developing individuals are nested within a series of interacting environmental systems in which they interact and influence individual development⁴¹. The relationship between parents and children can be regarded as a triangular system, in which parents and children constitute one party respectively, and are connected by three aspects at the psychological, physiological and sociological levels⁴². The ecosystem theory suggests that the family is an important component of the ecosystem⁴³. As a crucial part of the family ecosystem, a harmonious and close parent-child relationship leads to increased communication time and intimacy⁴⁴. Mobile phone dependency often arises from interpersonal deficiencies and the resulting internal discomfort or distress⁴⁵. When individuals experience poor parent-child relationships for an extended period, they are more likely to seek psychological comfort in the virtual world, resulting in reduced contact with parents and an increased tendency towards mobile phone dependency²⁴. Therefore, higher levels of parent-child relationship quality correspond to lower levels of mobile phone dependency. This implies that parents can prevent and reduce mobile phone dependency issues by focusing on improving the parent-child relationship.

Mediating role of self-respect and self-control in the relationship between parent-child relationship and mobile phone dependency

The research results suggest that self-respect and self-control partially mediate the relationship between parent-child relationship and mobile phone dependency, supporting hypotheses H2 and H3. This is consistent with previous studies indicating that self-respect, as a self-regulation structure within personality psychology, influences individual behavior and thinking patterns, and can mediate the impact of interpersonal relationships on mobile phone dependency⁴⁶. According to the family systems theory, the parent-child relationship is a type of interpersonal relationship and a crucial component of the family system. The relationship between parents and children forms a triangular system, connecting them on psychological, physiological, and sociological levels⁴². Any issues within this triangular system can destabilize it. A positive parent-child relationship facilitates emotional communication between parents and children. A positive parent-child relationship helps parents gain a better understanding of their children's recent physical and psychological conditions, while children receive more emotional support, encouragement, and some material support from their parents⁴⁷. This leads to higher levels of self-respect. Previous empirical research has demonstrated the negative predictive role of self-respect in mobile phone dependency⁴⁸, which aligns with the findings of our study. A positive parent-child relationship indirectly reduces the extent of mobile phone dependency. Self-control was positively correlated with parent-child relationship and mobile phone dependence, with students exhibiting lower self-control showing higher levels of mobile phone dependency²⁵. Low self-control is considered a major cause of problem behavior among adolescents in general strain theory, and self-control mediates the influence of parent-child relationship on problematic behavior in children⁴⁹. Negative and unhealthy parent-child relationships can disrupt the balance of the family relationship triangle, resulting in a generation gap in communication between parents and children. Parents lose some of the conditions for guiding, establishing, and managing their children, leading to reduced mutual companionship time and lower levels of self-control in children²⁴, thus contributing to mobile phone dependency and other problems.

Chain mediating role of self-respect and self-control in the relationship between parent-child relationship and mobile phone dependency

The research results demonstrate that self-respect significantly predicts self-control and that self-respect and self-control have a chain mediating effect in the relationship between parent-child relationship and mobile phone dependency, supporting hypothesis H4. This is consistent with previous research by Gao et al.²⁸ and Du et al.⁵⁰. Individuals with high self-respect exhibit stronger self-control, while those with low self-respect may struggle to control their behavior due to feelings of inferiority and negative emotions, making them susceptible to external temptations and influences. This provides a theoretical basis for the main effect hypothesis model of this study, indicating that an individual's self-respect can effectively change their self-control ability¹⁸. Higher levels of self-respect can be achieved through positive parent-child relationships, correct guidance, and improved self-control, leading to reduced levels of mobile phone dependency⁵¹. In other words, when the parent-child relationship is sufficiently intimate, middle school students receive more recognition and support from their parents, resulting in higher self-respect. Correct guidance and increased communication time between parents and children in three dimensions help reduce mobile phone dependency. Conversely, if the parent-child relationship is poor and the support and companionship from parents decrease, self-respect and self-control decrease. Individuals seek comfort through mobile phones as a medium, so that the level of mobile phone dependence increases, and may even eventually lead to psychological problems in middle school students.

Significance and limitations of the study

This study, based on ecosystem theory and general strain theory, explores the relationship between parent-child relationship and mobile phone dependency among middle school students, as well as the underlying mechanisms. The results reveal the chain mediating effect of self-respect and self-control in the relationship between parent-child relationship and mobile phone dependency, providing insights into the psychological mechanisms underlying the relationship between parent-child relationship and mobile phone dependency.

among middle school students. Moreover, the study has a broad sample range, sufficient sample size, and high reliability. The research findings provide empirical evidence for the prevention and intervention of mobile phone dependency among middle school students.

However, this study has some limitations. Firstly, it adopts cross-sectional data for multiple mediation analyses, and although the results are significant, causality between variables cannot be determined. Future research could employ longitudinal data to examine similar mediation effects and validate the results of this study. Secondly, the factors influencing the relationship between parent-child relationship and mobile phone dependency among middle school students are diverse and complex. Many influencing factors have not been explored in this study. Future research can continue to investigate these factors and their mechanisms to provide more strategies for effective intervention in mobile phone dependency among middle school students.

Data availability

The datasets generated and/or analysed during the current study are not publicly available due [our experimental team's policy] but are available from the corresponding author on reasonable request.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The study was approved by the Biomedicine Ethics Committee of Jishou University before the initiation of the

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Additional information

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