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ORIGINAL RESEARCH

Mobile Phone Addiction and Psychological Capital Mediates the Relationship Between Life Satisfaction and Learning Burnout in Chinese Medical Postgraduate Students: A Structural Equation Model Analysis

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Purpose: To analyze the relationship between life satisfaction and learning burnout, and explore the mediating effect of mobile phone addiction and psychological capital, and to provide a theoretical basis for the study of measures for medical postgraduate students to maintain a positive psychological state and keep interest and enthusiasm in academic life.

Methods: Convenience cluster sampling was used to recruit 628 medical postgraduate students in Chongqing, China. The Learning Burnout Questionnaire (LBQ), life satisfaction self-rated item, Mobile Phone Addiction Tendency Scale (MPATS), and the Psychological Capital Questionnaire (PCQ) were used to examine participants. Hierarchical regression was used to analyze the effect of life satisfaction, mobile phone addiction, and psychological capital on learning burnout. A structural equation model (SEM) with maximum likelihood was used to evaluate the mediating effect of mobile phone addiction and psychological capital on the relationship between life satisfaction and learning burnout. The bootstrap method was used to confirm the significance of the mediating effect.

Results: The average learning burnout score was (55.81±10.55). Results of hierarchical regression revealed that life satisfaction and psychological capital had a significant negative predictive effect on learning burnout, and mobile phone addiction had a positive predictive effect on learning burnout ($p<0.05$). The SEM revealed that the total and direct effects of life satisfaction on learning burnout were significant, and the mediating effects of mobile phone addiction and psychological capital between life satisfaction and learning burnout were significant ($p<0.05$).

Conclusion: Life satisfaction is a direct predictor of learning burnout among Chinese medical postgraduate students, and this relationship is mediated by mobile phone addiction and psychological capital.

Keywords: learning burnout, life satisfaction, mobile phone addiction, psychological capital, medical postgraduate students

Introduction

Learning Burnout

Medical postgraduate students serve as the preparatory talents of the future health care industry, acting as the main force to maintain and promote public health. Medical postgraduate students not only required to acquire expertise in their respective fields, but also encounter a range of distinctive pressures, such as scientific research, clinical practice, employment, doctor-patient conflict, etc.[1,2] Therefore, the problem of learning burnout is more serious, so we choose medical postgraduate students as the research object. Learning burnout, also known as student burnout or academic burnout, refers to a psychological state in which learners experience weariness when they lack interest or motivation for

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their studies but are compelled to engage in academic activities. This condition leads to a sense of exhaustion, both mentally and physically, causing a negative attitude towards academic tasks. This state is commonly identified as "learning burnout".[3] Learning burnout includes three dimensions of emotional exhaustion, depersonalization, and low achievement.[4]

A meta-analysis has reported that about 50–60% of medical students have experienced learning burnout.[5] Learning burnout is also a highly prevalent behavioral problem among medical students in China, with a prevalence rate of about 40%.[6] In the United States, 56% of medical students reported experiencing burnout during medical school.[7] Learning burnout not only results in a decline in academic performance but also leads to adverse negative consequences such as depression and suicide.[7,8] A meta-analysis reported that the global prevalence of depression among medical students was 27.2%, more than three times that of students of the same age.[9] At the same time, learning burnout during the student period will develop with the progression of medical curriculum, potentially evolving into job burnout in future work settings, which will have a negative impact on the future career development.[1,10] Studies have shown that the overall prevalence of job burnout among students preparing to enter residency is close to 50%.[11] And job burnout of physicians is a serious public health crisis.[12]

Researches have shown that there are multiple influencing factors on learning burnout, such as demographic factors (age, gender, grade level, etc), extrinsic factors (cell phone use, learning environment and atmosphere, etc), and intrinsic factors (life satisfaction, psychological capital, social support, etc).[13–15] This study focused on the factors of life satisfaction, mobile phone addiction, and psychological capital of medical postgraduate students. This study aimed to provide a theoretical basis for the study of measures for medical postgraduate students to maintain a positive psychological state and keep interest and enthusiasm in academic life.

