The Mediating Effect of Physical Exercise and Socially Learned Helplessness in The Relationship Between Parental Control and Mobile Phone Addiction

Chen Tingwei[1], Wang Haiqing[2], Yang Xintian[3], Chang Zhai[4], Xiya Li[5], Haoliang Mai[6], Weilin Su[7,8]

Abstract

This study investigated the impact of parental control on mobile phone addiction, exploring the mediating roles of physical exercise and socially learned helplessness. Questionnaires were used to collect data on parental control (including psychological control and behavioral control), mobile phone addiction, physical exercise, and learned helplessness from university students. After screening for validity, 500 valid questionnaires were obtained, resulting in an effective rate of 98.43%. Of these participants, 252 were male (50.40%) and 248 were female (49.60%). Data were analyzed using SPSS 26.0 and the PROCESS plugin. The results showed significant correlations among parental control, physical exercise, socially learned helplessness, and mobile phone addiction (ps < 0.001). Parental control and its dimensions directly predicted mobile phone addiction (ps < 0.001). Physical exercise and socially learned helplessness acted as parallel mediators between parental psychological control and mobile phone addiction, while they acted as serial mediators between parental behavioral control and mobile phone addiction. There was no significant mediation effect of physical exercise on the relationship between overall parental control and mobile phone addiction; however, parental control had a significant predictive effect on physical exercise. Socially learned helplessness mediated the effect of overall parental control on mobile phone addiction. These findings suggest that parents and schools should address students' behavioral problems not only from the perspective of technological advancements and individual factors but also consider other factors such as parental control and socially learned helplessness when developing intervention programs. Parents should adopt a correct educational perspective and gradually release their control when appropriate. Schools, teachers, and parents should emphasize the importance of physical exercise, provide more opportunities for sports activities, and guide students in recognizing the significance of physical exercise.

Keywords: Physical Exercise; Parental Control; Socially learned helplessness; Mobile Phone Addiction.

Introduction

Parental control, as a core dimension of parenting style, influences various aspects of individual development. Moderate psychological control by parents contributes to the development and well-being of adolescents, while excessive control can lead to a range of internalizing problems (Barber, Olsen, & Shagle, 1994). Study findings by Fang, Fang and Shen (2012) and Lai et al. (2014) indicate that parental psychological control positively predicts adolescent internet addiction. Research by Li et al. (2013a) suggests that psychological control leads to maladaptive cognition in adolescents and subsequently contributes to the development of internet addiction. University students, being an important group in mobile phone usage, have drawn widespread attention to the issue of mobile phone dependency (Ding, Zu, & Zhang, 2018).

Research on parenting styles (Hokoda & Fincham, 1995) has examined the relationship between socially learned helplessness and family education, revealing a certain association between socially learned helplessness and inappropriate parenting practices during childhood. Frequent experiences of failure and setbacks result in cognitive changes, whereby individuals with sustained low academic motivation and perceived incompetence attribute their failures to a lack of ability (Marsh, 1984). Repeated academic failures can lead to the adoption of self-protective strategies and a sense of helplessness (Valås,

[1] City University of Macau, Faculty of Humanities and Social Sciences, Macau.
[2] School of Psychology, Northwest Normal University, Lanzhou.
[3] City University of Macau, Faculty of Humanities and Social Sciences, Macau.
[4] City University of Macau, Faculty of Humanities and Social Sciences, Macau.
[5] Hengdian College of Film & Television, Dongyang.
[6] City University of Macau, Faculty of Humanities and Social Sciences, Macau.
[7] City University of Macau, Faculty of Humanities and Social Sciences, Macau.
[8] Guangdong Mechanical & Electrical Polytechnic, Institute of Public Administration, Guangzhou.
*Correspondence:

2001). From an attributional perspective, it is suggested that negative attributional styles contribute to the development of socially learned helplessness.

As society pays increasing attention to the field of mental health promotion, sports psychology is gaining recognition. Physical exercise not only has significant implications for physical health but also plays a positive role in individual psychological well-being and behavior. The main purpose of this study is to investigate whether sports activities can serve as a mediating variable or effective intervention in the relationship between parental control and mobile phone addiction, as well as to explore the mediating role of socially learned helplessness in the impact of parental control on mobile phone addiction. By examining these mechanisms through a chain mediation model and conducting a survey among a specific sample of university students, this study aims to provide theoretical guidance for the growth of adolescents within the family context.

Literature Review

Socially learned helplessness refers to a negative psychological state experienced by individuals after enduring prolonged and consistent setbacks and failures, resulting in a perception of a lack of control between their behavior and its outcomes, thereby damaging their cognition, emotions, and motivation (Seligman & Maier, 1967). Socially learned helplessness is a state where individuals experience learned helplessness in social situations due to failures and setbacks in social interactions, believing that they are unable to influence social events relevant to themselves. This behavior is characterized by passivity in social situations and easily giving up when faced with social challenges (Goetz & Dweck, 1980).

Parental behavioral control refers to parents' use of supervision, restrictions, and establishment of household rules to control the behavior of adolescents. Previous literature distinguishes parental control into psychological control and behavioral control. Psychological control involves parents managing and controlling the thoughts and emotional development of adolescents through parent-child relationships (inducing guilt, withdrawing affection) as well as adolescents' emotions and expressions (thoughts), thereby limiting their behavior.

Mobile phone addiction refers to the intense and persistent craving for and reliance on mobile phones due to excessive involvement in various activities mediated by mobile phones, leading to significant social and psychological impairments (Huang et al., 2014). Mobile phone addiction can result in psychological health problems such as anxiety, depression, loneliness (Elhai et al., 2016; Thomée, 2018).

Physical exercise, as a means of daily leisure and relaxation, not only maintains physical health but also has numerous psychological effects. Extensive research has shown that physical exercise helps individuals reduce anxiety levels (Landers & Petruzzello, 1994; Taylor, 2000; Xu et al., 2002), alleviate depression (Landers & Arent, 2007), adapt to stress responses (Liu & Mu, 2003; Ma, Wang, & Sui, 2005), enhance self-efficacy (McAuley, Bane, & Mihalko, 1995; McAuley et al., 2000; Yue et al., 2010), self-esteem (He & Ji, 2003), and reduce social avoidance and distress (Li et al., 2023).

The causes of socially learned helplessness mainly include parenting styles, frequent experiences of failure and setbacks, inappropriate attributional styles, and low social self-efficacy. Parental control, as a relatively stable pattern of family upbringing behavior, has a significant influence on individual growth and development. High levels of parental control make individuals more concerned about success and pleasing their parents, making it difficult for them to accept failure. It also affects individuals' self-evaluation and motivational processes, thereby influencing the formation of socially learned helplessness. Many studies have found that parental psychological control positively predicts adolescent internet addiction. Physical exercise can enhance individuals' self-efficacy and improve emotional experiences.

Based on this, the following hypotheses are proposed in this study:

H1: There are significant correlations between parental control, physical exercise, socially learned helplessness, and mobile phone addiction;

H2: Parental control has a direct positive predictive effect on mobile phone addiction;

H3: Physical exercise and socially learned helplessness mediate the impact of parental control on mobile phone addiction.

