PLOS ONE

Adolescent Resilience and Mobile Phone Addiction in Henan province of China: Impacts of Chain Mediating, Coping Style

--Manuscript Draft--

Manuscript Number:	PONE-D-22-09528
Article Type:	Research Article
Full Title:	Adolescent Resilience and Mobile Phone Addiction in Henan province of China: Impacts of Chain Mediating, Coping Style
Short Title:	The relationship between psychological resilience and mobile phone addiction in adolescents
Corresponding Author:	Anna Ma Xinxiang Medical University Xinxiang, CHINA
Keywords:	Keywords: Adolescent resilience; Coping style; Mobile phone addiction; China; DASS-21; Chain mediating
Abstract:	Abstract Background: As mobile phone use grows, so it brings benefits and risks. As an important part of adolescents healthy growth, resilience plays an indispensable role in Chinese adolescents. Thus, it is important to identify when mobile phone of adolescent use is addiction. This study proposed to explore the effects of adolescent resilience on mobile phone addiction, and tested the mediating role of coping style and depression, anxiety, and stress (DASS) on phone addiction among 2268 adolescents in the Henan Province. Methods: The adolescents were surveyed via an online questionnaire, and we used structural equation modeling to examine the correlations and moderation effects. All data analyses were performed using SPSS 26.0 and Amos 23.0. Results: The results show that both coping style and DASS could mediate the relationship between adolescent resilience and mobile phone addiction among Chinese adolescents. The relationship between adolescent resilience and mobile phone addiction in Chinese adolescents was mediated by the chain of coping styles and DASS. Conclusions: There is a negative relationship exists between resilience and mobile phone addiction in this population. In addition, stress, anxiety, depression, and coping style significantly influence the risk of adolescent mobile phone addiction and play an intermediary role in Chinese adolescent resilience and mobile phone addiction.
Order of Authors:	Anna Ma
	Hongjuan Chang
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Adolescent Resilience and Mobile Phone Addiction in Henan province of China: Impacts of Chain Mediating, Coping Style

Anna Ma[1 #a #b], Yan Yang[1], Shuangxi Guo[2], Xue Li[1], Shenhua Zhang[3], Hongjuan Chang[1*]

[1 #a] Xinxiang Medical University ,School of Nursing, Xinxiang, Henan province,China

[#b] St. Paul University, School of Nursing, Manila, Philippines

[2]The First Affiliated Hospital of Xinxiang Medical University, Department of Neurology, Xinxiang, Henan province, China

[3] Weihui Senior Middle School, Xinxiang, China

*** Correspondence:**

Hong juan Chang

E-mail: changhj0812@126.com

Conflict of Interest/Disclosure Statement

Competing interests

The authors declare that they have no competing interests and all methods were carried out in accordance with relevant guidelines and regulations. The authors alone are responsible for the content and writing of the article.

Funding

This work was supported by the National Natural Science Foundation of China(grant number: 81803252).

Ethics approval and consent to participate

The participants were under 18 years old, and we provided informed consent to their parents (or legal guardians). All procedures performed in studies involving human participants were approved by the Ethics Committee of Xinxiang Medical University(#XYLL-2018015).

Acknowledgements

Not applicable.

Abstract

Background: As mobile phone use grows, so it brings benefits and risks. As an important part of adolescents healthy growth, resilience plays an indispensable role in Chinese adolescents. Thus, it is important to identify when mobile phone of adolescent use is addiction. This study proposed to explore the effects of adolescent resilience on mobile phone addiction, and tested the mediating role of coping style and depression, anxiety, and stress (DASS) on phone addiction among 2268 adolescents in the Henan Province.

Methods: The adolescents were surveyed via an online questionnaire, and we used structural equation modeling to examine the correlations and moderation effects. All data analyses were performed using SPSS 26.0 and Amos 23.0.

Results: The results show that both coping style and DASS could mediate the relationship between adolescent resilience and mobile phone addiction among Chinese adolescents. The relationship between adolescent resilience and mobile phone addiction in Chinese adolescents was mediated by the chain of coping styles and DASS.

Conclusions: There is a negative relationship exists between resilience and mobile phone addiction in this population. In addition, stress, anxiety, depression, and coping style significantly influence the risk of adolescent mobile phone addiction and play an intermediary role in Chinese adolescent resilience and mobile phone addiction.