Life Satisfaction and Learning Burnout

Life satisfaction refers to an individual's comprehensive assessment of their quality of life and psychological well-being. It is the discrepancy between what one possesses and what one desires, serving as a crucial psychological factor influencing an individual's perception and management of stressful situations.[16–18] Life satisfaction is often used to define quality of life and well-being.[19] Life satisfaction, recognized as a significant factor influencing the physical and mental health of college students, has garnered considerable attention from scholars worldwide.[19,20] Low well-being and high burnout level are closely related, people with high life satisfaction are more positive and hopeful towards learning and life under the comprehensive effect of adaptability, optimism and self-efficacy, and are less prone to burnout.[21] A study involving 1271 medical students in China revealed a negative correlation between their life satisfaction and learning burnout.[13] A survey of 259 doctoral students at a medical school in China also found this relationship between life satisfaction and burnout.[22] The same conclusion was reached in the study of medical students majoring in pharmacy.[23] Similar conclusions were reached among students of other majors, with a cross-sectional study of 1917 college students finding that life satisfaction significantly and negatively predicted learning burnout,[24] and that life satisfaction also acted as a mediating variable between social support and burnout.[25] This relationship between life satisfaction and burnout has also been confirmed by studies in the field of burnout research among health care workers. It was found that life satisfaction of health care workers was negatively related to job burnout.[26,27] Satisfaction with children, family, and connections with others was found to be instrumental in reducing burnout among both male and female physiotherapist.[28] These studies collectively indicate an association between life satisfaction and burnout.

Given the increased stress in the lives of medical postgraduate students, which frequently results in negative emotions, it can subsequently impact their enthusiasm and interest in learning. Therefore, we hypothesize that among medical postgraduate students, there is a negative correlation between life satisfaction and learning burnout (Hypothesis 1).

Life Satisfaction, Mobile Phone Addiction and Learning Burnout

With the rapid development of the Internet, smartphones have become indispensable tools for communication in people's daily lives, especially for the younger generation. Smartphones are extensively used in social, entertainment, and learning activities, intricately woven into the fabric of people's lives. However, smartphones can be considered a "double-edged

sword", as excessive use may lead to a series of issues, such as mobile phone addiction. Mobile phone addiction, also known as problematic smartphone use or mobile phone dependence, is a non-substance addictive behavior.[29] Prolonged over-reliance on cell phones may lead to a loss of behavioral control, which can seriously affect physical and mental health and social functions.[30] This may trigger a range of adverse health problems such as reduced physical activity, decreased self-control, insomnia, anxiety and depression.[31–34]

College students who are immature and lack self-control are more susceptible to mobile phone addiction.[35] Additionally, medical postgraduate students, discontented with their lives due to the busyness of their daily routines and the pressures arising from doctor-patient conflicts and scientific research, may excessively turn to the Internet for support and solace, attempting to escape from reality. This coping mechanism may lead to the development of mobile phone addiction.[36] Currently, there are in-depth researches exploring the relationship between life satisfaction and smartphone usage. A survey conducted among undergraduate students in China revealed a significant correlation between longer smartphone use and lower life satisfaction.[37] Other studies also indicate that the duration of smartphone usage has an impact on life satisfaction.[38] Additionally, researches suggest a significant association between happiness, as a component of life satisfaction, and smartphone addiction.[39,40]

Mobile phone addiction can lead to decreased attention and interest in learning, resulting in learning burnout. A survey of Chinese medical undergraduate students and medical postgraduate students found that mobile phone addiction positively predicted learning burnout in both undergraduate and postgraduate students.[41] Meanwhile, a study of Chinese medical students found that mobile phone addiction could be used as a mediating variable to predict learning burnout.[42]

Based on the above researches, we propose a hypothesis: mobile phone addiction can serve as a mediating variable in the relationship between life satisfaction and learning burnout (Hypothesis 2).

Life Satisfaction, Psychological Capital and Learning Burnout

Psychological capital represents the development of individuals' positive psychology, leading to positive organizational behaviors and showcasing enhanced performance.[43] Psychological capital is associated with personal achievement and well-being and can be utilized like a social resource. Psychological capital consists of four psychological resource capacities: self-efficacy, hope, optimism, and resilience, which can all be validly measured.[44] Self-efficacy refers to an individual's confidence and belief in their ability to accomplish specific tasks. Hope refers to the positive state in which individuals strive to achieve established goals. Optimism is a positive mindset or attitude characterized by a hopeful and positive outlook on things, events, or the future. Resilience refers to an individual's capacity to adapt, recover, and grow when facing adversity, pressure, difficulties, or setbacks.[44–46]