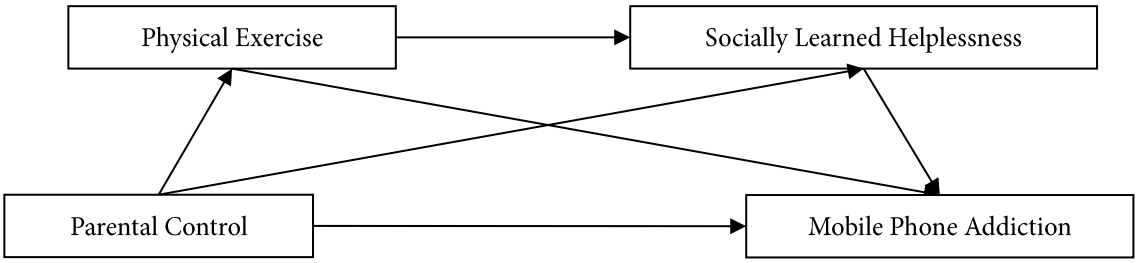

Figure 1: Hypothetical Model Diagram of the Influence of Parental Control on Mobile Phone Addiction.

Methodology

Research Methods

Import the valid data into SPSS 26.0 statistical analysis software. Conduct Pearson correlation analysis, regression analysis, and moderated mediation analysis using the PROCESS (version 3.4) plugin with BootStrap resampling for mediation effects testing. When analyzing the indirect effects of variables using the PROCESS plugin, specify the following settings: Model 6 is selected; X = physical exercise, M1 = self-control, M2 = mobile phone addiction, Y = academic procrastination; BootStrap Samples = 5000.

Parental Control Questionnaire

The parental control questionnaire used in this study is the Chinese version developed by Wang, Pomerantz and Chen (2007) from The Chinese University of Hong Kong. It consists of two sub-scales: psychological control and behavioral control. The psychological control sub-scale contains 18 items, which primarily assess parents' behaviors related to inducing guilt, withdrawing love, and exerting authoritarian power. Responses are scored on a five-point scale ranging from "completely inconsistent" to "completely consistent," with higher scores indicating higher levels of parental psychological control over their children.

The behavioral control sub-scale includes 16 items, measuring parents' behaviors in terms of active inquiry and restrictive supervision. Responses are also scored on a five-point scale ranging from "never" to "always," with higher scores indicating greater parental control over their children's behavior. The Cronbach's alpha coefficients for both sub-scales in this study were 0.968 and 0.964 respectively, indicating good internal consistency.

Physical Activity Rating Scale

To investigate the physical activity level of college students, the revised "Physical Activity Rating Scale" developed by Liang (1994) was utilized as the measurement tool. This scale is widely employed for assessing physical exercise or sports activity. The scale primarily examines participants' exercise volume based on three aspects: exercise intensity, duration, and frequency. Each aspect is divided into five levels. Exercise intensity and frequency are scored on a scale from 1 to 5, while exercise duration is scored on a scale from 1 to 5, with values ranging from 0 to 4. The exercise volume is calculated as the product of exercise intensity, duration, and frequency (Exercise Volume = Exercise Intensity × Exercise Duration × Exercise Frequency).

Socially learned helplessness Questionnaire

Learned helplessness can encompass various behaviors. This research aims to investigate learned helplessness in the context of social attributes. Drawing upon relevant literature, the University Students Learned Helplessness Questionnaire developed by scholars Wu, Zeng and Ma (2009) was ultimately selected as a reference tool. It was adapted to align with the research objectives, resulting in a total of 18 items. Participants rated each item on a 5-point scale, ranging from "completely inconsistent" to "completely consistent." Higher scores indicate a greater degree of learned helplessness. The questionnaire demonstrated high internal consistency with a reliability coefficient of 0.970.

Mobile Phone Addiction Tendency Scale for College Students

For the target population in this study, the Mobile Phone Addiction Tendency Scale for College Students (MPATS), developed by Xiong et al. (2012), was used as the measurement tool for mobile phone addiction. The scale consists of 16 items, scored on a 5-point Likert scale ranging from "completely inconsistent" to "completely consistent," with scores of 1-5 assigned accordingly. The mean score is used as a dividing standard. Based on the research conducted by Zhao (2022), the theoretical mean level for the total scale is 3. Scores above 3 indicate a certain degree of mobile phone addiction, and higher scores reflect a more severe level of dependence. In this study, the internal consistency coefficient of the scale was found to be 0.966.

Subjects

This study primarily employed an online data collection method to gather questionnaires from mainland Chinese university students. The average age of the participants was 22.700 ± 2.191. A total of 508 questionnaires were collected, with those displaying excessively short response times and incorrect answers to bogus items being excluded, finally, 500 valid questionnaires were obtained, resulting in an effective rate of 98.43%. Among the participants, 252 individuals were male, accounting for 50.40% of the sample, while 248 individuals were female, comprising 49.60% of the total sample size. In terms of geographical origin, 293 students (58.60%) hailed from urban areas, while 207 students (41.40%) came from rural regions. Additionally, concerning family structure, there were 88 only children (17.60%), with the remaining 412 students (82.40%) having siblings.

Regarding academic year distribution, participants were categorized as follows: 57 freshmen (11.40%), 76 sophomores (15.20%), 84 juniors (16.80%), 100 seniors (20.00%), 41 fifth-year students (8.20%), 70 first-year graduate students (14.00%), 43 second-year graduate students (8.60%), and 29 third-year graduate students

(5.80%). In terms of majors, there were 202 students in humanities (40.40%), 144 in science (28.80%), 130 in engineering (26.00%), and an additional 24 in other fields (4.80%).

Result

For the sake of brevity and convenience, this study will use abbreviations of the variable names in the following report. PPC: Parental Psychological Control; PBC: Parental Behavioral Control; PE: Physical Exercise; SLH: Socially learned helplessness; MPA: Mobile Phone Addiction.

Common Method Bias Test

In this study, data on parental control, physical exercise, socially learned helplessness, and mobile phone addiction were obtained through self-assessment using scales. However, this approach raises the possibility of common method bias, where participants' responses may be influenced by a common method or measurement approach rather than reflecting the true relationships among the variables.

To address this potential bias, the Harman one-way test was conducted to assess the extent of common method variance in the study. The Harman one-way test examines the variance explained by a single factor when all variables are entered into a factor analysis without rotation. If a single factor explains a substantial portion of the variance, it suggests the presence of common method bias.

The results of the Harman one-way test in this study indicated that the variance explained by the first factor without rotation was 27.46%. As this accounted for less than the threshold of 40%, it can be considered that the study does not suffer from serious common method bias. However, it is essential to acknowledge that some degree of common method bias might still be present in the data, and researchers should interpret the results with caution and consider additional methods to address potential bias, such as using multi-source data or employing longitudinal designs.

