

# Impact of Learning Burnout on Mobile Phone Dependence Among Adolescents in Western China Under the “Double Reduction” Policy: The Mediating Role of Social Support

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**Purpose:** This paper investigated the prevalence of mobile phone dependence (MPD) and its associated with learning burnout under the “double reduction” policy among adolescents in Guizhou Province in western China. In addition, the influence of the mediating mechanism of social support on this relationship was investigated.

**Methods:** The sample was collected from 16,216 adolescents in West China's Guizhou province, from December 2021 to January 2022 via multistage stratified random sampling. The Self-rating Questionnaire for Adolescent Problematic Mobile Phone Use (SQAPMPU) was used to assess the MPD, the Adolescent Student Burnout Scale (ASBI) was used to assess the learning burnout, and the Social Support Scale (SSS) was used to assess the social support. A hierarchical linear regression model was used to analyze the relationship between MPD, learning burnout, and social support. The mediating effect of social support between MPD and learning burnout was analyzed by structural equation model.

**Results:** Prevalence of MPD was 26.4% among adolescents in Guizhou province in western China. After adjusting for confounding variables like demographics, multiple linear regression model has revealed that learning burnout positively predicted MPD and social support negatively predicted MPD. The structural equation model showed that 10.9% of the effect was explained by the mediating effect of social support.

**Conclusion:** These findings could inform service delivery and policy formulation to reduce learning and avoid MPD in adolescents.

**Keywords:** “double reduction” policy, mobile phone dependence, learning burnout, social support, adolescents

## Introduction

On July 24, 2021, the General Office of the CPC Central Committee and The State Council of China promulgated the opinions on further reducing the burden of homework and after-school training for students (hereinafter referred to as “double reduction”).<sup>1</sup> The publication of “Opinions” aimed to relieve students’ academic pressure, freeing more time to enrich extracurricular life. However, in today’s educational environment, the problem of how to allocate leisure time does not seem to have been fully resolved, as the “double reduction” policy has not been able to fully alleviate the academic pressure.<sup>2</sup> In China’s exam-oriented education system, there is a great contradiction between the examination system, academic pressure, and physical and mental health, and how to balance the relationship between them under the premise of relieving student pressure has become a major task for education departments, schools, and parents.<sup>3</sup> If adolescents face more burden and stress in the long term, it will lead to numerous problems such as learning burnout.<sup>4</sup> Learning

burnout has been shown to be a risk factor for depression, school dropout and self-harm.<sup>5</sup> Another important problem resulting from the “double reduction” policy was that, under the condition of relatively reduced learning time, some students were addicted to watching short videos, playing games, chatting and other recreational activities on smart phones which occupy most of their leisure time.<sup>6</sup> After the promulgation of the “double reduction” policy, according to the 50th China statistical report on Internet development, by June 2022, China’s Internet users reached 1.047 billion, an increase of 17.85 million compared with December 2021, and the proportion of Internet users using mobile phones was 99.6%, adolescents accounted for 13.5% of the total.<sup>7</sup> Because adolescents are not mature physically and mentally, and their self-control ability is weak. Although smartphones are convenient for them to communicate, learn and enjoy themselves better, excessive use of smart phones brings many adverse effects, such as mobile phone dependence (MPD).<sup>8</sup> In previous studies, the most studied individual factors were depression, anxiety, sleep quality, academic performance and academic stress.<sup>9–12</sup> Family factors (domestic violence, parenting styles, parental exclusion, parental over-protection, family economic status) have been reported in many studies.<sup>13,14</sup> Social factors included social networking, online shopping, social support and current status of MPD within COVID-19,<sup>15–18</sup> but within social policy there is a lack of studies such as in the educational context. Furthermore, to our knowledge, the role of the adolescent social support to mediate the relationship between the learning burnout and MPD has not been clarified.