Keywords: Adolescent resilience; Coping style; Mobile phone addiction; China; DASS-21; Chain mediating

Introduction

With the development of information technology, the functions of mobile phone is becoming more and more powerful, it is considered as an important communication tool and social accessory. Due to the COVID-19 outbreak, mobile phones have become increasingly important for online teaching and learning in China. According to the 48th China statistical report on internet development, by June 2021, there were 1.07 billion mobile phone users in China, accounting for 99.7% of the total number of internet users. Furthermore, internet users spend an average of 26.9 hours online per week, and the number of internet users between the ages of 6 and 19 reached 158 million, accounting for 15.7% of the total(China Internet Network Information Center,2021). As part of normal adolescent psychological development, this age group develops susceptibility to peer influences and tends to have low-risk perception—factors that can result in increased risk-taking behavior and poor self-regulation (Patton GC,2016). Regarding the emotional state of adolescents, stressful life events have been identified as a significant risk factor, and the spread of COVID-19 led to substantial social and economic changes because many governments adapted quarantine policies to assure a population of safety and prevent the virus from spreading. Psychopathologists focused on the psychological impact of COVID-19 and its variations in the adolescent population; they identified moderate to severe levels of stress, anxiety, and depression in this population (Ozamiz-Etxebarria, N.,2020). There was a moderate positive correlation between negative coping style and adolescents' mobile phone addiction

(Guang Li Lu,2021).

In the middle of July 2021, the Henan province suffered from unusually heavy rainfall and maximum continuous rainfall of 958 mm (The Tenth Press Conference of Henan Province Flood Control and Disaster Relief,2021), causing severe flooding. The flood, named the "7.20 Henan rainstorm," blasted the overwhelmed dams and banks of rivers in a short time, causing severe traffic paralysis, water power failure, waterlogging, and upending tens of millions of lives. Randeniya reported that sleeping difficulties were the most affected problem by flooding disasters in adolescents of Sri Lanka (Enoka Randeniya,2018). Makwana indicated that the psychological effects of the disaster were fiercer among children, women, and the dependent elderly population (Makwana N,2019). Furthermore, research has shown significant differences exist in psychological effects among adolescents in terms of gender and family size(Satadeepa Som,2019; Breik,2019).

Many scholars believe that adolescent resilience is also related to substance use, such as smoking and excessive drinking (alcoholism) (Davis SJ,2011). Some experts also believe that depression, anxiety, and pressure may lead to internet addiction(Carli V,2013). However, studies on the relationship between mental resilience and adolescents' coping styles, mental health, and mobile phone addiction are rare.

In view of this, adolescents confined to their homes may be likely to overuse mobile phones and the internet due to floods in Henan province of China. Thus, we hypothesized that there is a correlation between resilience and mobile phone addiction among adolescents and that coping style and mental health play a mediating role in that

relationship.

“Coping” means constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding a person’s resources (Lazarus, R. S.,1984). Chapman thought that adolescents with lower self-esteem engage in coping strategies of ventilating feelings, avoiding problems, and relaxing, and adolescents with higher self-esteem were more likely to engage in coping styles that directly address solving the problem(Chapman, Paula L.1999). During the COVID-19 pandemic, children who used positive strategies to cope with the situation suffered less emotionally and behaviorally (Orgilés M,2021). Fang Liu found negative coping style mediated the relationship between smartphone addiction and childhood psychological maltreatment(Fang Liu,2020). Psychological resilience is the ability to cope with a crisis or to quickly return to a pre-crisis status from mentally or emotionally (de Terte, I., & Stephens, C,2014). Resilience is an important developmental stage during adolescence, as it is a transitional period characterized by significant neurobiological and psychosocial changes in the context of amplifying environmental demands and increasing sensitivity to social contexts (Schriber, R. A. & Guyer, A. E,2016).

Resilience has neurobiological, physical, social, cognitive-behavioral, and emotional regulation foundations (Southwick, S. M.,2014; Southwick, S. M. & Charney, D. S,2012; Hu, T., Zhang, D. & Wang, J,2015). However, how the neurobiological and psychosocial factors influence resilience in adolescence is not well understood. Malhi et al. proposed a model that captures the dynamic nature of resilience in adolescents,

with special attention to how it emerges, how neurobiological and psychosocial factors interact to build and strengthen resilience, and individual differences in resilience (Malhi, G.S., 2019). Resilience negatively predicted the negative coping style and positively predicted the positive coping style, life events not only had direct influenced negative coping style and positive coping style but also had indirect influenced coping styles by affecting resilience(Li J,2020). The mutually enhancing relationship between resilience and positive mental health, and vice versa, a mutually reducing relationship between resilience and mental illness, and presented the significant influence of mental health level on resilience(Wu Y,2020). Malek showed that avoidant coping styles can aggravate depressive, anxiety, and stress symptoms in participants during the COVID-19 pandemic. Keeping optimism, resilience, and approach coping styles can decrease the mental health burden of the pandemic on participants (Smida, M.,2021).