Table 1

Descriptive Statistics Table of Basic Demographic Information and Key Variables (N = 500)

	N	PPC	PBC	PC	PE	SLH	MPA
		M±SD	M±SD	M±SD	M±SD	M±SD	M±SD
Male	252	46.548±18.593	41.151±16.705	87.698±34.989	30.548±21.906	45.079±18.608	2.562±1.039
Female	248	47.524±19.223	41.887±16.629	89.411±35.547	30.097±22.698	46.399±18.964	2.635±1.082
t		-0.577	-0.494	-0.543	0.226	-0.785	-0.773
City	293	41.724±16.014	36.567±14.131	77.290±29.776	34.539±21.251	40.249±15.776	2.309±0.905
Rural	207	54.546±20.114	48.522±17.456	103.068±37.286	24.358±22.393	53.498±19.950	3.006±1.129
t		-7.623***	-8.147***	-7.938***	5.114***	-7.957***	-7.368***
Only children	88	57.148±20.241	50.568±17.439	107.716±37.469	20.625±21.781	55.023±20.237	3.190±1.076
Non-only children	412	44.871±17.893	39.583±15.846	84.454±33.396	32.396±21.861	43.750±17.861	2.471±1.014
t		5.267***	5.449***	5.385***	-4.599***	4.838***	5.747**

Note: * p < 0.05, ** p < 0.01, *** p < 0.001; "p" is the probability, reflecting the probability of an event.

According to Table 1, there were no significant gender differences observed in the various variables studied (ps > 0.05). However, significant differences were found in the Parental Psychological Control and Behavioral Control subscales as well as their total scores based on the participants' hometown (t = -7.623, p < 0.001; t = -8.147, p < 0.001; t = -7.938, p < 0.001). Specifically, participants from urban areas reported higher scores on parental control measures. There was also a significant difference in physical exercise based on the participants' hometown (t = 5.114, p < 0.001), with urban participants reporting higher levels of physical exercise. Furthermore, significant differences were observed in socially learned helplessness and mobile phone addiction scores based on the participants' hometown (t = -7.957, p < 0.001; t = -7.368, p < 0.001), with participants from rural areas reporting higher levels of socially learned helplessness and mobile phone addiction.

Additionally, significant differences were found in the Parental Psychological Control and Behavioral Control subscales as well as their total scores based on whether the participants were only child or not (t = 5.276, p < 0.001; t = 5.449, p < 0.001; t = 5.385, p < 0.001), with only children reporting higher parental control scores. There was also a significant difference in physical exercise based on whether the participants were only child or not (t = -4.599, p < 0.001), with non-only children reporting higher levels of physical exercise. Moreover, socially learned helplessness and mobile phone addiction scores showed significant differences based on whether the participants were only child or not (t = 4.838, p < 0.001; t = 5.747, p < 0.001), with

only children reporting higher levels of socially learned helplessness and mobile phone addiction.

Table 2

Correlation analysis for key variables (N = 500)

	1	2	3	4	5	6
1.PPC	1					
2.PBC	0.965***	1				
3.PC	0.992***	0.990***	1			
4.PE	-0.749***	-0.736***	-0.749***	1		
5.SLH	0.969***	0.964***	0.975***	-0.731***	1	
6.MPA	0.966***	0.963***	0.973***	-0.741***	0.962***	1

Note: * p < 0.05, ** p < 0.01, *** p < 0.001; "p" is the probability, reflecting the probability of an event.

The results of Pearson correlation analysis revealed significant negative correlations (ps < 0.001) between scores on the Parental Psychological Control and Behavioral Control subscales as well as their total scores, and physical exercise. Additionally, there were significant positive correlations (ps < 0.001) between these parental control scores and scores on socially learned helplessness and mobile phone addiction. Furthermore, a significant negative correlation (ps < 0.001) was found between physical exercise and scores on socially learned helplessness and mobile phone addiction. Moreover, there was a significant positive correlation (p < 0.001) between scores on socially learned helplessness and mobile phone addiction.

Table 3

Mediating effect analysis & model fitting (N = 500)

Dependent Variable	Independent Variable	R^2	F	β	t	p
MPA	PPC	0.946	2872.227***	0.533	12.283	0.000
	PE			-0.035	-2.196	0.029
	LH			0.420	9.968	0.000
SLH	PPC	0.938	3776.493***	0.959	57.055	0.000
	PE			-0.012	-0.736	0.462
PE	PPC	0.561	635.418***	-0.749	-25.208	0.000

The present study conducted separate serial mediation analyses on two dimensions of parental control, namely psychological control and behavioral control, to examine their effects on mobile phone addiction. Additionally, the study investigated the mediating roles of physical exercise and socially learned helplessness in the relationships between parental control dimensions and mobile phone addiction.

The SPSS PROCESS macro developed by Hayes was utilized, specifically Model 6, to test for serial mediation effects of physical exercise and socially learned helplessness in the relationships between parental control and its two dimensions (psychological control and behavioral control) on mobile phone addiction. This analysis involved 5000 bootstrap samples to calculate 95% confidence intervals (CIs) and test the indirect effects.

As shown in Table 3, most paths in the model yielded statistically significant results. Parental psychological control had a significant impact on mobile phone addiction, physical exercise, and socially learned helplessness (ps < 0.001). Higher levels of parental psychological control positively predicted mobile phone addiction and socially learned helplessness, indicating that higher levels of parental psychological control were associated with higher levels of socially learned helplessness and mobile phone addiction. Parental psychological control negatively predicted physical exercise, suggesting that higher levels of parental psychological control were associated with lower levels of physical exercise. Physical exercise had a negative impact on mobile phone addiction (p < 0.05), indicating that engaging in more physical exercise predicted lower levels of mobile phone addiction. However, physical exercise did not directly predict socially learned helplessness in the model (p > 0.05), as the path was not significant. Socially learned helplessness had a significant positive predictive effect on mobile phone addiction (p < 0.001), indicating that higher levels of socially learned helplessness were associated with higher levels of mobile phone addiction.

Table 4

Significance test of mediating effect (N = 500)

	Effect	Bootstrap SE	Bootstrap 95% CI	
			Low	High
Direct Effect: PPC→MPA	0.0299	0.0024	0.0251	0.0347
PPC→PE→MPA	0.0015	0.0007	0.0001	0.0028
PPC→SLH→MPA	0.0226	0.0034	0.0162	0.0294
PPC→PE→SLH→MPA	0.0002	0.0003	-0.0003	0.0008
Total Indirect Effect	0.0243	0.0034	0.0178	0.0312
Total Effect	0.0542	0.0006	0.0529	0.0555

As shown in Table 4, it is evident that the direct effect of parental psychological control on mobile phone addiction is 0.0299, with a confidence interval of [0.0251, 0.0347]. This confidence interval does not include zero, indicating that the direct effect of parental psychological control on mobile phone addiction is statistically significant. The indirect effect of parental psychological control on mobile phone addiction is 0.0243, with a confidence interval of [0.0178, 0.0312]. This confidence interval also does not include zero, indicating that the indirect effect of parental psychological control on mobile phone addiction is statistically significant.

Further exploration of the mediating effects reveals that the mediated effect through physical exercise is 0.0015, with a confidence interval of [0.0001, 0.0028]. Similarly, the mediated effect through socially learned helplessness is 0.0226, with a confidence interval of [0.0162, 0.0294]. However, the mediated effect through the serial mediation of physical exercise and socially learned helplessness is 0.0002, with a confidence interval of [-0.0003, 0.0008]. Since this confidence interval includes zero, it suggests that the serial mediation effect does not hold. However, both individual mediating effects are present and demonstrate parallel mediation effects.

