



## Research article

# The effect of childhood harshness and unpredictability on Internet addiction among college students: The mediating effect of self-control

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## ABSTRACT

College students are inevitably online and at risk of becoming addicted. Life history theory provides an explanatory framework for individual differences in Internet addiction, and childhood harshness and unpredictability may be important antecedents. However, it is unclear whether and how childhood harshness and/or unpredictability affect Internet addiction during college. In this study, we recruited 483 Chinese college students and assessed their childhood harshness, unpredictability, self-control, and Internet addiction. The results of path analysis showed that childhood unpredictability was positively associated with Internet addiction among college students and was partially mediated by self-control. The effect of harshness on Internet addiction showed a suppression effect, i.e., the direct effect of harshness on Internet addiction was negative and the indirect effect through self-control was positive. This suggests that the high risk of Internet addiction stems from harshness and unpredictability in childhood, but that the effects of these factors are independent and distinct. Self-control plays an important role in this process, but many internal mechanisms remain to be tested in future research.

## 1. Introduction

The Internet has both pros and cons that need to be taken seriously. Many people who enjoy the convenience and pleasure of the Internet also suffer from the negative effects of overdependence [1,2]. In particular, college students are more susceptible to Internet addiction than others, as they inevitably have to use the Internet frequently in their daily studies and life [2–4]. Numerous studies have found that many college students spend a great deal of time gaming, socializing, and browsing or downloading information on the Internet, making it difficult for them to extricate themselves [5–10]. This could lead to serious academic problems (e.g., poor academic performance [8,11] and academic procrastination [12,13]), and impaired physical and mental health (e.g., sleep problems [14,15], eating disorders [16], depression [11,14], anxiety [5], and even suicide attempts [17]).

Recently, there has been growing interest in providing an evolutionary explanation for Internet addiction [10,18–20]. Internet addiction, as an impulse control disorder, is considered negative from a developmental psychopathology perspective, but neither bad nor good from an evolutionary perspective. Under specific conditions, individuals can be driven by Internet addiction to crave

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immediate hedonic rewards or social rewards, thereby increasing their adaptive advantage [18,19]. Addiction may be passed genetically based on adaptations to the population's environment, but this can only be explained at the level of population selection. Life history theory, as an evolutionary perspective, provides an explanation for individual differences in behavioral risk, suggesting that individuals' behavior strategies may be selected based on their genetic diversity and early life environmental risk (i.e., childhood harshness and unpredictability) [21–23]. However, few studies have focused on the role of life history-related environmental factors in individual differences in Internet addiction. In the present study, we aim to contribute to the existing literature by investigating whether and how childhood harshness and/or unpredictability influence Internet addiction among college students from the life history theory perspective.

### 1.1. Harshness and unpredictability

Life history theory provides a basic framework for comprehending individual differences in physiology and behavior and their developmental antecedents [21,22,24]. Owing to limited resources (time, energy, and other resources), organisms must make trade-offs to allocate resources among life functions (maintenance, survival, reproduction), and to maximize their reproductive fitness, often unconsciously [21,22,25]. Individuals develop resource allocation strategies (i.e., life history strategies) along a fast-to-slow continuum. The faster life history strategy are related to earlier sexual maturation, earlier reproductive effort, and less parental investment, and behaviorally, they are short-term orientation, less self-control, more impulsive, and more socially deviant and risky behaviors [10,21–23,26–29]. On the contrary, individuals who adopt slower life history strategies tend to have a long-term orientation, more inhibitory control, and delayed gratification [19,21,22,26]. In particular, recent research has shown that faster life history strategies indirectly affected Internet gaming disorder [10], and directly affected smartphone addiction [10] and problematic use of short-form video applications [19]. We are more interested in their developmental antecedents.