Based on the literature review above, the present study constructed a chain mediation model to examine the mediating role of negative coping, stress, anxiety, and depression in the relationship between adolescent resilience and mobile phone addiction among Chinese adolescents. Furthermore, we proposed a model to test the associations among Chinese adolescent resilience, coping style, mental health, and mobile phone addiction, to further clarify mobile phone addiction related to resilience (Figure 1).

Methods

Participants

The convenience sampling method was employed to select students from grades 7th to 9th of middle school and grades 1st to 3rd of high school in Henan province of China to complete the questionnaires online from July 1 to August30, 2021. In total, 2268 valid questionnaires were obtained, with an effective rate of 97.28%. Among them, the mean age was 14.90 years (*SD* = 2.58, range = 12–21 years), participants included 979 boys(43.20%)and 1289 girls (56.80%). They completed a survey that included demographic variables, a mobile phone addiction index (MPAI), a depression, anxiety, and stress scale with 21 items (DASS-21), the Resilience Scale for Chinese Adolescents (RSCA), and the Simplified coping style questionnaire (SCSQ).

Measurement of Structures

DASS-21

The DASS-21was used to evaluate negative emotional states of depression, anxiety, and stress(Lovibond, P.F., Lovibond, S.H,1995), refer to the previous week, and each item is classified into four Likert responses from 0 to 3, from 0 = “nothing” to 3 = “Most of the time.” This self-report instrument includes three subscales: 1) the stress subscale, which measures tension, agitation, difficulty relaxing, and negative affection; 2)the anxiety subscale, which assesses autonomic arousal, skeletal musculature effects, situational anxiety, and subjective experience of anxious arousal; and 3) the depression subscale, which measures hopelessness, dysphoria, lack of interest, self-deprecation, and inertia. The reliability coefficients of depression,

anxiety and stress were 0.82, 0.82 and 0.79, respectively. The Cronbach's alpha of the total scale was 0.89.

MPAI

The MPAI was designed by Louis Leung to identify addiction symptoms associated with mobile phone use among adolescents in Hong Kong(Louis Leung,2008). The scale includes 17 items answered on a five-point Likert scale of 1 to 5 (1 = not at all; 2 = rarely; 3 = occasionally; 4 = often; and 5 = always). The scale covers four dimensions: 1) "inability to control craving," which reflects the amount of time adolescents spend on the mobile phone, thereby leading to complaints from family and friends about their compulsive mobile phone use and causing the adolescents loss of sleep due to the excessive use; 2) "Anxiety and feeling lost" assesses preoccupation, feeling lost or anxious, and having difficulty switching off the mobile phone; 3)"productivity loss" measures decreased productivity and diverted attention from pressing issues due to adolescents' excessive use mobile phones; 4) "withdrawal and escape" indicates that adolescents use their mobile phones to escape from isolation, loneliness, and feeling down. The Cronbach's alpha of scale was 0.90.

RSCA

The RSCA was developed by Yueqin Hu(Yueqin Hu, 2008)according to the process model of the resilience concept and applied to Chinese adolescents. There are 27 items divided into two factors: "manpower" and "support"; the former includes three factors: goal focus, emotion control, and positive cognition; the latter includes two

factors: family support and interpersonal assistance. The reliability of the total scale was 0.85.

SCSQ

This SCSQ was designed by Ya-Ning Xie (Ya-Ning Xie,1998), combined with the characteristics of culture in China, to simplify the ways of coping questionaires and modify, compiled a simple coping style questionnaire, composed of 20 items, often involving people in daily life may take different attitude and measures, according to people in relatively separated suffered setbacks coping styles can be two categories: “positive coping” and “negative coping." The reliability of the total scale was 0.90, while the positive coping and negative response subscales were 0.89 and 0.78, respectively.