In a study conducted among Chinese medical students, it was found that psychological resilience was positively correlated with life satisfaction.[47,48] A similar trend was observed among students in other majors in Chinese universities, indicating a positive relationship between life satisfaction and psychological capital among college students.[49,50] Similar conclusions were drawn from a survey of high school students.[51] Studies conducted in other countries targeting students also discovered this correlation.[52] This association has been validated among different professional groups such as healthcare professionals, disabled athletes, and refugees.[27,53,54] Psychological capital also acted as a mediating variable in the relationship between life satisfaction with other variables. Specifically, among Chinese medical students psychological capital not only mediated the relationship between life satisfaction and depression and anxiety,[55] but also fully mediated the relationship between courage and life satisfaction.[56]

Many studies have provided clues to the relationship between psychological capital and learning burnout. A study on Chinese clinical undergraduate students revealed that psychological capital was a predictive factor for learning burnout, and it partially mediated the relationship between professional commitment and learning burnout.[57] A study conducted among undergraduate and graduate students in China found a significant negative correlation between psychological capital and learning burnout, psychological capital was identified as a crucial predictive factor for learning burnout, and mobile phone addiction mediated this relationship.[41] Additionally, among medical students, a high level of psychological capital can strengthen the relationship between self-esteem and learning burnout.[58] Similar conclusions have been drawn

in researches on job burnout among other occupational groups. Among nurses, teachers, athletes, and company employees, psychological capital had a significant effect on job burnout.[59–63]

Based on the above researches, we hypothesized that the effect of life satisfaction on learning burnout can be mediated by psychological capital (Hypothesis 3).

While previous studies have provided clues about the effect of life satisfaction on learning burnout, there is an additional question that deserves to be explored, namely whether this relationship is mediated by mobile phone addiction or psychological capital. The aim of this study is to address the limitations of existing research and hypothesize that the direct and indirect effects of life satisfaction on learning burnout in medical postgraduate students are realized through two mediating variables, namely, mobile phone addiction and psychological capital. We employed structural equation modeling (SEM) to empirically test the proposed theoretical mediation model, as illustrated in Figure 1. This offers a broader, more diverse, and useful perspective for improving the learning burnout of medical postgraduate students.

Methods

Participants and Sampling

We conducted an online survey and cross-sectional study among postgraduate students at a medical university in Chongqing, China. Convenience cluster sampling was employed. We collected questionnaires through public lectures and during recess in some classes and data were collected through a online questionnaire link. Participants' specialties included clinical medicine, public health, and other medical specialties. Participants were required to meet the following criteria: (1) proficiency in reading Chinese; (2) enrollment as postgraduate students.

Measures

Life Satisfaction

Life satisfaction was assessed through a single item. Participants were asked to indicate their degree of life satisfaction by using a tenth-point scale from 1 = very dissatisfied to 5 = very satisfied.

Mobile Phone Addiction Tendency Scale (MPATS)

The questionnaire, designed by Chinese scholars including Xiong Jie, was employed to assess the inclination towards mobile phone addiction among Chinese university students. It comprises a total of 16 items categorized into four dimensions: withdrawal symptoms (6 items), salience behavior (4 items), social comfort (3 items), and mood alteration (3 items). The scoring system ranges from 1 (strongly disagree) to 5 (strongly agree) on a five-point scale, with higher total scores indicating a higher level of mobile phone addiction. The Cronbach's α coefficient for this scale was 0.943.[64]

Psychological Capital Questionnaire (PCQ)

The 6-point Psychological Capital Questionnaire (PCQ), developed by Luthans Fred et al[44] was utilized in this study. It was later translated into Chinese by scholars including Wen Lei to accommodate Chinese participants.[65] The questionnaire consists of 24 items distributed across four dimensions: self-efficacy (6 items), hope (6 items), resilience (6 items), and optimism (6 items). The scale employs a 6-point Likert rating from 1 (strongly disagree) to 6 (strongly agree), with total scores ranging from 24 to 144,