Ellis and co-workers suggested that environmental harshness and unpredictability in early life are salient determinants of life history strategies [22]. Harshness is defined as resource scarcity and extrinsic morbidity-mortality, often using childhood socioeconomic status (SES) as an indicator [22,27,30]. Lower SES in the first years implies resource scarcity and short life expectancy, and thus a tendency to develop faster life history strategies to optimize fitness [22,30]. Unpredictability refers to stochastic and frequent changes in environmental conditions, including changes in family ecology [31] and parental inconsistency [32,33]. Individuals with unpredictable environments need to adopt faster life history strategies to hedge against environmental change [22]. The environmental harshness and unpredictability in early life provide an early warning of future survival, allowing individuals to gain short-term rewards in an addictive way, with hedonistic pleasures, sensory stimulation, and instant social interaction, enabling them to “make the best of bad situations” [34].

Many studies have found that harshness and unpredictability play unique and distinct roles in life history strategy-related behaviors [23,26,30,35,36]. For example, Doom et al. found that both childhood harshness (lower childhood SES) and unpredictability predicted greater substance use at age 16, but only unpredictability, not harshness, predicted more externalizing problems at age 16 [26]. However, to our knowledge, no studies have distinguished between the effects of harshness and unpredictability on Internet addiction.

There is no doubt that SES is a predictor of problems related to Internet addiction, but research findings are inconsistent. The majority of studies have found that the lower the family SES, the more likely a teenager or college student is to experience Internet addiction [37,38], online gaming addiction [39], online shopping addiction [40], and online social media addiction [7]. However, studies have also found the opposite conclusion, that there is a positive relationship between family SES and Internet addiction among university students [13,41]. Koo and his co-workers argued that higher family SES meant having more Internet-connected devices and therefore more opportunities to access the Internet [41]. Little is known about the impact of unpredictability on Internet addiction. This leads to three curiosities: (1) whether perceived early life SES has the same effect as current family SES, as the former is more consistent with harshness; (2) whether the effect of childhood SES on Internet addiction among Chinese college students is positive or negative, (3) whether childhood unpredictability affects Internet addiction.

### 1.2. Self-control

A growing body of theoretical work [24,42] and empirical evidence [10,28] suggests that self-control may be a key pathway through which life history strategies influence addictive behaviors. Self-control occupies a central position among the traits related to life history strategies. Lower levels of self-control are closely associated with faster life history strategies, mainly in terms of present orientation and a lack of behavioral inhibition, enabling individuals to maximize resources in the short term [42]. It is almost undisputed that the level of self-control is a key predictor of whether college students will become addicted to the Internet [4,43–46]. Stronger evidence was provided by Zhang et al. [10], that impulse control mediates the effects of faster life history strategies on smartphone addiction and gaming disorder. Given that life history strategies are shaped by early life environments [22,30], it is reasonable to infer that self-control plays a mediating role between early life environmental risk and Internet addiction.

However, the understanding of harshness and unpredictability as influencing self-control or behavioral addiction is ambiguous. According to a study by Warren & Barnett [29], harshness (particularly neighborhood harshness), but not unpredictability, negatively predicted the development of effortful control at 36 months. In contrast, a study by Szepeswol et al. found that environmental unpredictability in early life, but not harshness, was an indirect negative predictor of emotional control at age 32 [36]. This suggests that harshness and unpredictability are unique and distinct predictors of self-control, perhaps with different sensitivities to period and situation. For this reason, it is important to investigate whether childhood harshness and/or unpredictability are more likely to influence Internet addiction through self-control, which may improve the existing framework.

### 1.3. The current study

In the present study, we used a cross-sectional study to examine the relationship between childhood harshness (childhood SES), childhood unpredictability, self-control, and Internet addiction in a sample of Chinese college students. Given that most previous studies have confounded the effects of harshness and unpredictability on Internet addiction by measuring only SES or more integrated concepts (e.g., fast life history strategy, childhood adversity), we attempted to statistically uncover the effects of harshness and unpredictability separately.

According to the life history theory perspective, growing up in harsh or unpredictable environments during childhood will tend to develop faster life history strategies traits, such as lack of self-control, which in turn leads to one more likely to exhibit addictive behaviors in adulthood. Therefore, we used path analysis to construct a mediation model, i.e., two independent variables (childhood harshness and unpredictability) affect one dependent variable (Internet addiction) via one mediator variable (self-control), and tested the following hypotheses.