Data Analysis

All data analyses were performed using SPSS 26.0 and Amos 23 (IBM Inc., Armonk, NY, USA). First, descriptive data were received using SPSS 26.0, and correlations variables were calculated using Pearson’s correlations. Second, according to Baron and Kenny(Baron,R.M.,Kenny,D.A. ,1986), we analyzed the mediation effects using two measurement models to examine how well the indicators represented each latent variable. Second, we tested the hypothesized relationships among latent variables. Maximum likelihood (ML) estimation was used to test the two structural models in the AMOS 23.0 program. When TLI > 0.90, CFI > 0.90, and RMSEA < 0.06, the

model fits well, according to Hu and Bentler (Hu, L. T., 1999).We followed the stepwise method to structure the best-fitting model for the mediated effects and bootstrapping with 5000 replications to measure the chain mediation model. All data analyses were two-tailed, with significance levels of $P < 0.01$ and $P < 0.05$.

Results

Descriptive Statistics

We included 2268 participants, including 979 boys (43.20%) and 1289 girls (56.80%), in the final analysis. The proportion of girls was slightly higher than that of boys (56.80% vs. 43.20%). The mean age was 14.90 years (SD = 2.58, range 12–21 years). There were 1244 (54.85%) participants in the middle school, 1,024 (45.15%) in the high school, 169 (7.50%) from one-child families, 2099 (92.50%) were from non-one-child families. The other results are shown in Table 1.

Univariate Analysis

As displayed in Table 2, the results for the 2268 participants, The category totals as total mean (*SD*) are as follows: MPAI, 39.57 (±13.82); DASS-21, 5.190 (±4.57); positive coping was 22.45 (±9.18); negative coping, 11.93 (±5.64); RSCA, 88.89 (±18.50).

Correlation Analysis of Major Study Variables

The variables correlated with the constructs in Table 3 were less than 0.85. The discriminant validity value (< 0.85) was met in the construct correlation (Kline RB,2005). These findings showed that valid and reliable constructs were used.

Structural Model Testing and Structural Relationship Between Constructs

The test results revealed the goodness of fit of the proposed structural model ($\chi 2/df$ = 2.57, RMSEA = 0.054, GFI = 0.978, CFI = 0.984). The hypothesis relationships between the variates are demonstrated in Table 4 and Figure 2. The indirect effects are presented in Table 5. Bootstrapping (the process was repeated 5000 times)analyses showed that the indirect effects of adolescent resilience on mobile phone addiction through negative coping and stress, anxiety, and depression were significant and positive (standardized indirect effect 0.029,95%CI [0.012,0.048], P < 0.01), and the indirect effect of adolescent resilience on mobile phone addiction through stress, anxiety, depression was 0.111, 95% CI [0.045, 0.186], P < 0.01, excluding 0, and mediating effect was significant. The indirect effect of adolescent resilience on mobile phone addiction through negative coping was -0.092, 95% CI [-0.125, -0.061], P < 0.01, excluding 0, and the mediating effect was significant.

Discussion

This study surveyed the ways by which adolescent psychological resilience, coping style and Depression, anxiety, and stress affected mobile phone addiction among Chinese adolescents. The results showed that adolescent psychological resilience

could directly and negatively affect mobile phone addiction in Chinese adolescents, which is consistent with previous research findings (Robertson, T.W., 2018). According to the psychological resilience framework theory (Kumpfe K.L. , 2004), psychological resilience is an important protective factor for problem behavior and personal mental health. Griffiths argued that addictions consist of several components, such as relapse, mood modification, tolerance, conflict, and withdrawal (Mark Griffiths,2005). In the studies, psychological resilience was found to protect the addictive behaviors (internet problematic use)(Lee Y.K.,2014; Hou X.L.,2017).Adolescent mobile phone addiction affect their life and study, and this study suggests that family, peer, teacher support, and exercise help enhance the brain and make it more resilient to adversity and stress.

The experimental results show that negative coping style is negatively correlated with adolescents psychological resilience, negative coping style is negatively correlated with mobile phone addiction. It shows that adolescents with good psychological resilience are more likely to adopt positive coping styles when facing pressure and frustration and are less likely to addicted to mobile phones; this results show that negative coping styles and depression, anxiety, and stress (DASS) play intermediary roles, respectively, in adolescent resilience and mobile phone addiction in Chinese adolescents; thus, our hypothesis was verified. This finding is consistent with the results of previous studies. Understanding how one copes with stress and managing coping styles can be particularly effective for smartphone addiction (Alan R, 2020).