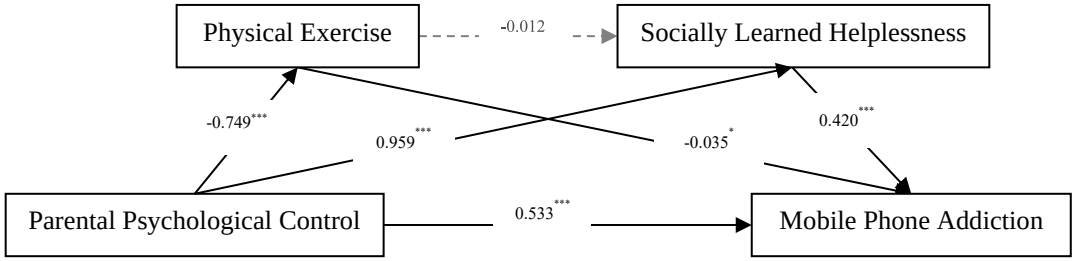

Figure 2: The Effects of Parental Psychological Control on Mobile Phone Addiction: Diagram of the Mediation of Physical Exercise and Socially learned helplessness.

Table 5

Mediating effect analysis & model fitting (N = 500)

Dependent variable	Independent variable	R^2	F	β	t	p
MPA	PBC	0.945	2815.443***	0.477	11.780	0.000
	PE			-0.049	-3.127	0.002
	SLH			0.467	11.628	0.000
SLH	PBC	0.931	3328.976***	0.931	53.273	0.000
	PE			-0.046	-2.607	0.009
PE	PBC	0.542	589.355***	-0.736	-24.277	0.000

In the second analysis, parental behavioral control was included as the independent variable in the serial mediation model (refer to Table 5). All paths in the model yielded significant results (ps < 0.01). Parental behavioral control positively predicted mobile phone addiction and socially learned helplessness (ps < 0.001), indicating that higher levels of parental behavioral control were associated with higher levels of socially learned helplessness and mobile phone addiction. Parental behavioral control negatively predicted physical exercise, suggesting that higher levels of parental behavioral control were associated with lower levels of physical exercise. Physical exercise had a negative impact on both socially learned helplessness and mobile phone addiction (ps < 0.001), indicating that engaging in more physical exercise improved the conditions of socially learned helplessness and mobile phone addiction. Socially learned helplessness also had a positive predictive effect on mobile phone addiction (p < 0.001), where higher levels of socially learned helplessness were associated with higher levels of mobile phone addiction.

Table 6

Significance test of mediating effect (N = 500)

	Effect	Bootstrap SE	Bootstrap 95% CI	
			Low	High
Direct Effect: PBC→MPA	0.0303	0.0026	0.0253	0.0354
PBC→PE→MPA	0.0023	0.0008	0.0008	0.0039
PBC→SLH→MPA	0.0276	0.0032	0.0215	0.0339
PBC→PE→SLH→MPA	0.0010	0.0004	0.0002	0.0019
Total Indirect Effect	0.0309	0.0033	0.0244	0.0373
Total Effect	0.0613	0.0008	0.0598	0.0628

As shown in Table 6, the direct effect of parental behavioral control on mobile phone addiction is 0.0303, with a confidence interval of [0.0253, 0.0354]. This confidence interval does not include zero, indicating that the direct effect of parental behavioral control on mobile phone addiction is statistically significant. The indirect effect of parental behavioral control on mobile phone addiction is 0.0309, with a confidence interval of [0.0244, 0.0373]. This confidence interval also does not include zero, indicating that the indirect effect of parental behavioral control on mobile phone addiction is statistically significant.

Further exploration of the mediating effects reveals that the mediated effect through physical exercise is 0.0023, with a confidence interval of [0.0008, 0.0039]. Similarly, the mediated effect through socially learned helplessness is 0.0276, with a confidence interval of [0.0215, 0.0339]. The mediated effect through the serial mediation of physical exercise and socially learned helplessness is 0.0010, with a confidence interval of [0.0002, 0.0019]. Since this confidence interval does not include zero, it suggests that the serial mediation effect of physical exercise and socially learned helplessness holds, indicating both mediating factors play a role in explaining the relationship between parental behavioral control and mobile phone addiction.

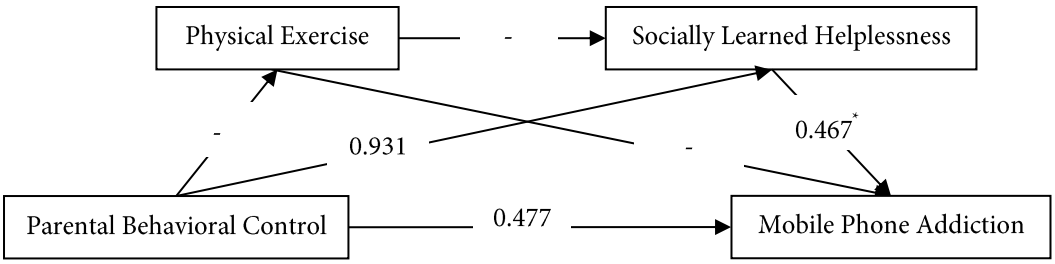

Figure 3: The Effects of Parental Behavioral Control on Mobile Phone Addiction: Diagram of the Serial Mediation of Physical Exercise and Socially learned helplessness.

Table 7

Mediating effect analysis & model fitting (N = 500)

Dependent variable	Independent variable	R^2	F	β	t	p
MPA	PC	0.951	3213.461***	0.689	14.951	0.000
	PE			-0.027	-1.801	0.073
	SLH			0.271	6.068	0.000
SLH	PC	0.951	4778.256***	0.975	64.723	0.000
	PE			-0.0001	-0.009	0.993
PE	PC	0.562	637.832***	-0.749	-25.255	0.000

Finally, the scores from the Parental Control Scale were included as the independent variable in the serial mediation model, and the results are presented in Figure 7. Similarly, parental control positively predicted mobile phone addiction and socially learned helplessness (ps < 0.001), indicating that higher levels of parental control were associated with higher levels of socially learned helplessness and mobile phone addiction. Parental control negatively predicted physical exercise, suggesting that lower levels of parental control were associated with potentially higher levels of physical exercise. However, the paths from physical exercise to socially learned helplessness and mobile phone addiction in the model were not significant (ps > 0.05). Socially learned helplessness had a positive predictive effect on mobile phone addiction (p < 0.001), where higher levels of socially learned helplessness were associated with higher levels of mobile phone addiction.

Table 8

Significance test of mediating effect (N = 500)

	Effect	Bootstrap SE	Bootstrap 95% CI	
			Low	High
Direct Effect: PC→MPA	0.0207	0.0014	0.0180	0.0234
PC→PE→MPA	0.0006	0.0003	0.0000	0.0013
PC→SLH→MPA	0.0079	0.0018	0.0045	0.0117
PC→PE→SLH→MPA	0.0000	0.0001	-0.0002	0.0002
Total Indirect Effect	0.0086	0.0019	0.0050	0.0123
Total Effect	0.0293	0.0003	0.0287	0.0299

As shown in Table 8, the direct effect of parental control on mobile phone addiction is 0.0207, with a confidence interval of [0.0180, 0.0234]. This confidence interval does not include zero, indicating that the direct effect of parental

control on mobile phone addiction is statistically significant. The indirect effect of parental control on mobile phone addiction is 0.0086, with a confidence interval of [0.0050, 0.0123]. This confidence interval also does not include zero, indicating that the indirect effect of parental control on mobile phone addiction is statistically significant.