- H1. Childhood harshness is positively correlated with Internet addiction.
- H2. Childhood unpredictability is positively correlated with Internet addiction.
- H3. Self-control is negatively correlated with Internet addiction.
- H4. Lower self-control mediates the effect of childhood harshness on Internet addiction.
- H5. Lower self-control mediates the effect of childhood unpredictability on Internet addiction.

## 2. Methods

### 2.1. Participants

From 20 April to May 20, 2022, we conducted a survey at a university in Zhejiang Province, China, using a convenience sampling method. We created a link to the questionnaires via an online survey platform (Questionnaire Star, <http://www.wjx.cn>), which has been widely used in China [47], and distributed the link to students via the university's Tencent QQ subject group (the sample pool of Zhejiang Sci-Tech University). 554 undergraduates participated in the survey. We removed participants who did not pass the attention check ( $n = 64$ ) [48] and those who reported that their years of Internet use to date (which we termed 'Internet age' in China,  $n = 7$ ) exceeded their age. In the end, 483 valid questionnaires were retained. As this study used structural equation modeling (SEM) for path analysis, according to Jackson's N:q rule, the recommended minimum ratio of sample size (N) to parameters (q) would be 20:1 [49]. There were 9 distinct parameters to be estimated in the path analysis model, so the minimum sample size for this study is  $N = 180$ . In addition, Jackson also suggested that the larger the N:q, the better [49], and many researchers suggested that the minimum sample size of SEM should be more than 200 [50]. Therefore, the sample size of this study was good enough for the path analysis model. Of the valid participants, 219 were male, 264 were female, their mean age was 20.84 years ( $SD = 1.63$  years), and the socio-demographic information was shown in Table 1. This study was in accordance with the Declaration of Helsinki, and approved by the Ethics Committee for Psychological Research at Zhejiang Sci-Tech University. The survey instructions stated that completion the questionnaire implied consent for participation and the publication of survey results. All participants voluntarily and anonymously took part in this study.

**Table 1**  
Descriptive statistics of the socio-demographic information.

	N	M(SD)	%(n)	Range
Age	483	20.84 (1.63)		18–28
Internet age	483	8.62 (3.55)		0–25
Gender (%male)	483		45.34 % (219)	0–1
Location in childhood (%urban)	483		54.24 % (262)	0–1
Year in university	483			1–4
1st year			20.08 % (97)	
2nd year			36.02 % (174)	
3rd year			21.12 % (102)	
4th year			22.77 % (110)	
Monthly family income (CYN)	483			1–6
0-2500			1.45 % (7)	
2501-7500			25.05 % (121)	
7501-12500			34.58 % (167)	
12501-17500			22.57 % (109)	
17501-22500			7.87 % (38)	
>22501			8.49 % (41)	

Note: CYN = Chinese Yuan.

## 2.2. Measures

### 2.2.1. Childhood harshness

As in previous studies [27,51], childhood harshness was operationalized as lower SES in childhood, which was assessed by using the Childhood SES Scale. Participants point out their agreement with three statements, “My family usually had enough money for things when I was growing up”, “I grew up in a relatively wealthy neighborhood”, “I felt relatively wealthy compared to the other kids in my school” [27], using a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). All of the items were scored reversely, so that higher total scores indicated higher levels of childhood harshness (i.e., lower childhood SES). We assessed the construct validity of 3 items using Confirmatory Factor Analysis (CFA) and found that the model was a good fit ( $\chi^2(1) = 1.960$ ,  $\chi^2/df = 1.960$ , CFI = 0.998, RMSEA = 0.045, SRMR = 0.011). Cronbach’s alpha was 0.81 in the current study.

### 2.2.2. Childhood unpredictability

Following previous studies [51,52], we measured the unpredictability of childhood in two dimensions: the unpredictability of the living environment (3 items, e.g., “things were often chaotic in my house”) [31], and the unpredictability of parents’ emotions and behaviors (6 items, e.g. “Whether or not my parents disciplined me when I acted up depended on her mood at the time”) [32]. All items were scored by a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) and the higher scores meant a more unpredictable childhood. We used CFA to assess the construct validity of 9 items, and the model showed adequate fit ( $\chi^2(23) = 89.085$ ,  $\chi^2/df = 3.87$ , CFI = 0.956, RMSEA = 0.077, SRMR = 0.044). Cronbach’s alpha was 0.85 in the current study.