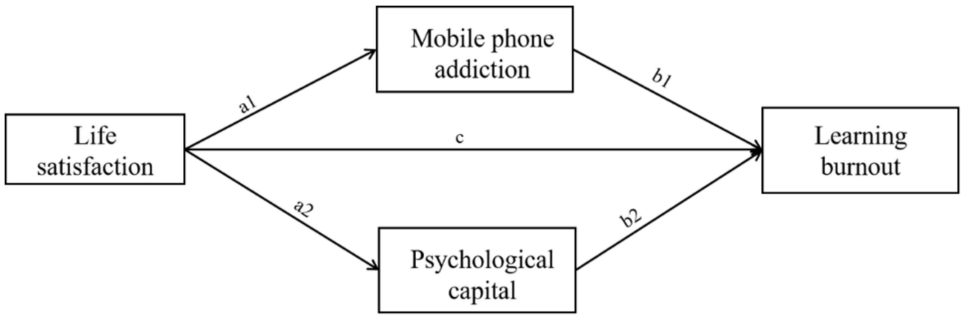

Figure 1 The hypothetical model.

higher scores indicating higher levels of psychological capital. The Cronbach's α coefficient for the questionnaire was found to be 0.967.

Learning Burnout Questionnaire (LBQ)

The University Students Learning Burnout Survey Questionnaire (LBQ) developed by Lian Rong consists of 20 items encompassing three dimensions: emotional exhaustion (8 items), inappropriate behavior (6 items), and low achievement (6 items). The scale employs a five-point rating from 1 (completely disagree) to 5 (completely agree), with reverse scoring applied to items 1, 3, 6, 8, 11, 13, 15, and 18. The total score ranges from 20 to 100, with a midpoint of 60. Higher scores indicate higher levels of learning burnout. In this study, the overall Cronbach's α coefficient for the questionnaire was found to be 0.823.[66]

Statistical Analysis

Descriptive analysis was used to present the background characteristics and variables. Categorical variables were represented in percentages, while continuous variables were presented as mean ± standard deviation. *T*-tests and analysis of variance (ANOVA) were utilized to examine differences in levels of life satisfaction, mobile phone addiction, psychological capital, and learning burnout among various background features. Correlation analysis was conducted to explore relationships between the studied variables. Hierarchical regression was used to analyze the effect of life satisfaction, psychological capital and mobile phone addiction on learning burnout and the effect of life satisfaction on psychological capital and mobile phone addiction. In this study, there was no multicollinearity, and the variance inflation factor (VIF) values were all less than 5. A structural equation model (SEM) was constructed to validate the inherent relationship between life satisfaction and learning burnout. Two parallel mediation paths were employed to assess the roles of mobile phone addiction and psychological capital in mediating this relationship. Fit indices, including Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), were utilized to examine the goodness-of-fit of the model to the data.

Results

Background Characteristics and Differences in the Variables

The study included 628 participants, and Table 1 outlined their demographic characteristics. Medical postgraduate students, on average (27.62±5.12) years old, reported an average learning burnout score of (55.81±10.55) points. Out of the 628 participants, 236 (37.58%) were male, and 392 (62.42%) were female. Among them, 370 had rural household registration (58.92%), while 258 had urban household registration (41.08%). In terms of monthly family income, 113 participants (17.99%) had an income below 5000 yuan, 220 (35.03%) between 5000 and 10000 yuan, 135 (21.50%)

Table 1 Demographic Information and Differences in the Variables

Variables		n(%)	LB (M±SD)	PC (M±SD)	MPA (M±SD)	LS (M±SD)
Gender	Male	236(37.58%)	55.25±10.558	105.11±18.561	45.8±13.609	3.12±0.699
	Female	392(62.42%)	56.15±10.539	100.06±16.283	45.44±11.246	3.08±0.683
t			−1.039	3.569	0.344	0.607
p			0.299	**	0.731	0.544
Residence	Countryside	370(58.92%)	54.99±10.924	104.23±17.22	45.48±12.14	3.11±0.690
	City	258(41.08%)	56.99±9.883	98.71±17.008	45.71±12.255	3.08±0.687
t			−2.347	3.973	−0.238	0.478
p			*	***	0.812	0.633
Family income	<5000	113(17.99%)	57.39±10.651	97.72±18.258	47.88±12.248	3.04±0.772
	5000~10,000	220(35.03%)	56.07±10.701	100.27±15.777	44.93±11.689	3.06±0.616
	10,000~15,000	135(21.50%)	56.16±10.175	102.69±18.682	46.43±11.861	3.13±0.761
	>15,000	160(25.48%)	54.06±10.426	106.67±16.539	44.11±12.855	3.15±0.656
F			2.43	7.173	2.576	0.834
p			0.064	***	0.053	0.475

Notes: M±SD, mean value ± standard deviation; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

between 10000 and 15000 yuan, and 160 (25.48%) exceeding 15000 yuan. Learning burnout levels varied among medical postgraduate students with different household registrations. Additionally, psychological capital levels showed variations based on gender, household registration, and monthly family income. Refer to Table 1 for specific details.