## MPD During Adolescents

MPD is defined as excessive and uncontrolled use of a mobile phone, the urgent need to use a mobile phone after a period of time, and changes in mood when use is blocked or difficult, with consequences that can affect real-world relationships, academic performance, physical and mental health.<sup>19</sup> MPD is a considerable concern, especially among adolescents. Haug et al<sup>20</sup> compared MPD detection rates in different age groups among 1519 students in Switzerland, those aged 15–16 was the highest one (18.1%), followed by 136 (17.9%) among those aged 17–18, both of which were higher than those aged 19 and older. Compared with young adults (19 years and older), MPD was more common among younger adolescents (15–17 years). The problem of MPD in adolescents is widespread across the globe. It has been reported that 62.4% of high school students in Philippines,<sup>21</sup> 70.3% of high school students in Brazil,<sup>22</sup> 26.6% of middle school students in Korea,<sup>23</sup> and 25.4% of middle school students in China.<sup>24</sup> These surveys showed that significant variations between regions and countries about the prevalence of MPD. With its vast land area and large population, China’s 30 provinces are very different in terms of economy, society, ideology and geography. In terms of economic development, China consists of three regions: the highly developed east, the moderately developed middle and the least developed west.<sup>25</sup> Research has suggested that the occurrence of MPD may also be influenced by economic development levels, with low economic levels positively predicting MPD in adolescents.<sup>15,26</sup> Therefore, whether the MPD detection rate is higher in western China needs further investigation.

## The Relationship MPD and Learning Burnout

Learning burnout is a negative mental state of student learning that has been defined as emotional exhaustion, depersonalization, and reduced personal achievement caused by course pressure, course load, or other psychological factors in the educational process.<sup>27</sup> The emergence of burnout is accompanied by a gradual depletion of the self-regulation resource, which leads to the failure of the self-regulation mechanism when suffering from depression and anxiety.<sup>28</sup> According to compensatory network use theory, mobile phones and the Internet can be used as a way of compensating for negative emotions in adolescents, but the failure of self-control in the use of mobile phones was positively correlated with MPD.<sup>29</sup> In addition, direct and indirect evidence for learning burnout and MPD in adolescents has been provided by previous studies. Direct evidence comes from Zhang et al<sup>30</sup> study of 1475 adolescents in China, which showed that MPD was a direct predictor of learning burnout. Results from a separate study of 675 adolescents showed that MPD in adolescents had a significant positive effect on learning burnout.<sup>31</sup> Indicative evidence from two longitudinal waves of data from 1702 early (12 to 14 years) and 1636 late (16 to 18 years) Finnish adolescents revealed a cross-lagged path between excessive Internet use and learning burnout among both groups of adolescents, with learning burnout being predicted by later excessive Internet use and excessive Internet use being predicted by later learning burnout.<sup>32</sup> Both theoretical underpinnings and previous studies have demonstrated the relationship between MPD and

adolescent learning burnout. However, previous empirical studies have focused more on the impact of MPD on learning burnout, with little empirical evidence to suggest that learning burnout may also be an influencing factor of MPD.

Based on the above theoretical analysis, Hypothesis 1 is proposed in this study.

H1: Learning burnout has a significant positive effect on MPD.