### 2.2.3. Self-control

Self-control was assessed by 19 items Self-Control Scale for Chinese College Students [53], which was revised by Tan and Guo on the basis of Tangney’s Self-Control Scale [54]. It consisted of five dimensions: controlling impulses, keeping healthy habits, resisting temptation, concentrating on work, and controlling entertainment. Items were answered with a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) and a higher score shows a higher level of individual self-control. This scale has shown good reliability and validity among Chinese students in previous research, such as studies by Jiang & Zhao [44] or Yang et al. [46], and the reliability ( $\alpha = 0.90$ ) and validity ( $\chi^2(143) = 505.610$ ,  $\chi^2/df = 3.536$ , CFI = 0.906, RMSEA = 0.073, SRMR = 0.061) of the scale in the current study were also good.

### 2.2.4. Internet addiction

Internet addiction was assessed using the Different Types of Internet Addiction Scales for Chinese Undergraduates compiled by Zhou and Yang [55]. It included 20 items, divided into three types of Internet game addiction (e.g., “I often neglect many things around me because I concentrate on playing games.”), Internet relationship addiction (e.g., “Classmates and friends often say that I spend too much time chatting online.”), and Internet information addiction (e.g., “Browsing or downloading information online is an important part of my life.”). The score of each item ranged from 1 to 5 (1 = strongly disagree, 5 = strongly agree) and a higher score shows a higher level of Internet addiction ( $\alpha = 0.94$ ). This scale has been widely used to assess participants’ Internet addiction in China, such as studies by Leng et al. [56] or Zhang et al. [57], and the reliability ( $\alpha = 0.90$ ) and validity ( $\chi^2(169) = 570.132$ ,  $\chi^2/df = 3.374$ , CFI = 0.940, RMSEA = 0.070, SRMR = 0.057) of the scale in the current study were also good.

## 2.3. Data analysis

We used SPSS 25.0 for all data cleaning, common method bias, and descriptive statistical analyses. Then we used AMOS 21.0 for path analysis with observed variables (PA-OA), in which all of the variables are observed, and used maximum-likelihood estimation to test the hypothesized model. As recommended by Kline [50], we examined the following statistics to confirm model fit: the  $\chi^2$  with its degree of freedom ( $\chi^2/df < 5$ ), Comparative Fit Index (CFI  $> 0.90$ ), Root Mean Square Error of Approximation (RMSEA  $< 0.08$ ), and Standardized Root Mean Square Residual (SRMR  $< 0.10$ ). The significance of the direct and indirect effects was tested by using 5000 bias-corrected bootstrap samples, with 95 % bootstrap confidence intervals without zero [58,59].

**Table 2**

Correlations of variables.

	M	SD	1	2	3	4
1. Internet addiction	60.65	16.73	-			
2. Childhood harshness	10.74	3.82	-0.17***	-		
3. Childhood unpredictability	24.52	6.88	0.39***	-0.05	-	
4. Self-control	58.95	12.55	-0.53***	-0.13**	-0.42***	-

Note:

\* $p < .05$ .

\*\* $p < .01$ .

\*\*\* $p < .001$ .

### 3. Result

#### 3.1. Common method bias

Harman's single-factor test was used to evaluate the likelihood of common method bias in this study [60]. Four self-reported variables (i.e., childhood harshness, childhood unpredictability, self-control, and Internet addiction) were examined with exploratory factor analysis. As the first factor explained 28.12 % of the total variance, which was below the threshold of 40 %, there was no emergence of a single method factor.

#### 3.2. Descriptive statistics

Table 2 showed the means, statistical deviations, and bivariate correlations between the study variables. Internet addiction was positively correlated with childhood unpredictability, but negatively correlated with childhood harshness and self-control. Both childhood harshness and unpredictability showed negative correlations with self-control. In addition, there was no significant association between childhood harshness and unpredictability.