Correlation Among Variables

Correlation analysis was conducted among the variables of life satisfaction, psychological capital, mobile phone addiction, and learning burnout to understand their relationships. The results revealed a positive correlation between life satisfaction and psychological capital (r=0.450, p<0.01), a negative correlation between life satisfaction and both mobile phone addiction (r=−0.121, p<0.01) and learning burnout (r=−0.401, p<0.01). Additionally, psychological capital showed a negative correlation with learning burnout (r=−0.554, p<0.01), while mobile phone addiction exhibited a positive correlation with learning burnout (r=0.429, p<0.01). More details were in Table 2.

Independent Factors of Learning Burnout

First, we set learning burnout as the dependent variable. In step 1, significant variables for learning burnout in univariate analysis were entered; in step 2, life satisfaction was entered; in step 3, psychological capital and mobile phone addiction were entered. We then set psychological capital and mobile phone addiction as the dependent variable, and in step 1, significant variables for psychological capital and mobile phone addiction in univariate analysis were entered; in step 2, life satisfaction was entered.

The results of hierarchical regression indicated that after controlling for significant variables in the univariate analysis in step 1, life satisfaction negatively explained 15.9% of the variance in learning burnout; then, life satisfaction was controlled in step 2, psychological capital and mobile phone addiction totally explained 28.6% of the variance in learning burnout. Life satisfaction also positively predicted psychological capital by explaining 19.7% of its variance. Life satisfaction also negatively predicted mobile phone addiction by explaining 1.5% of its variance. The detailed results were summarized in Table 3.

Mediating Effects of Mobile Phone Addiction and Psychological Capital

The results of the SEM were presented in Figure 2 and Table 4. The fit indices for the hypothetical model were as follows: chi-square statistic (χ^2)/degrees of freedom (DF) (CMIN/DF) =4.833, GFI=0.950, AGFI=0.913, RMSEA=0.078, IFI=0.967, CFI=0.967, NFI=0.959, TLI=0.952, indicating a good model fit. According to the results from the mediation effects table, the total effect of life satisfaction on learning burnout was significant [total effect = −2.433, 95% CI = (−3.18, −1.745)]. The direct effect = −0.694, 95% CI = (−1.313, −0.285), indicating a significant direct effect. The mediation effect of mobile phone addiction between life satisfaction and learning burnout was −0.194, 95% CI = (−0.465, −0.041), signifying a significant mediation effect. The proportion of indirect effect due to emotional exhaustion was 11.081% (−0.041/-0.37). The mediation effect of psychological capital was −1.545, 95% CI = (−2.011, −1.222), confirming the presence of the mediation effect, and the proportion of indirect effect was 88.919% (−0.329/-0.37). The total indirect effect = −1.739, 95% CI = (−2.22, −1.339), and the total proportion of indirect effect was 71.429% (−0.37/-0.518). The research findings indicated that mobile phone addiction and psychological capital operate through distinct mechanisms in the relationship between life satisfaction and learning burnout. In the mechanism where mobile

Table 2 Correlation Among Variables

	M±SD	LS	PC	MPA	LB
LS	3.10±0.688	1			
PC	101.96±17.334	0.450**	1		
MPA	45.57±12.178	−0.121**	−0.142**	1	
LB	55.81±10.547	−0.401**	−0.554**	0.429**	1

Notes: *p < 0.05, **p < 0.01, ***p < 0.001; LS, life satisfaction; PC, psychological capital; MPA, mobile phone addiction; LB, learning burnout.