## The Mediation Role of Social Support in the Linking MPD and Learning Burnout

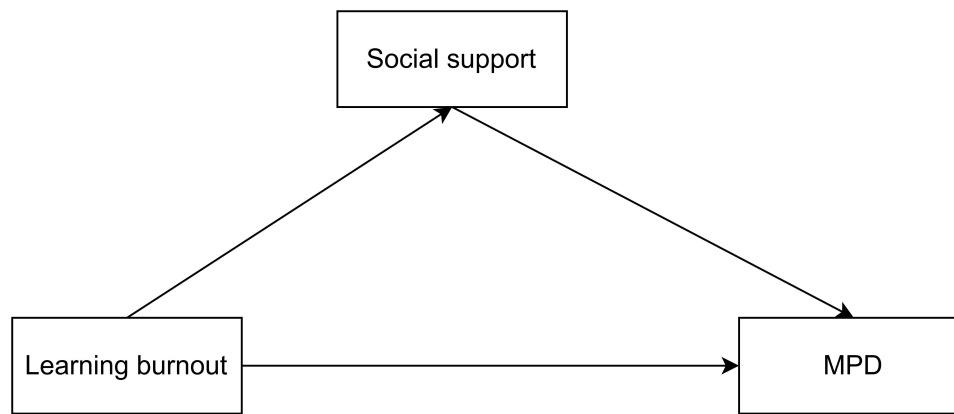
Society is a macro educational environment, and rich social resources need to be fully utilized to provide an important platform for students to broaden their horizons and develop in an all-round way. Under the “double reduction” policy, China’s measures to reduce students’ learning burnout and mobile phone use mainly focus on two aspects: home-school linkage and government supervision. However, problems such as under-development and under-utilization of social support resources remain due to the lack of empirical research to guide these measures.<sup>2</sup> As a multi-dimensional system, social support system plays an important role in maintaining. It is often used as a positive resource, which can alleviate individual burnout to a certain extent and thus reduce the occurrence of bad behaviour.<sup>33</sup> Hobfoll<sup>34</sup> proposed resource conservation theory to explain burnout processes such as stress and exhaustion in terms of resource loss and gain. He argues that the depletion of resources that individuals strive to obtain and maintain is due to the loss of resources or the imbalance of resource utilization due to increased work, and that these include material and construction resources, social support resources and energy resources.<sup>35</sup> Prevailing research have suggested that social support is one of the most important resources in combating learning burnout and has been the most extensively studied resource in buffering against burnout.<sup>33,36</sup> In a study of 378 adolescents from Turkey, social support was found to be negatively associated with learning burnout.<sup>37</sup> The relationship between MPD and social support is supported by evidence. Circumstantial evidence suggests that social resources are a quality and quantity buffer against the development of Internet addiction. In a study of 567 adolescents, those with larger social networks and higher scores on social support reported the least likelihood of becoming addicted to using the Internet.<sup>38</sup> Therefore, as a crucial buffer resource, social support can not only alleviate the burnout caused by the imbalance of individual resource allocation, but also help individual avoid problematic Internet behaviors.<sup>39</sup> A meta-analysis also provided direct evidence of the negative association between social support and MPD.<sup>40</sup> An empirical survey of adolescents in Poland has also shown that social support is an important resource for avoiding MPD.<sup>41</sup> Additionally, Cohen and Wills’s<sup>42</sup> social support buffer theory suggests that that social support maintains and promotes physical and mental health by regulating the adverse effects of individual stress and burnout on psychological behavior. A range of buffering effects of social support for mental health (eg, anxiety, depression and burnout) and problem behavioral outcomes (eg, suicidal thoughts and MPD) have been demonstrated.<sup>43,44</sup> MPD as a result of learning burnout, previous studies have shown that learning burnout and MPD can damage the sense of social support, specifically leading to a reduction in school participation and family closeness.<sup>45</sup> Therefore, if adolescents are not provided with adequate social support, their learning burnout will not be alleviated, which indirectly leads to MPD. Although both the theoretical underpinnings and the empirical research supported a pin-point correlation between MPD, learning burnout and social support, there is a lack of known about the mediating role of adolescents’ social support in the relationship between learning burnout and MPD.

Accordingly, we propose research hypothesis 2 and hypothesis 3.

H2: Social support has a significant negative effect on MPD.

H3: Social support mediates between MPD and learning burnout.

Therefore, a cross-sectional study was conducted to investigate MPD status in Guizhou Province in western China, and to explore the impact of learning burnout on MPD among adolescents under the “double reduction”. Moreover, we further examined the mediating effect of social support on the relationship between learning burnout and MPD. The hypothesized mediation model was drawn in this study, as shown in [Figure 1](#).



**Figure 1** The hypothesized mediation model.

## Methods

### Participants and Procedure

A multistage stratified cluster random sampling method was used to obtain participants for a descriptive cross-sectional design study. The stratification was based on the 2020 GDP level of Guizhou Province in western China (high, middle and low),<sup>46</sup> type of school (junior middle schools, senior high schools and vocational middle schools), and grade (year1, year2, year3). Three regions were selected. Then, four junior middle schools, four senior middle schools and two vocational middle schools were randomly selected in each region (subtotal: 36 schools). Every school surveyed has fully implemented the double reduction policy. In each selected target school, a total of 4 classes in each grade were randomly selected (subtotal: 432 classes). We first contacted education authorities, school leaders and relevant classroom teachers, and with the help of relevant subject teachers, trained investigators completed field questionnaires of students in relevant classes. It took about 20–25 minutes for the students to complete the questionnaire. Before the survey was conducted, all participants were informed about the survey and their consent was obtained. Consent was also obtained from the parents or legal guardians of the participants.