#### 3.3. Path analysis

The total scores obtained from the data collection instruments as observed variables were included in the path analysis model (see Fig. 1) and the structural model was found to have a good fit ( $\chi^2(1) = 1.060$ ,  $\chi^2/df = 1.060$ , CFI = 1.000, RMSEA = 0.011, SRMR = 0.017).

All the standardized regression coefficients of the direct path in the model were statistically significant, as reported in Table 3. The results showed that childhood harshness can positively affect Internet addiction in the expected direction ( $\beta = 0.17$ , 95%BcCI = [0.08, 0.27]), so H1 was not supported. However, childhood harshness had a negative effect on Internet addiction ( $\beta = -0.22$ , 95%BcCI = [-0.30, -0.15]), so H2 was supported. Both childhood harshness ( $\beta = -0.15$ , 95%BcCI = [-0.24, -0.06]) and unpredictability ( $\beta = -0.43$ , 95%BcCI = [-0.51, -0.34]) showed a statistically significant negative direct effect on self-control. The negative effect of self-control on Internet addiction was significant ( $\beta = -0.49$ , 95%BcCI = [-0.58, -0.40]), so H3 was supported. Two mediating effects in the path model were reported in Table 4. The mediating effect of self-control between childhood unpredictability and Internet addiction was statistically significant, as well as between childhood harshness and Internet addiction. We found childhood harshness could positively affect Internet addiction via self-control ( $\beta = 0.07$ , 95%BcCI = [0.03, 0.13]), but the direction of the mediating effect was opposite to the direct effect ( $\beta = -0.22$ ), and the total effect ( $\beta = -0.15$ , 95%BcCI = [-0.24, -0.06]). Childhood unpredictability could positively affect Internet addiction via self-control ( $\beta = 0.21$ , 95%BcCI = [0.16, 0.27]), with the same direction as the direct effect ( $\beta = 0.17$ ), the total effect of it was also positive ( $\beta = 0.38$ , 95%BcCI = [0.28, 0.47]). Therefore, H4 and H5 were supported. Both the direct and indirect effects of the model explained 35.9 % of the variance in Internet addiction.

We also tested one competing model, a moderated mediation model. Specifically, to examine whether the impact of childhood harshness on Internet addiction via self-control is moderated by childhood unpredictability. The results showed that the competing model ( $\chi^2(4) = 51.538$ ,  $\chi^2/df = 12.88$ , CFI = 0.865, RMSEA = 0.157, SRMR = 0.086) was a poorer fit with the data compared to the hypothesized model ( $\Delta\chi^2(3) = 50.47$ ,  $p < 0.05$ ). It suggests that childhood harshness and unpredictability are unique and distinct predictors of self-control.

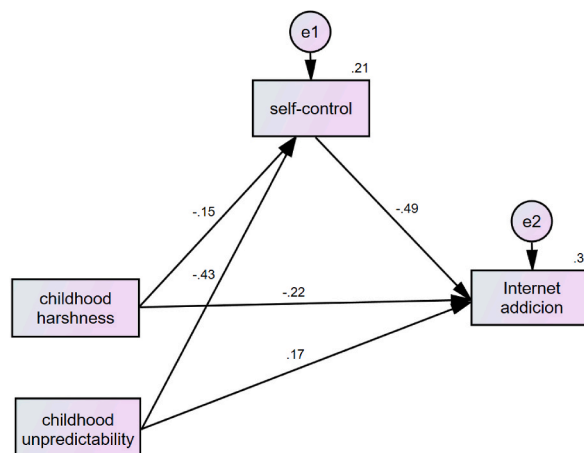


Fig. 1. The path analysis model. The standardized estimates were shown.

**Table 3**  
Bootstrapping analysis of direct effects.

path	$\beta$	B	S.E.	t	95%CI
harshness-self-control	-0.15	-0.49	0.13	-3.63***	[-0.24, -0.06]
unpredictability-self-control	-0.43	-0.78	0.07	-10.56***	[-0.51, -0.34]
self-control-Internet addiction	-0.49	-0.65	0.05	-11.91***	[-0.58, -0.40]
harshness-Internet addiction	-0.22	-0.98	0.16	-6.07***	[-0.30, -0.15]
unpredictability-Internet addiction	0.17	0.42	0.10	4.32***	[0.08, 0.27]

Note.