Further exploration of the mediating effects reveals that the mediated effect through physical exercise is 0.0006, with a confidence interval of [0.0000, 0.0013]. Since this confidence interval includes zero, it suggests that the mediating effect through physical exercise does not hold. Similarly, the mediated effect through socially learned helplessness is 0.0079, with a confidence interval of [-0.0002, 0.0002]. Since this confidence interval includes zero as well, it indicates that the serial mediation effect does not hold. The specific model diagram is shown in Figure 4, indicating that only the mediation model of parental control → socially learned helplessness → mobile phone addiction holds true.

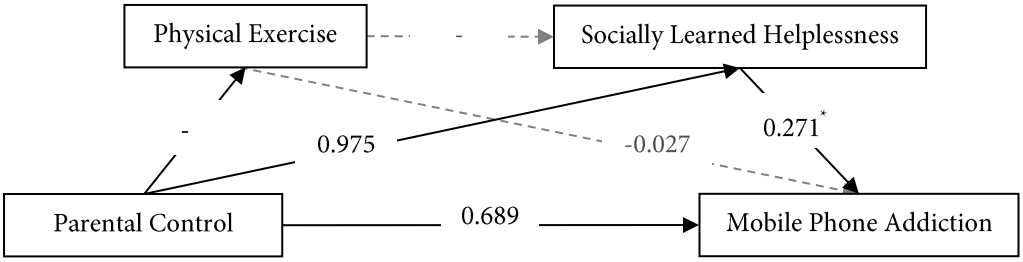

Figure 4: The Effects of Parental Control on Mobile Phone Addiction: Diagram of the Serial Mediation of Physical Exercise and Socially learned helplessness.

Discussion

Parental Control

Parental control has two main pathways through which it influences mobile phone addiction. The first is the direct pathway, where parental control directly predicts mobile phone addiction. The second is the indirect pathway, specifically through the influence of socially learned helplessness in social interactions, which in turn predicts mobile phone addiction. Socially learned helplessness acts as a mediating factor in this relationship.

Parental control can predict mobile phone addiction among college students, as previous research has shown a close association between parental control and problematic internet use (Li, Li, & Newman, 2013b). Moreover, parenting styles have a significant impact on mobile phone addiction. Studies have found that when parents show more favoritism and overprotection towards their children or exhibit high levels of refusal, interference, and coercion (Miao et al., 2018), the likelihood of adolescent mobile phone addiction increases. With the rapid development of communication technology and advancements in mobile phone technology, individuals have easy access to and extensive use of mobile phones. Mobile phones now play a crucial role in daily life, offering convenience in various aspects such as work, leisure, and communication. This accessibility creates an environment conducive to the development of mobile phone addiction. Under parental control, adolescents are often deprived of autonomy over their thoughts and emotions, leading to a lack of self-independence and a sense of security. This is often accompanied by low self-esteem (Bean & Northrup, 2009), resulting in withdrawal, loneliness, and rejection in social interactions (Hastings et al., 2010). The increased parental control brings negative emotions and stress; simultaneously, individuals find themselves in a university environment with reduced academic pressure compared to high school while being immersed in the era of mobile phones. Under these conditions, individuals are more inclined to use mobile phones as a means to release stress and seek entertainment.

The second indirect pathway involves socially learned helplessness in social interactions mediating the relationship between parental control and mobile phone addiction. The higher the level of parental control, the more severe the individual's socially learned helplessness in social interactions, which in turn increases mobile phone addiction. Due to parental control, individuals lack social exposure, and their interest and motivation in engaging in social activities are diminished. As a result, individuals seek alternative ways to satisfy their social needs and self-identity. The use of mobile phones helps individuals alleviate internal stress and becomes an effective means to address socially learned helplessness in social interactions under parental control. It provides more reasons for mobile phone usage, leading individuals to believe that extended and increased mobile phone usage is necessary for self-protection and improvement of their inner emotional state. These two pathways highlight the role of parental control in individual development. However, contrary to the hypothesis, physical exercise does not mediate these

effects. Additionally, the hypothesized mediated effect of physical exercise on socially learned helplessness in social interactions is not supported. Parental control can be divided into psychological control and behavioral control, each with distinct meanings and consequences. The following sections will discuss the effects of parental psychological control, behavioral control, as well as the mediating roles of physical exercise and socially learned helplessness.

Parental Psychological Control

Parental psychological control has three pathways that influence mobile phone dependence. The first pathway is the direct impact of psychological control on mobile phone dependence, while the second and third pathways involve parental psychological control as a mediator in the relationship between physical exercise and socially learned helplessness in social interactions, leading to mobile phone dependence. These indirect pathways contribute to the influence of parental psychological control.

Directly predicting mobile phone addiction, parental psychological control aligns with previous research findings. Studies by Fang et al. (2012) and Lai et al. (2014) have both found that parental psychological control positively predicts adolescent internet addiction, with Lai et al. (2014) also suggesting that emotional regulation acts as a mediator between the two factors. Furthermore, Li et al. (2013a) discovered that psychological control leads to maladaptive cognition in adolescents, consequently resulting in addictive behaviors.

Physical exercise serves as a mediator between parental psychological control and mobile phone addiction. Eccles (1983) propose that parents' expectations and beliefs regarding their children's values can influence their behavior and activity choices. Specifically, parents' perceptions of how likely their children are to succeed in sports and the importance they place on sports participation can influence children's motivation for physical exercise (Dempsey, Kimiecik, & Horn, 1993). For instance, dimensions such as the perceived cost of failure and perceived difficulty of work represent parents' value beliefs about their children's engagement in sports. When parents believe that there are negative consequences associated with failure or overestimate the difficulty of activities, it undermines adolescents' autonomous motivation for physical exercise and discourages them from engaging in moderate to high-intensity physical activities. This can be observed when parents express concerns about their children's performance or difficulties in sports, which result in negative beliefs towards their participation or even prohibiting them from being involved in physical activities. Consequently, this could decrease adolescents' autonomous motivation for physical exercise and ultimately reduce opportunities for engaging in such activities. Physical exercise has been found to reduce stress responses, regulate emotions, and enhance psychological well-being (Sun, Dai, & Wang, 2006). When individuals are unable to address and alleviate their psychological pressure and emotional issues through physical exercise, they may become reliant on mobile phones. Parental psychological control diminishes individuals' enthusiasm and motivation for physical exercise, consequently increasing their dependence on mobile phones.