The survey started in December 2021 and all questionnaires were collected by January 2022. Exclusion criteria were: students who did not attend school for various reasons during the survey period, refused to be surveyed and had other mental disorders. A total of 18,838 questionnaires were distributed during the survey period. 1233 students submitted incomplete questionnaires, with a response rate of 93.45%. In the first two times of data analysis, questionnaires of 16,216 students were finally included for analysis, with an effective rate of 92.11%. There were 7921 boys (36.3%), 8695 girls (51.1%), 7868 middle school students (48.4%), 5901 high school students (36.3%), and 2447 vocational middle school students (15.3%). The age was 11–22 years old ( $M=15.12$ ,  $SD=1.85$ ). Our study was approved by the Human Experiment Ethics Committee of Guizhou Medical University (No. 2021–229).

### Measures

The Self-rating Questionnaire for Adolescent Problematic Mobile Phone Use (SQAPMPU) is a standardized questionnaire designed to effectively evaluate the MPD status of adolescents.<sup>47</sup> The questionnaire includes 13 items to assess MPD, covering three dimensions of withdrawal symptoms, cravings, and physical and mental health status. The Likert 5 scale was used, with total scores ranging from 13 to 65, with the 75th percentile as the cut-off. The effectiveness and reliability of SQAPMPU have been tested by previous studies.<sup>48</sup> Cronbach's  $\alpha = 0.921$  of the scale in this study.

The Adolescent Student Burnout Scale (ASBI), which has been used to measure adolescent learning burnout problems, was originally designed by Wu et al<sup>49</sup> based on the Maslach Burnout Inventory-Student Survey (MBI-SS).<sup>50</sup> The inventory consists of 16 items measuring 3 factors of student burnout: exhaustion (4 items), cynicism toward the meaning of study (5 items), and sense of inadequacy at studying (7 items). Each item was scored on a 5-point Likert scale

ranging from 1 (completely disagree) to 5 (strongly agree). The validity and reliability of ASBI have been previously examined.<sup>51</sup> This study adopted Cronbach's  $\alpha = 0.831$  for the scale.

Social support was assessed by the Social Support Scale (Chinese version).<sup>52</sup> 17 items and 3 measurable dimensions of subjective support (5 items), supportive utilization (6 items) and objective support (6 items) were included in the questionnaire. Likert five-point scoring method was used to evaluate each item, that is, the range was from 1 to 5 points for "inconsistent" to "consistent". The sum of the scores of all 17 items is the total score of the scale, which reflects the overall status of social support of the subjects. The validity and reliability of social support scale has been previously examined.<sup>53</sup> Cronbach's  $\alpha = 0.952$  was adopted in the scale of this study.

## Data Analysis

IBM SPSS24.0 for windows statistical software was used for descriptive analysis to describe the detection rate of adolescent MPD. Chi-square test was used to analyze the detection rate of MPD among adolescents with different gender, school type, ethnicity and other demographic characteristics. The relationship between learning burnout, social support and MPD was evaluated using the analysis of the hierarchical linear regression model. The multiple linear regression model was corrected for demographic variables that potentially distorted the data. Structural equation modeling was used in Amos to fit variable relationships and validate models. Maximum likelihood method was used to estimate the parameters. AIC, BIC, GFI, CFI, TLI,  $\chi^2/df$  and RMSEA were used to determine the degree of fit of the model.<sup>54,55</sup> In the mediating effect model, MPD score was used as the dependent variable, learning burnout score as the independent variable, and social support score as the mediating variable. The statistical significance level was set at 0.05; thus, all the p values below 0.05 were interpreted as significant.

## Results

### Characteristics of the Participants

As shown in Table 1, a total of 16,216 adolescents were included in this study. For these, 26.4% were classified as MPD. There were significant differences in rate of MPD between the learning stage ( $p < 0.001$ ), the rates of MPD were higher

**Table 1** Characteristics of the Study Samples

Variables	Option	MPD Group	Non-MPD Group	$\chi^2$	p
Gender	Male	2089(26.4)	5832(73.6)	0.009	0.926
	Female	2193(26.4)	6102(73.6)		
Learning stage	Junior middle school	1643(20.9)	6225(79.1)	241.228	<0.001
	Senior middle school	1845(31.3)	4056(68.7)		
	Secondary vocational school	794(32.4)	1653(67.6)		
Nation	Han	1665(22.7)	5663(77.3)	93.421	<0.001
	Minorities	2617(29.4)	6271(70.6)		
Grade	Year1	1499(25.8)	4317(74.2)	4.129	0.127
	Year2	1540(27.4)	4089(72.6)		
	Year3	1243(26.1)	3528(73.9)		
Residential area	Rural	2709(29.3)	6524(70.7)	95.003	<0.001
	Urban	1573(22.5)	5410(77.5)		
Family economic status	Lower	1446(33.5)	2868(66.5)	199.027	<0.001
	Medium	2376(25.3)	7029(74.7)		
	Upper	455(18.4)	2012(81.6)		
Father's education level	Primary School and lower	915(31.1)	2028(68.9)	92.530	<0.001
	Junior middle school	2011(27.7)	5261(72.3)		
	Senior middle school	631(24.3)	1965(75.7)		
	College or above	432(20.2)	1704(79.8)		
	Unknown	288(23.4)	942(76.6)		