\* $p < .05$ .

\*\* $p < .01$ .

\*\*\* $p < .001$ .

**Table 4**  
Bootstrapping analysis of mediating effects.

path	$\beta$	95%CI
harshness-self-control-Internet addiction	0.07	[0.03, 0.13]
unpredictability-self-control-Internet addiction	0.21	[0.16, 0.27]

#### 4. Discussion

The Internet is an integral part of university life. For some, it serves as a mentor and friend, while for others, it can be a fatal temptation. It is important to understand the factors that contribute to individual differences in vulnerability to Internet addiction. In this study, we used a cross-sectional study in a sample of Chinese college students to examine the relationship between childhood harshness, childhood unpredictability, and Internet addiction, and the mediating effect of self-control between these variables. Our findings supported the hypothesis about whether and how childhood unpredictability affected Internet addiction, that greater childhood unpredictability directly affected more severe Internet addiction, and a positive indirect effect through self-control. However, our data partially supported the hypothesis about whether and how childhood harshness affected Internet addiction. We found a suppression effect, indicating a negative direct effect of harshness on Internet addiction and a positive indirect effect mediated by self-control.

In line with our hypothesis, childhood unpredictability was a direct and positive predictor of Internet addiction among college students. Childhood environmental unpredictability may be associated with frequent moves, parental inconsistency, and fluctuations in parental ability to provide basic necessities [32,33]. Children form unpredictability schemas through their perceptions of unstable environments, and these schemas provide a belief that both people and the world are unpredictable and uncontrollable. If investments in the future do not necessarily pay off, they will ignore the long-term costs and benefits (harm and health) and focus on the 'here and now', leading to risk-taking and addictive behavior [33]. Ross and Hill also argue that the unpredictable caregiver responses are detrimental to the formation of secure attachments [32,33]. It can be seen that smartphones, akin to pacifiers for adults, can provide emotional attachment, and to some extent, Internet addiction can provide feelings of comfort and relief from stress [61]. Based on life history theory [33], we proposed that self-control played an important role in this process, which was supported for the first time by the data in our study. Consistent with previous studies, we found that greater unpredictability in childhood was significantly associated with lower levels of self-control [31,36], which in turn was significantly linked to higher risk of Internet addiction [4,43–46]. Self-control theory suggests that children who are not effectively parented by the age of 10 have lower self-control than their peers [62], which in turn predicts their future parenting [63], explaining the persistent disadvantage of some families. While frequent family conflict is associated with increased Internet addiction among adolescents, improving self-control in adolescents can counteract this negative effect [45]. Therefore, the prevention of Internet addiction among adolescents and young adults can be approached from both sides: maintaining parental consistency and developing self-control.

More interestingly, the findings on whether and how harshness affected Internet addiction revealed a suppression effect. In other words, the direct and indirect effects were inconsistent. Focusing on the results of the indirect pathway, which supported our hypothesis based on life history theory, that lower self-control mediates the effect of childhood harshness on Internet addiction. As mentioned in the introduction, harshness represents extrinsic rates of morbidity and mortality, and lower childhood SES is linearly associated with higher levels of almost all forms of morbidity and mortality [22]. According to life history theory, the harshness is like a weather forecast, indicating that death may come sooner, and they need to develop traits that facilitate reproductive efforts, such as short-term orientation, impulsivity, and antisociality [42]. Uncontrolled use of the Internet for short-term rewards (e.g., hedonistic pleasures, sensory stimulation, and instant social interaction) may ultimately lead to Internet addiction. Therefore, childhood harshness (i.e., lower childhood SES) positively influences Internet addiction via lower self-control.