The Simplified Coping Style Questionnaire(SCSQ) results revealed that coping style had a maximal effect on adolescent mobile phone addiction (Lu GL,2021). Many studies have indicated a relationship between depression, anxiety, and loneliness with smartphone usage (Ozen S, 2017; Elhai JD,2018). Depression and social anxiety are risk determinants for greater problematic smartphone use (Pera A,2020). Stress, anxiety, and depression were significantly positively correlated with smartphone addiction (Sonali Tanmay Choksi, 2021). The found a significant positive relationship between anxiety about COVID-19 infection and daily smartphone use hours; the largest predictor of smartphone addiction was anxiety about COVID-19 infection (Al. Qudah, M.F.,2021).

Negative coping style and DASS played a continuous intermediary role in the impact of adolescent resilience on mobile phone addiction among Chinese adolescents. Smartphone users who experience depressive symptoms may similarly use their mobile devices as a coping strategy to alleviate these unpleasant symptoms (Ahn, S. Y., 2015). Coping and affective disorders appear to play key roles in international addiction among adolescents (Einar B,2017). COVID-19 and floods as stressors can cause psychological stress responses in adolescents, and differences in coping styles can cause differences in behaviors in adolescents. Coping style is a significant factor leading to smartphone addiction among adolescents. Problem-focused coping strategies indicate that coping behaviors directly target the source of stress and can prompt participants to use positive coping styles to deal with the adverse

consequences of the pandemic; conversely, coping styles of avoidance, denial, and fantasy in dealing with stress make it a potentially strong risk factor for smartphone addiction (Stahl GK, 2005; Duan L,2021).

Limitations

This study had several limitations. The convenience sample limits the universality of the results. Factors such as family environment, personality traits, peer relationships, and sleep quality may also affect mobile phone addiction among adolescents. Therefore, future studies should examine whether the relationship between Chinese adolescent resilience, coping style, DASS, and mobile phone addiction will change over time.

Conclusions

This study explored the impact mechanism of the effect of resilience on mobile phone addiction among Chinese adolescents during a pandemic and flood. The structural equation model was utilized to synchronously examine the individual and continuous mediating roles of coping styles and DASS. This study results indicate a negative relationship exists between resilience and mobile phone addiction in this population. In addition, stress, anxiety, depression, and coping style significantly influence the risk of adolescent mobile phone addiction and play an intermediary role in Chinese adolescent resilience and mobile phone addiction. These results indicate the importance of mobile phone addiction and the importance of resilience for

adolescents. The findings may also help educators and medical personnel distinguish between predictive factors for adolescent mobile phone addiction; they could be used to design intervention to effectively treat and prevent mobile phone addiction in adolescents when dealing with future difficult and traumatic events.

List of abbreviations

DASS: depression, anxiety, and stress; MPAI: mobile phone addiction index; RSCA: the Resilience Scale for Chinese Adolescents ; SCSQ: the Simplified coping style questionnaire.

Acknowledgements

Not applicable.

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Supporting information

S1 Fig.

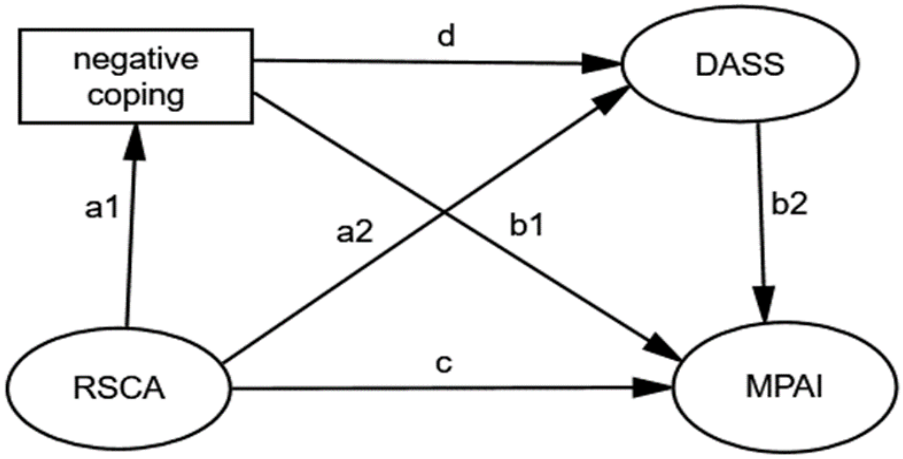

Figure 1 Hypothesized model

Notes: mobile phone addiction index (MPAI); depression, anxiety, and stress scale with

21 items (DASS-21); Resilience Scale for Chinese Adolescents (RSCA); Simplified coping style questionnaire (SCSQ).