Table 3 The Independent Factors of Learning Burnout

	PC		MPA		LB		
	Block1 (β)	**Block2 (β)**	**Block1 (β)**	**Block2 (β)**	**Block1 (β)**	**Block2 (β)**	**Block3 (β)**
(Constant)	117.237***	81.608***	45.827***	52.664***	51.728***	72.210***	76.706***
Gender	−4.800**	−4.428***	−0.374	−0.445	0.81	0.607	−0.417
Residence	−5.301***	−5.019***	0.252	0.198	1.963*	1.809*	0.438
LS		11.181***		−2.139**		−6.114***	−2.548***
PC							−0.261***
MPA							0.301***
R	0.206	0.489	0.18	0.122	0.101	0.411	0.674
R^2	0.043	0.240	0.000	0.015	0.101	0.169	0.455
F	13.894***	65.509***	0.097	3.150*	3.190*	42.351***	103.764***
Adjusted R^2	0.040	0.236	−0.003	0.010	0.007	0.165	0.450
ΔR^2	0.043	0.197	0.000	0.015	0.101	0.159	0.286

Notes: *p < 0.05, **p < 0.01, ***p < 0.001; LS, life satisfaction; PC, psychological capital; MPA, mobile phone addiction; LB, learning burnout.

phone addiction served as the mediating variable, an increase in life satisfaction was associated with a decrease in mobile phone addiction, subsequently exacerbating medical postgraduate students' learning burnout. In the mechanism with psychological capital as the mediating variable, an increase in life satisfaction was linked to an increase in medical postgraduate students' psychological capital, thereby alleviating learning burnout. Furthermore, the difference between the two standardized mediation effects was 0.288, with a significance level of p=0.001 and a 95% *CI* of (0.965, 1.857). This indicated a significant disparity between the two mediation effects.