Socially learned helplessness serves as an intermediary between parental psychological control and mobile phone addiction. Self-determination theory (Deci, 1975; Deci & Ryan, 1985) posits that human behavior can be categorized into self-determined behavior and non-self-determined behavior. Parental psychological control can lead to unmet autonomous needs in individuals, which in turn results in lower internal motivation and hampers cognitive and emotional development. Simultaneously, parental psychological control can create interpersonal barriers for adolescents, preventing the satisfaction of two other basic needs: relatedness needs and competence needs (Soenens & Vansteenkiste, 2010). This situation drives adolescents to seek psychological needs online (Suler, 1999). According to the compensatory model of psychological needs (Wan et al., 2010), the psychological needs met through mobile phone use commonly include autonomous needs, escape from reality, relaxation/entertainment, social interaction, and achievement needs. With the prevalence of mobile phones and advancements in their functionalities nowadays, it has become a daily habit for many adolescents to engage in online social interactions and gaming (Kwon et al., 2013). For middle school students who experience parental psychological control, immersing themselves in mobile phone use may provide temporary escape from their parents' control. Through online interactions with others or by finding relaxation through gaming activities, they can experience a sense of autonomy and influence. Parental psychological control affects internal motivationand contributes to the development or intensification of socially learned helplessness in individuals, consequently increasing their reliance on mobile phones.

Contrary to the hypothesis, physical exercise and socially learned helplessness do not participate as mediators in the relationship between parental psychological control and mobile phone addiction. This may be because physical exercise is not an effective method for alleviating socially

learned helplessness. Physical exercise does not necessarily change individuals' cognitive perceptions and outcomes in social interactions. Therefore, as shown in the Figure 4, physical exercise and socially learned helplessness do not constitute a chain-mediated effect of parental psychological control on mobile phone addiction.

Parental Behavioral Control

Parental behavioral control exerts its influence on mobile phone addiction through three pathways. The first pathway involves direct effects, while the second and third pathways involve parental behavioral control mediating the impact on mobile phone addiction through physical exercise involvement and socially learned helplessness, respectively. Parental behavioral control has a direct predictive effect on mobile phone addiction. Contrary to previous research findings that identified parental behavioral control as a positive predictor of externalizing problems (Barber et al., 1994), this study reveals that parental control increases the level of mobile phone addiction. The participants in this study were college students, whereas previous studies focused on adolescents or children in middle and high school. Parental control, as a core dimension of parenting style, influences various aspects of individual development throughout their growth process, extending beyond childhood (Soenens et al., 2008). In addition to age differences, college students face variations in academic pressures and living environments compared to middle and high school students. With reduced academic pressures in college, students may seek relaxation and indulge in mobile phone usage as they lack motivation without stress and goals. Furthermore, the college environment, which often includes collective dormitories providing independent personal space and time, creates favorable conditions for the development of mobile phone addiction.

Physical exercise serves as a mediator between parental behavioral control and mobile phone addiction. According to Gattshall et al.'s (2008) concept of "home environments for physical activity," family physical activity environments refer to the interactive forms of engagement between parents and children in physical activities, as well as parents' regulations or restrictions on their children's physical activities. Controlling behaviors include restrictions on play (such as rules requiring children to be quiet at home or keeping their clothes clean while playing outside), limitations or monitoring of screen time (regulating or supervising children's television, phone, or computer usage time), and using screen time as a means to reward or control child behavior. In China, families often prioritize academic and cultural achievements while undervaluing the role of physical exercise in individual psychological well-being and stress relief. Behavioral control may also lead individuals to sacrifice opportunities for enjoyment and engagement in physical activities to ensure and improve their academic performance, thereby substituting mobile phones as a means to cope with stress. Parental behavioral control reduces the frequency and opportunities for physical exercise, prompting individuals to turn to mobile phones for pleasure and increasing their dependency.

Socially learned helplessness acts as an intermediary between parental behavioral control and mobile phone addiction. Behavioral control encompasses supervision of individuals' social interactions and methods, which, under the pressure of monitoring and control, may restrict individuals' access to sufficient social interaction opportunities. In this restricted condition for social interaction behavior, individuals may lack a sense of autonomy in their social interactions and feel powerless to change or escape these restrictions. Long-term behavioral control not only decreases individuals' willingness and motivation for proactive social interaction but also hinders their ability to establish healthy and normal social relationships. The unmet need for social interaction and recognition, coupled with strict rule-based supervision, drives individuals to seek self-existence and a sense of value through mobile phones and online platforms. Parental behavioral control contributes to the formation of socially learned helplessness in individuals, thus increasing their reliance on mobile phones.

Physical exercise and socially learned helplessness play a serial mediating role in the relationship between parental behavioral control and mobile phone addiction. Parental behavioral control, characterized by supervision, restrictions, and rule enforcement, can be seen as limiting an individual's control over engaging in physical exercise. Individuals can only participate in physical exercise under the established rules and conditions. The increase in parental behavioral control not only diminishes individuals' sense of control over physical exercise but also lowers their self-efficacy due to excessively strict rules. By reducing individuals' sense of control over physical exercise and self-efficacy, parental behavioral control also undermines their sense of mastery and self-efficacy in social interactions, leading to increased levels of socially learned helplessness. Consequently, individuals become more dependent on mobile phones as a means to compensate for these deficiencies.

Regarding Physical Exercise

Engaging in physical exercise is beneficial for the release of endorphins, which can reduce the severity of depression, anxiety, confusion, and other negative emotions (Liu, Tong,

& Yan, 2009). Many individuals who regularly exercise are able to maintain a positive mental state and a sense of confidence in life, which is associated with the effects of endorphins. This effect can also impact one's personality, enhancing their resilience against mental stress and harmful stimuli from various sources.

Furthermore, exercise allows practitioners to divert their attention from troubling matters, forget about disappointment and repression, and fully enjoy the joy brought by physical activity. It promotes inner peace and relieves mental stress, enabling individuals to have greater vitality and an optimal mindset. Studies by Berger and McInman (1993), Yu (1997), Zhao (2007), and others have shown that regular participation in sports activities is conducive to improving interpersonal relationships. Individuals who frequently engage in physical exercise possess better physical fitness levels and psychological well-being. Physical exercise also increases their self-efficacy, allowing them to participate in sports activities with more confidence. As their sports skills improve, they receive recognition, encouragement, and trust from their peers and teammates. This recognition enables individuals participating in physical exercise to establish a sense of self-worth. Additionally, many sports activities involve both competition and cooperation processes, providing a favorable setting and avenue for social interactions with others. Learning to cooperate with others and maintaining a competitive mindset through sports activities effectively enhances individuals' social skills.

Guiding and encouraging adolescents during their adolescence to embrace a favorite physical exercise can help them build a foundation for physical health through sports while also providing psychological relief from stress and emotional release at a psychological level. Physical activities not only satisfy the need for recognition through the social cooperative attributes inherent in sports but also support the establishment of social friendships through shared interests in sports.

Currently, many families and schools in China overly prioritize academic performance and intellectual knowledge, neglecting the importance of physical exercise. Parents and schools, as important role models for adolescents in their rapid developmental stage, need to provide correct guidance for adolescents to develop a sense of value and appreciation for exercise. Schools should collaborate with parents to help adolescents understand that the benefits of physical exercise are not immediately felt. Without a healthy foundation built through exercise, when faced with unhealthy psychological and physiological states, engaging in physical exercise will not yield sufficient results. In the long run, the assistance provided by physical exercise is not only in establishing a foundation for physical and mental health but also in creating a stable internal psychological environment concerning attributions, self-efficacy, and resistance against negative emotions. It also helps alleviate the negative influences brought about by excessive parental control and reduces undesirable habits such as dependence on mobile phones.