(Continued)

**Table I** (Continued).

Variables	Option	MPD Group	Non-MPD Group	$\chi^2$	p
Mather's education level	Primary School and lower	1497(31.0)	3333(69.0)	118.213	<0.001
	Junior middle school	1606(26.1)	4558(73.9)		
	Senior middle school	485(23.8)	1553(76.2)		
	College or above	293(18.1)	1327(81.9)		
	Unknown	392(25.5)	1145(74.5)		
Perceived Academic record	Poor	1722(32.4)	3598(67.6)	156.061	<0.001
	Medium	1293(24.9)	3899(75.1)		
	Good	1249(22.1)	4391(77.9)		
Perceived Academic pressure	Lower	534(17.8)	2467(82.2)	279.076	<0.001
	Medium	1788(24.3)	5560(75.7)		
	Higher	1946(33.4)	3873(73.6)		

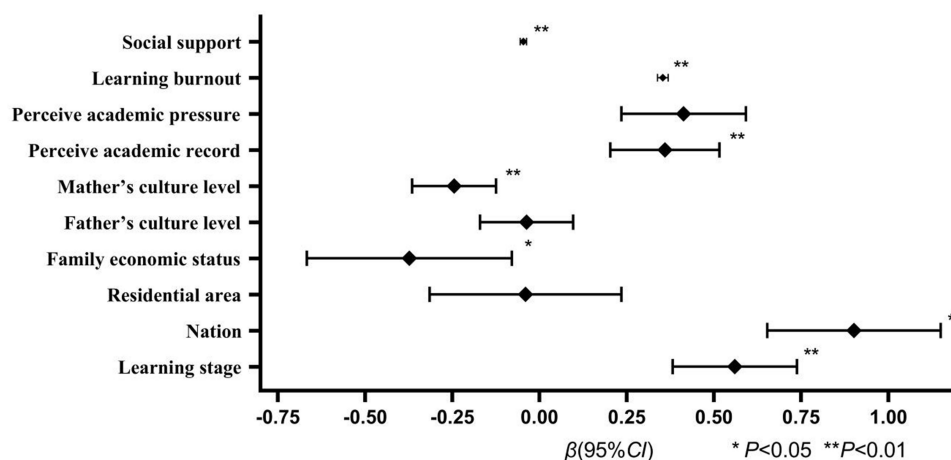
in senior middle school and secondary vocational school. There were nation-based differences in rate of MPD ( $p < 0.001$ ) and MPD was more frequent in minorities. The rate of MPD among adolescents from rural was higher than that in urban ( $p < 0.001$ ). The rate of MPD was higher among adolescents from families with lower economic status ( $p < 0.001$ ). Adolescents who reported lower parents' educational level showed a higher proportion of MPD (both  $p < 0.001$ ). The rates of MPD were highest in adolescents with poor perceived academic record or higher perceived academic pressure ( $p < 0.001$ ).

### Association of Learning Burnout and Social Support with MPD in Adolescents

Multiple linear regression was used to examine the relationship between learning burnout, social support, and MPD. School grade, ethnic group, economic status of living family, father's education level, mother's education level, perceived academic record and perceived academic pressure were taken into the model as control variables. The results showed that learning burnout positively predicted MPD ( $\beta = 0.354, p < 0.01$ ), social support negatively predicted MPD ( $\beta = -0.046, p < 0.01$ ). Detailed results are shown in Figure 2.

### Mediating Effect Analysis

Table 2 presented the results of the mediating effect model analysis. The direct effect value of learning burnout on MPD was 0.392, the mediating effect value of social support was 0.048, and the total effect value was 0.440. The direct effect accounted for 89.1% of the total effect, and the mediating effect accounted for 10.9% of the total effect. Figure 3 showed



**Figure 2** Association of learning burnout and social support with MPD in adolescents. \* $p < 0.05$  \*\* $p < 0.01$ .