S2 Fig.

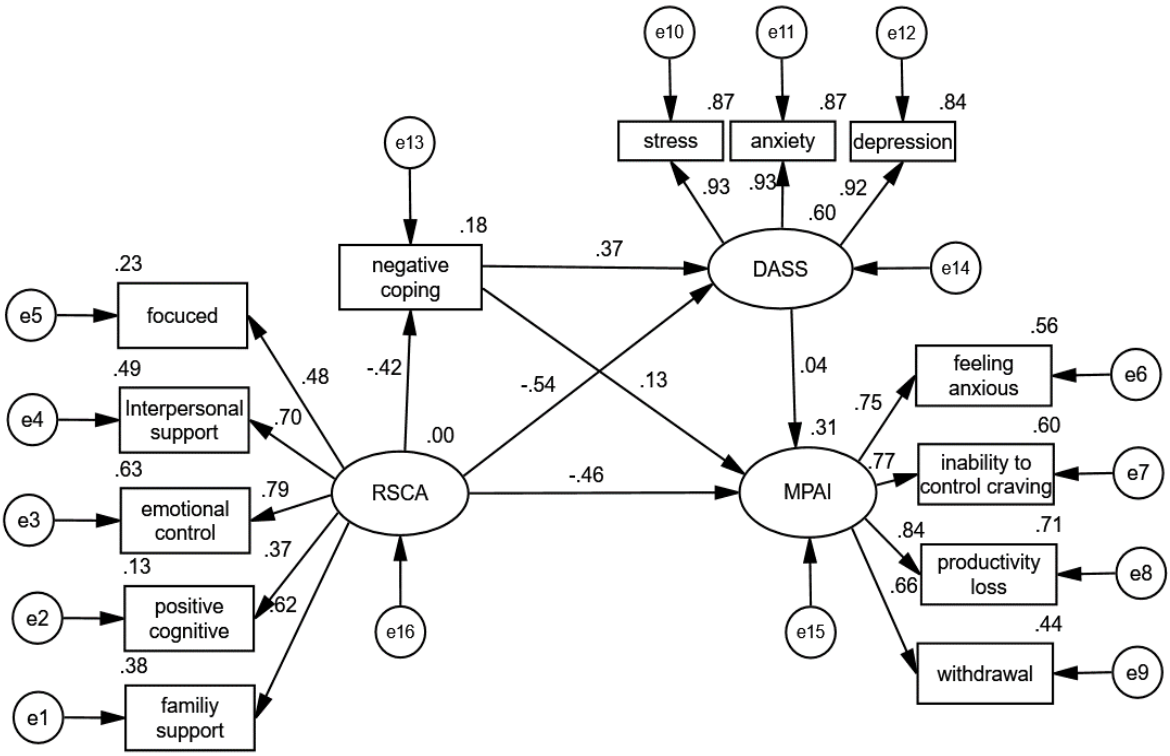

Figure 2 The standardized path coefficients in model testing

S1 Table.

Table 1: Demographic profiles and descriptive statistics of the participants.

Gender	Frequency	Percentage
boy	979	43.2
girl	1289	56.8
One-child		
yes	169	7.5
no	2099	92.5
Birth order		
1st	1048	46.2
2nd	1041	45.9
3rd	179	7.9
Nationality		
Han	2259	99.6
Hui	8	0.4
Miao	1	0.0
Grade		
middle school 7th	174	7.7
middle school 8th	634	28.0
middle school 9th	436	19.2
high school 1st	34	1.5
high school 2nd	471	20.8
high school 3rd	519	22.9
Total	2268	100.0

S2 Table.