Conclusion

There is a significant correlation between parental control, physical exercise, socially learned helplessness, and mobile phone addiction. Parental control and its dimensions had direct predictive effects on mobile phone addiction. Physical exercise and socially learned helplessness acted as parallel mediators between parental psychological control and mobile phone addiction, while they acted as serial mediators between parental behavioral control and mobile phone addiction. There was no significant mediation effect of physical exercise on the relationship between overall parental control and mobile phone addiction; however, parental control had a significant predictive effect on physical exercise. Socially learned helplessness mediated the effect of overall parental control on mobile phone addiction.

Suggestions

This study had a moderate sample size, so generalizability of the findings may need further investigation. The research design was cross-sectional rather than longitudinal, and the methodology was relatively limited, making it challenging to establish causal relationships.

Prospect

Future research could expand the sample size and combine experimental methods to conduct phased investigations on physical exercise, exploring its role in the relationship between parental control, socially learned helplessness, and mobile phone addiction through longitudinal studies. This would provide a theoretical basis and guidance for family and school education activities for adolescents.

References

Barber, B. K., Olsen, J. E., & Shagle, S. C. (1994). Associations between Parental Psychological and Behavioral Control and Youth Internalized and Externalized Behaviors. *Child Development, 65*(4), 1120-1136. https://doi.org/10.1111/j.1467-8624.1994.tb00807.x

Bean, R. A., & Northrup, J. C. (2009). Parental Psychological Control, Psychological Autonomy, and Acceptance as Predictors of Self-Esteem in Latino Adolescents. *Journal of Family Issues, 30*(11), 1486-1504. https://doi.org/10.1177/0192513x09339149

Berger, B. G., & McInman, A. (1993). Exercise and the Quality of Life. In R. N. Singer, M. Murphy, & L. K. Tennant (Eds.), *Handbook of Research on Sport Psychology* (pp. 729-760). New York: Macmillan.

Deci, E. L. (1975). The Intrinsic Motivation of Behavior. In E. L. Deci (Ed.), *Intrinsic Motivation* (pp. 93-125). Springer US. https://doi.org/10.1007/978-1-4613-4446-9_4

Deci, E. L., & Ryan, R. M. (1985). Conceptualizations of Intrinsic Motivation and Self-Determination. In E. L. Deci & R. M. Ryan (Eds.), *Intrinsic Motivation and Self-Determination in Human Behavior* (pp. 11-40). Springer US. https://doi.org/10.1007/978-1-4899-2271-7_2

Dempsey, J. M., Kimiecik, J. C., & Horn, T. S. (1993). Parental Influence on Children's Moderate to Vigorous Physical Activity Participation: An Expectancy-Value Approach. *Pediatric Exercise Science, 5*(2), 151-167. https://doi.org/10.1123/pes.5.2.151

Ding, X., Zu, J., & Zhang, X. (2018). Intervention Effect of Inhibitory Control Training on Mobile Phone-Dependent College Students. *Studies of Psychology and Behavior, 16*(3), 342-348. https://doi.org/10.3969/j.issn.1672-0628.2018.03.009

Eccles, J. S. (1983). Expectancies, Values, and Academic Behaviors. In *Achievement and Achievement Motives* (pp. 75-146). Freeman.

Elhai, J. D., Levine, J. C., Dvorak, R. D., & Hall, B. J. (2016). Fear of missing out, need for touch, anxiety and depression are related to problematic smartphone use. *Computers in Human Behavior, 63*, 509-516. https://doi.org/10.1016/j.chb.2016.05.079

Fang, C., Fang, X., & Shen, Z. (2012). Psychological Control, the Relationship Between Behavioral Control and Adolescent Internet Addiction. *China Special Education,* (12), 70-74. https://doi.org/10.3969/j.issn.1007-3728.2012.12.013

Gattshall, M. L., Shoup, J. A., Marshall, J. A., Crane, L. A., & Estabrooks, P. A. (2008). Validation of a Survey Instrument to Assess Home Environments for Physical Activity and Healthy Eating in Overweight Children. *International Journal of Behavioral Nutrition and Physical Activity, 5*(1), 3. https://doi.org/10.1186/1479-5868-5-3

Goetz, T. E., & Dweck, C. S. (1980). Learned Helplessness in Social Situations. *Journal of Personality and Social Psychology, 39*(2), 246-255. https://doi.org/10.1037/0022-3514.39.2.246

Hastings, P. D., Nuselovici, J. N., Rubin, K. H., & Cheah, C. S. L. (2010). Shyness, Parenting, and Parent-Child Relationships. In K. H. Rubin & R. J. Coplan (Eds.), *The Development of Shyness and Social Withdrawal* (pp. 107-130). The Guilford Press.

He, Y., & Ji, L. (2003). Effects of Duration of Physical Exercise on Depression Level and Physical Self-esteem Level in College Students and Validation of Mediation Models. *Sports and Science, 24*(4), 58-60. https://doi.org/10.3969/j.issn.1004-4590.2003.04.017

Hokoda, A., & Fincham, F. D. (1995). Origins of Children's Helpless and Mastery Achievement Patterns in the Family. *Journal of Educational Psychology, 87*(3), 375-385. https://doi.org/10.1037/0022-0663.87.3.375

Huang, H., Niu, L., Zhou, C., & Wu, H. (2014). Reliability and Validity Test of Mobile Phone Dependence Index Chinese Version in College Students. *Chinese Journal of Clinical Psychology, 22*(5), 835-838. https://doi.org/10.16128/j.cnki.1005-3611.2014.05.062

Kwon, M., Lee, J.-Y., Won, W.-Y., Park, J.-W., Min, J.-A., Hahn, C., et al. (2013). Development and Validation of a Smartphone Addiction Scale (SAS). *PloS One, 8*(2), e56936. https://doi.org/10.1371/journal.pone.0056936

Lai, X., Zhang, W., Bao, Z., Wang, Y., & Xiong, Q. (2014). The Relationship Between Parental Psychological Control and Adolescent Depression: A Moderated Mediating Model. *Psychological Development and Education, 30*(3), 293-302. https://doi.org/10.16187/j.cnki.issn1001-4918.2014.03.008

Landers, D. M., & Arent, S. M. (2007). Physical Activity and Mental Health. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of Sport Psychology* (pp. 467-491). John Wiley & Sons. https://doi.org/10.1002/9781118270011.ch21

Landers, D. M., & Petruzzello, S. J. (1994). Physical Activity, Fitness, and Anxiety. In C. Bouchard, R. J. Shephard, & T. Stephens (Eds.), *Physical Activity, Fitness, and Health: International Proceedings and Consensus Statement* (pp. 868-882). Human Kinetics Publishers Inc.