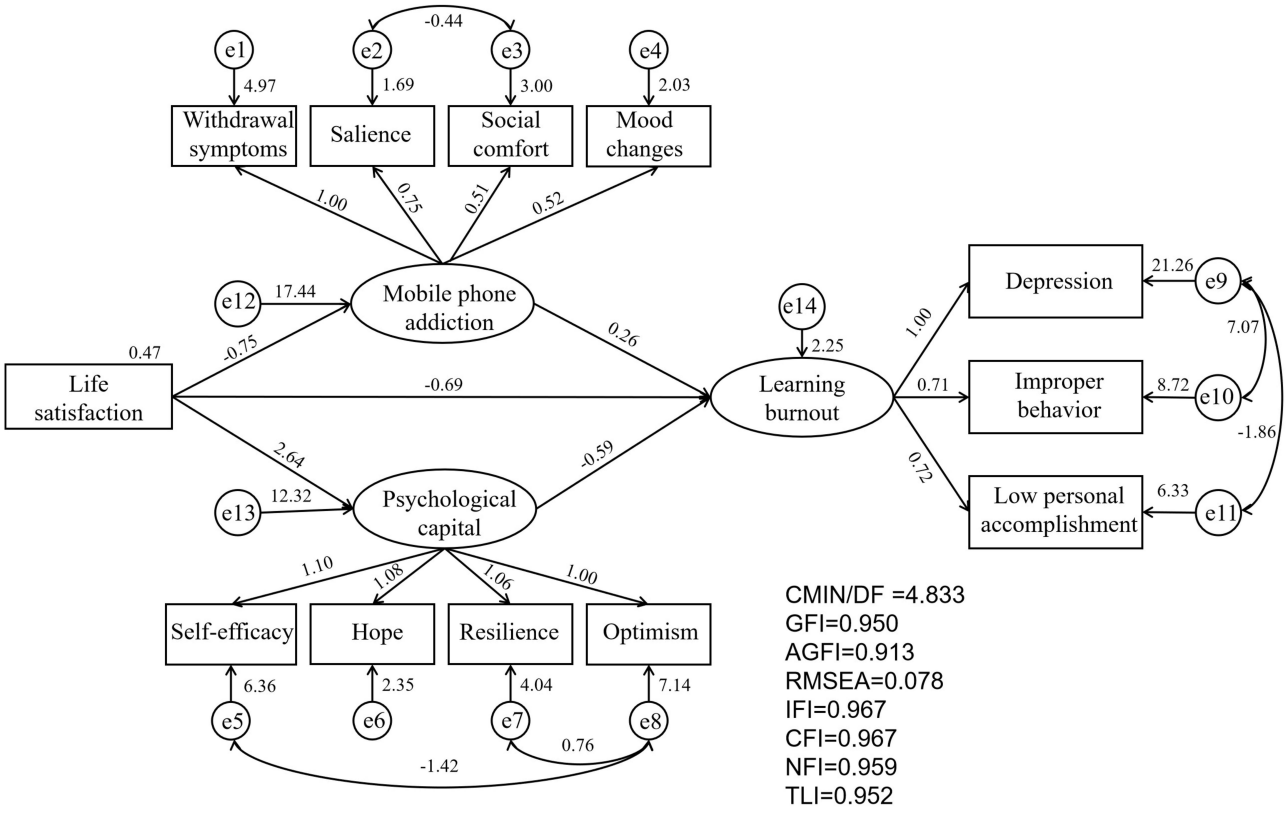

Figure 2 The structural equation modelling for the hypothetical model.

Table 4 The Standard Effects in the Hypothetical Model

Effects	Path	Estimate	STD Estimate	S.E.	*p*	95% *CI*	
						Lower	Upper
Direct effect	**LS→LB**	−0.694	−0.148	0.211	**	−0.246	−0.062
	LS→MPA	−0.751	−0.123	0.251	**	−0.233	−0.029
	MPA→LB	0.259	0.337	0.041	***	0.222	0.452
	LS→PC	2.639	0.459	0.224	***	0.381	0.536
	PC→LB	−0.585	−0.716	0.046	***	−0.828	−0.571
Indirect effect	**LS→MPA→LB**	−0.194	−0.041	0.105	*	−0.465	−0.041
	LS→PC→LB	−1.545	−0.329	0.197	**	−2.011	−1.222
Total indirect effect		−1.739	−0.370	0.227	**	−2.220	−1.339
Total effect		−2.433	−0.518	0.362	**	−3.180	−1.745
Indirect effect/Total effect	71.429% (−0.37/-0.518)						

Notes: *p < 0.05, **p < 0.01, ***p < 0.001; LS, life satisfaction; PC, psychological capital; MPA, mobile phone addiction; LB, learning burnout; ind1, LS→MPA→LB; ind2, LS→PC→LB; r1, ind1/Indirect effect; r2, ind2/Indirect effect; 95% CI, 95% Confidence Intervals.

Discussion

The purpose of this study was to explore the relationship between life satisfaction and learning burnout. Although there have been studies confirming the relationship between life satisfaction and learning burnout, there is a lack of research among the specific group of medical postgraduate students, as well as a lack of research on the mediating roles of mobile phone addiction and psychological capital in this context. To address these gaps in this research field, this study conducted an investigation among medical postgraduate students to understand the current status and influencing factors of their learning burnout. The research focused on examining the impact of life satisfaction on learning burnout among medical postgraduate students and exploring the potential mediating roles of mobile phone addiction and psychological capital.

The results of the study showed that life satisfaction of medical postgraduate students had a direct effect on learning burnout, which was consistent with the results of previous studies.[13,22–28] Meanwhile, our study additionally revealed that the influence of life satisfaction on learning burnout could be mediated by mobile phone addiction and psychological capital. In the following section, we will analyze the mechanism of the mediating effect of these two variables. Life satisfaction refers to a person's overall evaluation of their own mental health and quality of life, it includes emotional and cognitive evaluations of one's life.[16] As medical postgraduate students are busy in their daily lives and also face pressure from doctor-patient conflicts, scientific research and other aspects,[1,2] when postgraduate medical students have negative emotions about their personal lives, they will look for an emotional outlet, and cell phones provide an accessible channel to help them vent their emotions and escape from reality, which makes them easy to rely on cell phones and develop mobile phone addiction behavior.[36] According to the cognitive-behavioral theory, an individual's cognition and emotions not only influence his or her behaviors, but are also influenced by his or her own behaviors. Therefore, mobile phone addiction can influence a person's emotions and cognition.[67] The more medical postgraduate students rely on the Internet, the more emotional comfort they get from the Internet, the more they will be dissatisfied with real life, thus killing their interest in learning, and producing resistance to learning, that is, learning burnout. Therefore, mobile phone addiction may act as a mediating variable in the relationship between life satisfaction and learning burnout.