**Table 2** Mediating Effect of Social Support in the Association Between Learning Burnout and MPD in Adolescents

Effect		Estimate	95% CI	SE	p
Direct effect	Learning burnout → MPD	0.392	(0.376, 0.408)	0.008	<0.001
	Learning burnout → social support	-0.480	(-0.494,-0.466)	0.003	<0.001
	Social support → MPD	-0.099	(-0.119,-0.079)	0.021	<0.001
Mediation effect	Learning burnout → social support → MPD	0.048	(0.038, 0.058)	0.005	<0.001

the mediating effect path of social support in the association between learning burnout and MPD among adolescents. All path coefficients were statistically significant ( $P < 0.001$ ). The results showed that AIC = 35,352.000, BIC = 35,390.469, GFI=0.999, CFI = 0.999, TLI = 0.998 (All parameters were higher than 0.9),  $\chi^2/df = 7.625$  ( $p < 0.001$ ), RMSEA = 0.02 ( $p < 0.001$ ). The model fit index showed that the mediating effect model was acceptable.

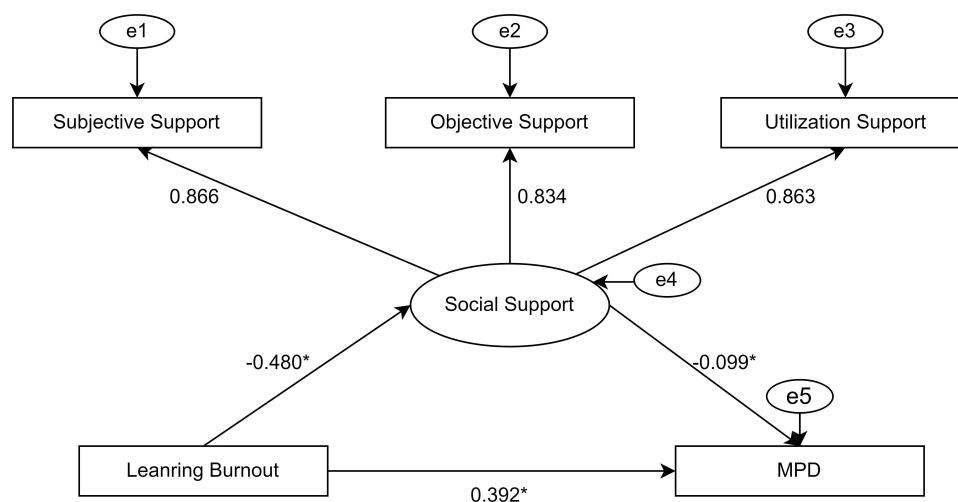
## Discussion

### The Prevalence in Western China

This study reveals that the positive rate of MPD in Guizhou Province in western China was 26.4%. The positive rate of MPD was higher than that of Shandong college students in East China (9.0%),<sup>56</sup> and that of Hunan college students in Central China (21.3%)<sup>57</sup> and Anhui junior high school students (22.8%).<sup>58</sup> It was lower than that of Asian university students (41.9%)<sup>59</sup> and higher than that of global meta-analyses results (23.3%).<sup>60</sup> Although MPD prevalence appear to vary due to differences in MPD definition, sample size, assessment tools, economic level, survey duration, and social and cultural background, even when these differences are taken into account, our results still indicate that MPD was serious in adolescents, and it seems to be improved compared with previous surveys in other parts of China. The positive MPD rate in western Guizhou is higher than that in eastern and central regions, possibly because Guizhou is an economically backward western province. Its per capita GDP ranks 29th out of 31 provinces, according to the data, one reason it has become a major labor exporter in China.<sup>61</sup> More parents are choosing to work in the more economically developed eastern and central regions. According to statistics, Guizhou had 475,000 left-behind minors by the end of 2020, ranking 6th in China.<sup>62</sup> As teenagers are often separated from their parents, their mobile phone use cannot be supervised, and problems with their mobile phone use cannot be detected in a timely manner.<sup>63</sup>

### The Effect of Learning Burnout on MPD

The hypothesis 1 was supported in this study, as learning burnout positively affected MPD. Policies do not work to reduce and adolescents' learning pressure or learning burnout. South Korea is a very striking example. In South Korea,