Li, D., Zhang, W., Wang, Y., & Li, D. (2013a). Maternal Psychological Control and Adolescent Problematic Network Use: The Mediating Role of Non-Adaptive Cognition. *Psychological Science, 36*(2), 411-416. https://doi.org/10.16719/j.cnki.1671-6981.2013.02.005

Li, J., Wang, H., Chen, D., Yu, S., Ding, P., Mai, H., et al. (2023). The positive significance of government-organized nationwide sports events in the post-epidemic era: The impact on citizens' psychological well-being, mindfulness level, and social avoidance distress. *Revista de Psicología del Deporte (Journal of Sport Psychology), 32*(2), 134-146. https://rpd-online.com/index.php/rpd/article/view/1307

Li, X., Li, D., & Newman, J. (2013b). Parental Behavioral and Psychological Control and Problematic Internet Use Among Chinese Adolescents: The Mediating Role of Self-Control. *Cyberpsychology, Behavior, and Social Networking, 16*(6), 442-447. https://doi.org/10.1089/cyber.2012.0293

Liang, D. Q. (1994). Stress Level of College Students and Its Relationship with Physical Exercise. *Chinese Journal of Mental Health, 8*(2), 5-6. https://qikan.cqvip.com/Qikan/Article/Detail?id=1570602

Liu, C., & Mu, F. (2003). The Relationship Between Stress Level and Physical Exercise Among College Students in Xi'an. *Journal of Xi'an Institute of Physical Education,* (5), 7-9. https://doi.org/10.3969/j.issn.1001-747X.2003.05.003

Liu, H., Tong, Z., & Yan, J. (2009). Research on the Effects of Exercise on Interpersonal Relationships, Self-Efficacy and Mental Health of Female College Students. *Journal of Nanjing Institute of Physical Education: Social Science Edition, 23*(4), 126-128. https://doi.org/10.3969/j.issn.1008-1909.2009.04.030

Ma, S., Wang, B., & Sui, G. (2005). Intervention Effect of Physical Exercise on Psychological Stress in College Students. *China Health Education, 21*(3), 189-191. https://doi.org/10.3969/j.issn.1002-9982.2005.03.008

Marsh, H. W. (1984). Students' Evaluations of University Teaching: Dimensionality, Reliability, Validity, Potential Biases, and Utility. *Journal of Educational Psychology, 76*(5), 707-754. https://doi.org/10.1037/0022-0663.76.5.707

McAuley, E., Bane, S. M., & Mihalko, S. L. (1995). Exercise in Middle-Aged Adults: Self-Efficacy and Self-Presentational Outcomes. *Preventive Medicine, 24*(4), 319-328. https://doi.org/10.1006/pmed.1995.1053

McAuley, E., Blissmer, B., Katula, J., & Duncan, T. E. (2000). Exercise environment, self-efficacy, and affective responses to acute exercise in older adults. *Psychology & Health, 15*(3), 341-355. https://doi.org/10.1080/08870440008401997

Miao, M., Yang, Y., Hu, X., & Chen, Y. (2018). Research on the Impact of Cell Phone Dependence. *Chinese School Doctor, 32*(2), 81-84. https://www.zgxyzz.org.cn/CN/abstract/abstract18287.shtml

Seligman, M. E., & Maier, S. F. (1967). Failure to Escape Traumatic Shock. *Journal of Experimental Psychology, 74*(1), 1-9. https://doi.org/10.1037/h0024514

Soenens, B., & Vansteenkiste, M. (2010). A theoretical upgrade of the concept of parental psychological control: Proposing new insights on the basis of self-determination theory. *Developmental Review, 30*(1), 74-99. https://doi.org/10.1016/j.dr.2009.11.001

Soenens, B., Vansteenkiste, M., Vandereycken, W., Luyten, P., Sierens, E., & Goossens, L. (2008). Perceived Parental Psychological Control and Eating-Disordered Symptoms: Maladaptive Perfectionism as a Possible Intervening Variable. *The Journal of Nervous and Mental Disease, 196*(2), 144-152. https://doi.org/10.1097/NMD.0b013e318162aabf

Suler, J. R. (1999). To Get What You Need: Healthy and Pathological Internet Use. *CyberPsychology & Behavior, 2*(5), 385-393. https://doi.org/10.1089/cpb.1999.2.385

Sun, B., Dai, J., & Wang, Z. (2006). Introduction to College Students' Mental Health, Lifestyle, Physical Activity and Physical Fitness. *Journal of Nanjing Institute of Physical Education (Social Science), 20*(2), 1-3. https://doi.org/10.3969/j.issn.1008-1909.2006.02.001

Taylor, A. H. (2000). Physical Activity, Stress and Anxiety: A Review. In S. J. H. Biddle, K. Fox, & S. Boutcher (Eds.), *Physical Activity, and Psychological Well-Being* (pp. 10-45). Routledge.

Thomée, S. (2018). Mobile Phone Use and Mental Health. A Review of the Research That Takes a Psychological Perspective on Exposure. *International Journal of Environmental Research and Public Health, 15*(12), 2692. https://doi.org/10.3390/ijerph15122692

Valås, H. (2001). Learned Helplessness and Psychological Adjustment: Effects of age, gender and academic achievement. *Scandinavian Journal of Educational Research, 45*(1), 71-90. https://doi.org/10.1080/00313830020042689

Wan, J., Zhang, J., Liu, Q., Deng, L., & Fang, X. (2010). Preparation of Questionnaire for College Students' Psychological Needs Network Satisfaction. *Studies of Psychology and Behavior, 8*(2), 118-125. https://psybeh.tjnu.edu.cn/CN/Y2010/V8/I2/118

Wang, Q., Pomerantz, E. M., & Chen, H. (2007). The Role of Parents' Control in Early Adolescents' Psychological Functioning: A Longitudinal Investigation in the United States and China. *Child Development, 78*(5), 1592-1610. https://doi.org/10.1111/j.1467-8624.2007.01085.x

Wu, X. Y., Zeng, H., & Ma, S. H. (2009). Development of Learned Helplessness Scale and Its Relationship With Personality. *Journal of Sun Yat-sen University (Medical Sciences), 30*(3), 357-360. https://doi.org/10.3321/j.issn:1672-3554.2009.03.026

Xiong, J., Zhou, Z. K., Chen, W., You, Z. Q., & Zhai, Z. Y. (2012). Development of the Mobile Phone Addiction Tendency Scale for College Students. *Chinese Mental Health Journal, 26*(3), 222-225. https://doi.org/10.3969/j.issn.1000-6729.2012.03.013

Xu, B., Ji, L., Hu, Z., Ye, B., & Chen, F. (2002). A Study of Physical Exercise Alleviating Depression and Anxiety in Graduate Students. *Journal of Guangzhou Institute of Physical Education, 22*(3), 42-43. https://doi.org/10.13830/j.cnki.cn44-1129/g8.2002.03.014

Yu, J. (1997). Physical Activity and Mental Health. *Fujian Sports Science and Technology,* (2), 52-54.

Yue, X., Yang, G., Wang, A., Xin, Z., & Ge, M. (2010). A Comparative Study of General Self-efficacy Among College Students with Different Extracurricular Physical Exercise Behaviors. *Zhejiang Sports Science,* (1), 92-94. https://doi.org/10.3969/j.issn.1004-3624.2010.01.029

Zhao, G. (2007). An Experimental Study on the Promotion of Physical Activity on the Mental Health Level of College Students. *Journal of Nanjing University of Physical Education: Social Science Edition, 21*(3), 114-116. https://doi.org/10.3969/j.issn.1008-1909.2007.03.030

Zhao, M. (2022). *The Effect of Mobile Phone Dependence on Exercise Engagement and Exercise Behavior of College Students* [Master's Thesis, Liaoning Normal University, Dalian].