However, the opposite effect has been shown by the direct path of childhood harshness to Internet addiction. We used childhood SES to assess harshness and found that higher childhood SES was associated with higher risk of Internet addiction, which was consistent with some previous studies [13,41], but was inconsistent with others [37,38], and also inconsistent with the hypothesis we speculated from life history theory. It is possible that some of the pathways not included in our model have the opposite effect. From

the perspective of life history theory, individuals with higher childhood SES adopt slower life history strategies and are characterized by self-control, cooperation, and social conformity [20,24]. According to Zhang and Wu [20], the motivation of social conformity may contribute to their higher risk of Internet addiction. In addition, compared to other risk behaviors, Internet addiction is somewhat unique because the Internet is a relatively new electronic communication technology in the last 20 years and requires certain access skills and devices. Most of our participants were born in the early-2000s, when computer and Internet penetration was still low [64]. In recent years, Internet penetration in China has increased rapidly, from 52.52 % in 2016 to 73.06 % in 2021, but still lags in rural areas [65]. Thus, higher SES in childhood implies earlier ownership of electronic devices and access to the Internet, increasing the likelihood of Internet addiction due to excessive exposure. It is also possible that wealthier university students can afford to purchase gaming devices and other online services to enhance their network experience and exacerbate their addiction [13], as there is a strong correlation between childhood SES and current SES. It is evident that proper parental guidance in Internet use is also important for individuals from wealthy families. However, these are our speculations, and more studies are needed in the future to investigate the pathways through which childhood SES influences Internet addiction.

Our study has several strengths. First, we found that childhood harshness and unpredictability had independent and distinct effects on Internet addiction. Childhood unpredictability may have a greater impact on Internet addiction than harshness, and we proposed that maintaining the stability of the family environment is a protective factor against Internet addiction. Second, self-control is an important mechanism through which the early environment risk influences Internet addiction. In addition to the family environment, the school is another crucial developmental context for shaping self-control. Particularly, school discipline, such as setting clear rules, supporting autonomy, fostering high-quality teacher-student relationship, is beneficial in creating a safe and predictable environment, which in turn enhances students' self-control [66]. This reminds us that, even under a disadvantaged early environment, individuals' self-control can still be trained in school, which is very important for the prevention of Internet addiction. Finally, our results support that the effect of SES on Internet addiction is multi-path and complicated, which provides directions for further research.

The present study also has the following limitations. First, our study employed a cross-sectional design using a retrospective self-report approach to assess childhood harshness and unpredictability. Although it was assumed that childhood environment preceded addictive behavior, all relationships we found were correlated in nature, and therefore some longitudinal design studies would still be necessary to draw causal conclusions. Second, we assessed childhood unpredictability by referring to previous studies [31,32], and the accuracy of this measure was supported by some Chinese studies (e.g., the studies by Luo et al. [51,52]). However, due to cultural differences, Chinese family stability and parent-child relationships have some local characteristics. Therefore, there is a need to revise or develop a Chinese version of the Childhood Unpredictability Scale for use in research, which we are working on. Third, we used a convenience sample of college students, which may not be representative of the larger population of Chinese college students or young adults. It is recommended that larger random sample studies be conducted in the future to test the generality of the current research findings. Fourth, we only tested the mediating role of self-control, which is far from sufficient to understand how childhood environment influences Internet addiction, and therefore additional pathways need to be considered in the future to complete the model.

## 5. Conclusion

In summary, our study revealed that childhood harshness and unpredictability, antecedents of life history strategies, were independent and distinct predictors of Internet addiction among college students, and that self-control was an important mediating mechanism. These findings add to the evolutionary explanation of Internet addiction and suggest that maintaining parental consistency and fostering self-control are necessary to promote healthy Internet use among college students.

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## Ethics statement

This study was reviewed and approved by Ethics Committee for Psychological Research at Zhejiang Sci-Tech University, with the approval number: 202310H002. Participation was entirely voluntary, and completion of the questionnaire implied the participant's consent for participation and the publication of survey results.

## Data availability statement

Data is available in the Open Science Framework at: [https://osf.io/9n8pk/?view\\_only=a644d3ec3f1242f28eeddfdc3a28ba8](https://osf.io/9n8pk/?view_only=a644d3ec3f1242f28eeddfdc3a28ba8).

## CRedit authorship contribution statement

**Wei Qi:** Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Xiang Liao:** Writing – review & editing. **Dan Wang:** Writing – original draft, Investigation, Data curation. **Jie Cai:** Writing – review & editing.

## Declaration of competing interest

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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