**Figure 3** Mediating effect path of social support in the relationship between learning burnout and MPD in adolescents. \* $p < 0.001$ .

shadow education has failed because it has led to severe educational inequality. Government policies have eased some of the pressure on students, but intensive reading and private tutoring in South Korea have not been changed by the policies.<sup>64</sup> This problem may also exist in Japan, Japan's "loose education" has led to a decline in the academic ability of Japanese students in basic education, and the direction of "de-loose".<sup>65</sup> Both Japan and South Korea have promulgated or implemented educational decisions of "reducing the burden", but their feasibility and long-term effect often become mere formality because they cannot meet the needs and wishes of the country and society for the development of education. As American scholar G. Allison said, "In the process of realizing the policy goal, the function determined by the plan only accounts for 10%, while the rest 90% depends on the effective implementation". In the case of China's "double reduction" policy, it has achieved temporary results in shortening students' homework time and cancelling off-campus training, but under the guidance of "only score" and "only academic qualification", the problem of academic burden and learning burnout has not been fundamentally solved.<sup>66</sup> What's more, since China's school admission system, parental expectations and students' sense of achievement are also important sources of learning burnout among adolescents, helping them reduce it is still a long way off.<sup>67,68</sup> A comparative study of China and Germany, the data showed that Chinese adolescents had higher average burnout scores, and the positive correlation between high level of learning burnout and high level of Internet addiction or MPD.<sup>69</sup> After the "double reduction" policy, the time allocated to study is reduced and the entertainment time such as playing mobile phone is increased.<sup>2</sup> Teenagers with high levels of learning burnout, low academic performance and other negative feelings need a medium or a way to release them, and after the rapid development of modern electronics, mobile phones are the most effective tools to quickly release negative feelings.<sup>12,70</sup> Over time, uncontrolled excessive use of mobile phones leads to MPD. This result can be reasonably explained by the theory of compensatory network usage, which implies that MPD can be a coping strategy for learning burnout due to escape incentives.<sup>28,71</sup> When individuals lack the resources to combat learning burnout, networked devices such as mobile phones are the best substitute. Therefore, MPD should be avoided by controlling learning burnout.

## The Effect of Social Support on MPD

Our results also suggested that social support positively influences MPD, which consistent with hypothesis 2. Social support from parents and teachers, as well as friends and classmates, is strongly associated with MPD among adolescents and young adults. The relationship between MPD and social support has also been confirmed by other studies with similar findings to ours. The study of 567 Polish students showed that students in the MPD category had lower social support levels compared to non-MPD students, and that low social support levels were also positively associated with isolation and social fear among students, which led to more frequent use of mobile phones.<sup>41</sup> A study of 1149 Turkey college students found that those who used their phones problematic had fewer support resources from family, teachers and friends than those who used their phones normally.<sup>72</sup> Furthermore, a meta-analysis in China found that the negative correlation between MPD and social support in the eastern region ( $r = -0.152$ ) with the best economic development level is lower than that in the central region ( $r = -0.216$ ), but because of the lack of studies on the relationship between MPD and social support in the western region with the lowest level of economic development, few studies were included in the meta-analysis, so the relationship between the two is not significant.<sup>63</sup> Our results of this study also showed that social support negatively predicts MPD among adolescents in western China, which makes up for the shortcomings of previous studies. This research results showed that the correlation coefficient between MPD and social support in the western China is  $-0.099$ , which is lower than the correlation coefficient in central China and eastern China of the above meta-analysis. The reason for this phenomenon may be that most of the previous studies selected college students as research subjects,<sup>63</sup> while the subject of our study is middle school students. Middle school students have simpler social networks, so it is easier for them to receive social support, which mainly comes from parents, teachers and classmates who are more closely connected.<sup>73</sup> In addition, middle school students mobile phone ownership rate is lower than that of college students,<sup>74</sup> so they are less likely to become addicted to mobile phones even if they lack social support. In addition, the scales for social support and MPD are different, which also affects the result.