Life satisfaction is an important psychological factor influencing individuals' perception and control of stressful situations.[18] Psychological capital is the developmental state of an individual's positive psychology and is related to personal achievement and well-being.[43,44] Medical postgraduate students are busy with their studies and work, and also face a series of unique pressures, such as scientific research, clinical practice, employment, and doctor-patient conflict, etc.[1,2] When they feel dissatisfied with the quality of life, they will produce negative and pessimistic emotions, reduce their evaluation of themselves, and tend to produce incorrect attribution when facing setbacks, thus the level of psychological capital is reduced.[44] Students with high life satisfaction have higher levels of hope and optimism under

the combined effect of self-efficacy, adaptability and optimism.[21] According to the cognitive-behavioral theory, students with positive self-cognition can calmly analyze and make appropriate adjustments to their behaviors, that is, they can make timely adjustments to increase their motivation when they are burned out on learning, thus buffering the effects of low life satisfaction on learning.[68–70] This explains why psychological capital has a mediating role between life satisfaction and learning burnout among medical postgraduate students.

In conclusion, the direct and indirect effects of life satisfaction on learning burnout among medical postgraduate students are mediated by two mediating variables, mobile phone addiction and psychological capital, and the results of this study have important implications for medical education. First, life satisfaction has a negative predictive effect on learning burnout, which suggests that medical education of postgraduate students should take effective measures to enhance their life satisfaction in order to improve learning burnout. Life satisfaction is an individual's overall evaluation of his or her quality of life and mental health.[16] Therefore, it is not only necessary to improve the quality of life of medical graduates in all aspects, but also to pay attention to their mental health. Second, this study found that mobile phone addiction mediates the relationship between life satisfaction and learning burnout, which suggests that learning burnout can be improved by intervening mobile phone addiction behaviors of medical postgraduate students. Medical postgraduate students are under great pressure in study and work, and are easy to find relaxation and comfort through the reliance of mobile phones.[36] Therefore, while medical education strives to improve the living environment of medical graduate students, it should also encourage them to take healthy ways to relieve pressure, such as sports, music, etc., to reduce the screen time and reliance on mobile phones, so as to effectively reduce learning burnout. Third, this study found that psychological capital acted as a mediating variable in the effect of life satisfaction on learning burnout, which suggests that learning burnout can be improved by intervening psychological capital. For the intervention of psychological capital, Professor Luthans Fred' psychological capital intervention model, which is the most widely used at present, develops the four dimensions of psychological capital and ultimately achieves the purpose of improving psychological capital.[44] Psychological capital is a kind of positive psychological resources, and the development of psychological capital can help medical postgraduate students reduce psychological distress,[71] improve subjective well-being,[72] and alleviate negative emotions about learning.

Limitations and Future Research Directions

Although this study provides insights into the relationship between life satisfaction and learning burnout among medical postgraduate students, there are inevitably some limitations. First, the cross-sectional design cannot draw conclusions about causality, and longitudinal studies are needed in the future. Second, because it is a questionnaire survey, there is inevitable investigation bias. Third, this study was conducted at a medical university in China, so conclusions should be drawn with caution, and future studies in multi-institutional multi-centers in different cultures should be recommended. Fourth, this study analyzed the role of mobile phone addiction and psychological capital in the relationship between life satisfaction and learning burnout of medical postgraduate students, but in addition to this, there may be other variables in this influencing mechanism, which need to be further investigated in future studies.

Data Sharing Statement

The datasets supporting the conclusions of this study are available from the corresponding author on reasonable request.

Ethics Approval

This study was approved by the ethics committee of Chongqing Medical University (2018015) and in accordance with the Declaration of Helsinki. Since this study was an anonymous survey research, and a non-intervention research, we only obtained verbal informed consent from the participants, which was in accordance with Article 33 of *the Measures for Ethical Review of Biomedical Research Involving Human Beings* implemented by the Ethics Committee of Chongqing Medical University: when conducting research, project researchers shall obtain informed consent voluntarily signed by subjects; when subjects cannot give consent in writing, project researchers shall obtain their verbal informed consent, and submit process records and supporting materials.Prior to the start of the survey, we verbally obtained the consent of the participants to fill in the questionnaire only if they agreed to participate. Participants were also informed in

writing at the beginning of the questionnaire that the survey was completely anonymous and that informed consent was as follows:

This survey is anonymous, and the information obtained from the survey will only be used for group analysis, not for individual cases. There are no good or bad or right or wrong options for the questions, so please answer truthfully and honestly according to the actual situation, we will treat you with strict confidentiality.

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Disclosure

The authors report no conflicts of interest.

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