	M	Std.Error of Mean	Frequency	Percentage
Age	14.90	2.58		
MPAI Total	39.57	13.82		
feeling anxious&lost	7.96	4.02		
inability to control craving	16.65	5.92		
productivity loss	7.64	3.28		
withdrawal	7.32	3.49		
DASS-21 Total	5.19	4.57		
Stress	7.40	5.07		
normal			2054.00	90.56
mild			124.00	5.47
moderate			76.00	3.35
severe			14.00	0.62
extremely severe			0.00	0.00
Anxiety	6.31	4.94		
normal			1583.00	69.80
mild			218.00	9.61
moderate			304.00	13.40
severe			103.00	4.54
extremely severe			60.00	2.65
Depression	6.58	5.09		
normal			1773.00	78.18
mild			258.00	11.38
moderate			179.00	7.89
severe			48.00	2.12
extremely severe			10.00	0.44
SCSQ Total	56.39	17.91		
positive coping	22.45	9.18		
negative coping	11.93	5.64		
RSCA Total	88.89	18.50		
focuced	16.24	4.88		
Interpersonal support	18.51	5.90		
emotional control	19.63	5.76		

Positive cognitive	14.30	3.78
familiy support	16.77	4.50

Table 2. Basic characteristics and measure scores.

S3 Table.

Table3: Correlation analysis of study variables

	1	2	3	4
1.RSCA Total	1			
2.Negative coping	-.317**	1		
3.DASS-21 Total	-.593**	.603**	1	
4.MPAI Total	-.405**	.322**	.448**	1

Note: ***P* < 0.01

S4 Table.

Table 4. Results of the structural model: tests of hypothesized associations between constructs.

			Estimate	S.E.	t-value	P
negative coping	**<---**	**RSCA**	-1.025	0.078	-13.216	***
DASS	**<---**	**negative coping**	0.292	0.017	16.871	***
DASS	**<---**	**RSCA**	-1.152	0.061	-18.992	***
MPAI	**<---**	**RSCA**	-0.836	0.07	-11.919	***
MPAI	**<---**	**negative coping**	0.09	0.017	5.355	***
MPAI	**<---**	**DASS**	-0.096	0.031	-3.092	0.002

Note: ***P < 0.01

S5 Table.

Table 5. Bootstrap truncated regression results.

				Bootstrapping				
		Product of coefficients		BC 95%CI		Percentile 95%CI		
Relationships	**point estimate**	***SE***	***Z***	**Lower**	**Upper**	**Lower**	**Upper**	***P***
				Indirect Effects				
RSCA → negative coping → MPAI	-0.092	0.018	-5.111	-0.125	-0.061	-0.125	-0.061	0
RSCA → DASS → MPAI	0.111	0.043	2.581	0.043	0.188	0.045	0.186	0.002
RSCA → negative coping → DASS→ MPAI	0.029	0.011	2.636	0.012	0.048	0.012	0.048	0.002
Total	-0.789	0.052	-15.173	-0.889	-0.698	-0.89	-0.699	0

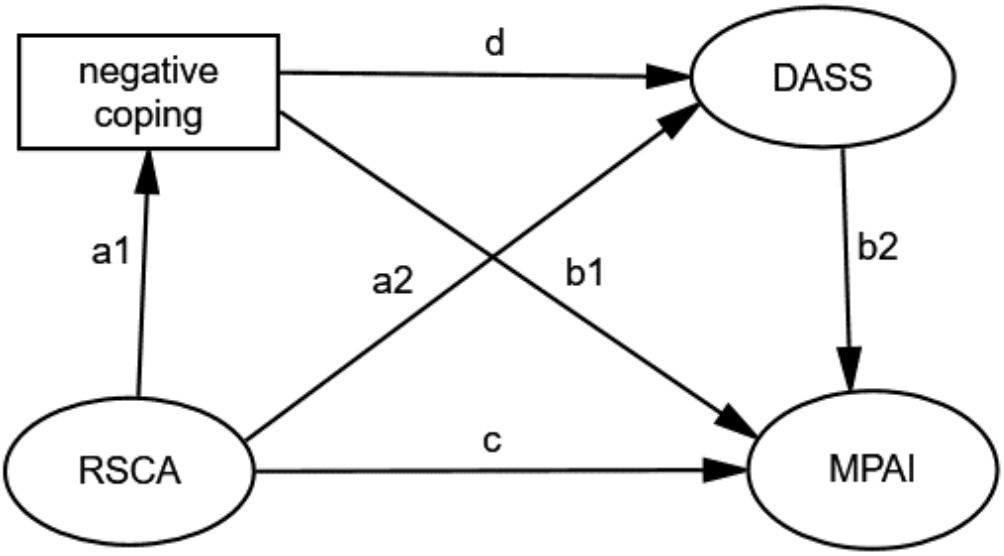

Figure 1 Hypothesized model

Notes: mobile phone addiction index (MPAI); depression, anxiety, and stress scale with 21 items (DASS-21); Resilience Scale for Chinese Adolescents (RSCA); Simplified coping style questionnaire (SCSQ).