## The Mediation of Social Support

Results of this study indicated that social support had a mediating effect between learning burnout and MPD, which was consistent with hypothesis 3. Specifically, learning burnout negatively impact social support and social support negatively



impact MPD among adolescents. The theory conservation of resources and social support buffer theory have been verified by this result. For the mediating role of social support, the likely reason is that support from family, teachers, and friends is used as a resource to perform self-control, and which is prior studies that indicated a positive relationship between a low level of self-control and MPD.<sup>75</sup> Learning burnout is considered to be a negative emotion that depletes adolescents' limited resources and gradually negatively affects self-control.<sup>76</sup> Many off-campus education institutions have disappeared or are on the verge of closure as the "double reduction" policy has been effectively implemented for more than a year.<sup>77</sup> A survey of 400 students in Fuzhou, China, found that 56.5% of students now spend less than 90 minutes on written homework, an effective reduction in homework load from 48% before policy implementation.<sup>78</sup> However, previous studies have mainly focused on the direct effects of the double reduction policy. Learning burnout is a subjective perception of students and cannot be measured by off-campus education and homework volume. Under the condition that the examination-oriented education and examination system in China remains unchanged, the indirect impact of the "double reduction" policy is the MPD problem of students. Students' learning burnout may not be effectively alleviated and the increase of students' leisure time are the two causes of MPD. An effective way to alleviate learning burnout and thus alleviate the MPD problem of students is to provide social support for students under the "double reduction" policy. Therefore, it is necessary to keep a close eye on MPD in adolescents with learning burnout symptoms, and it is important to provide them with adequate social support resources and encourage students to return to real life from virtual networks. Policies are regarded as a social determinant in the development of societies that can influence health and well-being by shaping the socio-economic and health-access environment.<sup>79</sup> Specifically, the makers of the "double reduction" policy, educators, and the public can contribute to reduce learning burnout and avoid the occurrence of MPD of adolescent by supporting measures into standard educational practice.<sup>80,81</sup> Compensating for psychological loss through mobile networks is not entirely negative. For individual learning burnout, normal use of mobile phone is considered as "constructive compensation", which will return to normal development after the completion of compensation, while excessive use of mobile phone will form "pathological compensation".<sup>82</sup> There is a need to build social support buffers through individuals, families and policymakers forming a "systematic compensation comprehensive psychotherapy" approach to avoid the "pathological compensation" consequences of excessive mobile phone use among adolescents. First of all, the government should fully develop community resources to meet the needs of adolescents to relax after learning burnout.<sup>2</sup> Secondly, in addition to banning students from using mobile phones, the cultivation of students' physical quality and sports quality should be taken as the key content, and schools should expand physical education programs and cultivate students' sports hobbies.<sup>83</sup> Thirdly, parents should guide teenagers to make the most of their time at home and strengthen the supervision on children's mobile phone use and timely detect, stop and correct adolescents' MPD.<sup>84</sup> Additionally, previous studies have found that the cause of MPD in individuals is not entirely due to the lack of realistic social support resources, but also may be due to the failure to make good use of existing social support.<sup>41</sup> Therefore, in addition to providing adequate social support to adolescents, we should also pay attention to their emotional social support and support utilization.

## Limitations

The results of this study are innovative, but there are constraints to consider. First, our cross-sectional study cannot determine cause and effect. Future cohort studies are needed to identify causal trends between learning burnout and MPD and to better understand the specific effects on the relationship. Second, self-reported variables can lead to information bias. Objective measures for MPD (Some of the links between actual use and addiction can be recorded by Mobile Phone Application.) should be used in the future studies.

## Conclusion

We found that the positive rate of MPD in Guizhou Province in western China is at a high level, which requires control. In addition, MPD was also significantly positively predicted by learning burnout, and social support level played a mediating role in the relationship between learning burnout and MPD in adolescents. This study emphasizes that a high level of social support may contribute to the reduction of MPD risk in learning burnout students. Under the "double reduction" policy, we suggest that social support intensification is probably an effective and viable strategy for MPD reduction in learning burnout students.

## Ethics Statement

Our study complies with the Declaration of Helsinki. Our study was approved by the Human Experiment Ethics Committee of Guizhou Medical University (No. 2021-229). All respondents read the consent form and completed the survey voluntarily. Informed consent was obtained from the participants and their parents.

## Acknowledgments

We thank all the participating institutions for providing information and assistance during the study. The authors also thank all members of the investigational team who collected the data.

## Funding

This work was supported by the Guizhou Province education science planning key topic, 2021 Innovation and Entrepreneurship Training Program for College Students in Guizhou Province, Research project of Guizhou Drug Evaluation Center (grant number: 2021A042, s202110660042, GZSADRHT2021004).

## Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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