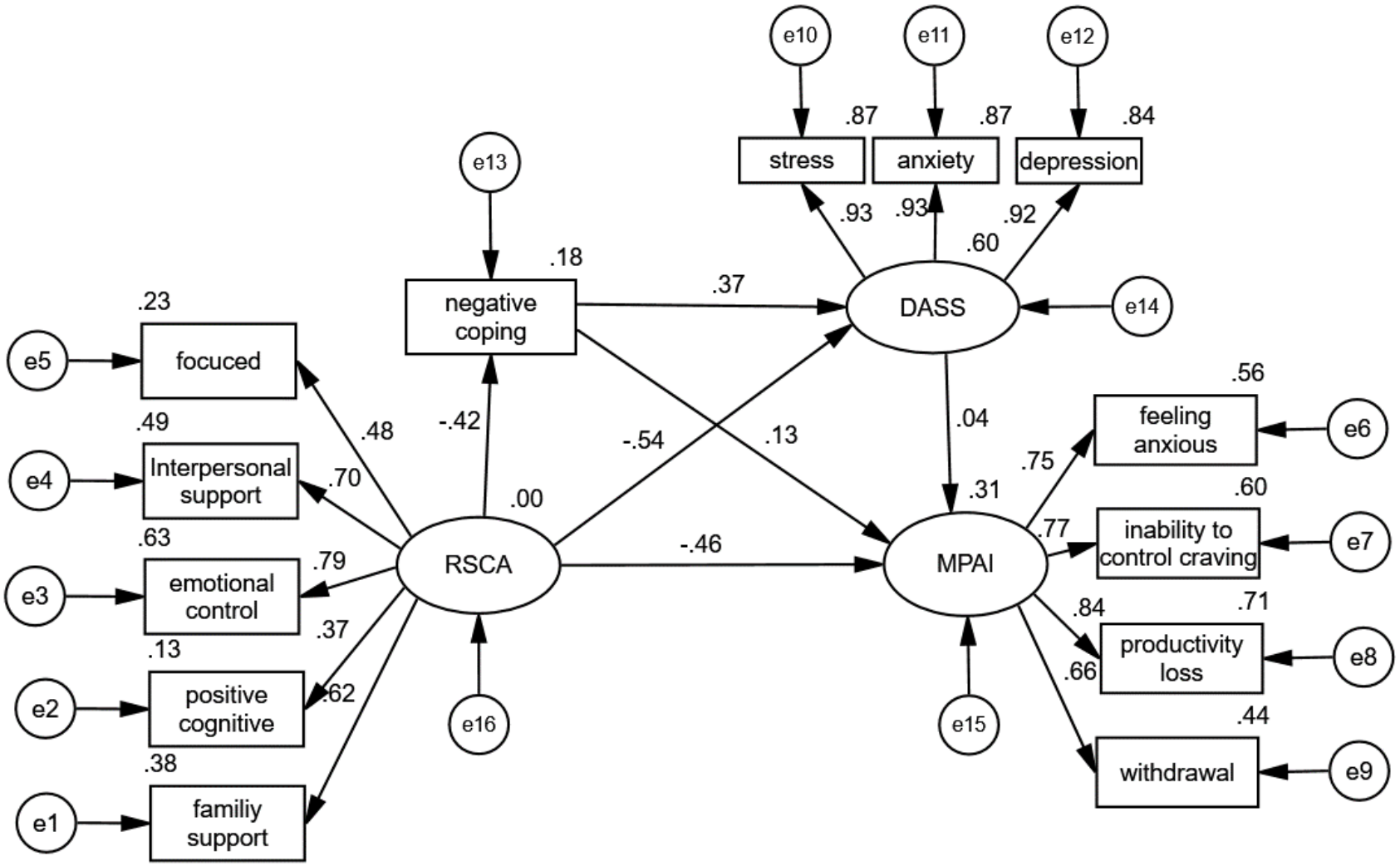

Figure 2 The standardized path coefficients in model testing