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**Perceived Social Support and Internet Gaming Disorder Symptoms
among Chinese College Students: The Serial Mediating Roles of
Loneliness and Self-Control**

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Abstract

Background: Internet gaming disorder (IGD) symptoms among college students have attracted sustained research attention, but less is known about the sequential interpersonal and self-regulatory mechanisms through which social support may relate to IGD. Drawing on the Interaction of Person-Affect-Cognition-Execution (I-PACE) model and compensatory Internet-use perspectives, this cross-sectional study examined whether loneliness and self-control serially mediated the association between perceived social support and IGD symptoms in Chinese college students. **Methods:** A total of 509 Chinese college students completed an online self-report questionnaire. Participants were 18 to 30 years old ($M = 20.27$, $SD = 1.45$); 360 were men (70.7%) and 149 were women (29.3%). Perceived social support, loneliness, self-control, and IGD symptoms were assessed using self-report scales; all four measures showed good to excellent internal consistency (Cronbach's $\alpha = .874-.952$). Gender, age, and pre-college residence were entered as covariates. Serial mediation was tested using PROCESS Model 6 with 5,000 bootstrap samples. **Results:** Perceived social support was negatively associated with loneliness ($B = -0.392$, $p < .001$). Loneliness was negatively associated with self-control ($B = -0.528$, $p < .001$) and positively associated with IGD symptoms ($B = 0.137$, $p < .001$). Self-control was negatively associated with IGD symptoms ($B = -0.135$, $p < .001$). The direct effect of perceived social support on IGD symptoms was nonsignificant after the mediators were included ($B = -0.008$, $p = .732$). The total indirect effect was significant (Effect = -0.086 , 95% bootstrap CI $[-0.113, -0.060]$), including the loneliness pathway and the serial pathway through loneliness and self-control. The indirect path through self-control alone was not significant. **Conclusions:** Lower perceived social support may be associated with higher IGD symptoms primarily through greater loneliness and, secondarily, through the sequential pathway from

loneliness to lower self-control. These findings support an interpersonal-self-regulatory account of IGD symptoms among Chinese college students. Because the data were cross-sectional and based on self-report, causal and clinical interpretations should be avoided.

Keywords: Internet gaming disorder; perceived social support; loneliness; self-control; Chinese college students; serial mediation

Introduction

Internet gaming disorder (IGD) has been described in DSM-5 Section III as a condition requiring further study and has become an important topic in behavioral addiction research. Although gaming is normative and nonpathological for many students, a subset of individuals report impaired control, persistence despite negative consequences, and functional interference related to gaming. For college students, the transition to greater autonomy, increased academic pressure, and changing social networks may create conditions in which gaming becomes a salient strategy for regulation, escape, or social compensation. Therefore, research on IGD symptoms in nonclinical college populations should focus not only on symptom severity but also on modifiable interpersonal and self-regulatory mechanisms.

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model provides a useful framework for studying IGD and other specific Internet-use disorders. The model proposes that relatively stable person-level factors interact with affective and cognitive responses and executive-control processes in the development and maintenance of addictive online behaviors. Within this framework, perceived social support can be viewed as an interpersonal resource that shapes affective states such as loneliness, whereas self-control reflects an executive-regulatory capacity that may constrain or amplify excessive gaming. This framework is especially

appropriate for the present model because it links social context, subjective emotional experience, self-regulation, and behavioral symptoms in a coherent sequence.

Perceived social support refers to the degree to which individuals believe that support is available from family, friends, and significant others. Stronger perceived support is generally associated with better psychological adjustment, whereas low social support is linked to loneliness, distress, and poorer adaptation. For college students, perceived social support may be particularly important because it protects against the social disconnection that can emerge during adjustment to university life. When offline support is insufficient or perceived as unavailable, students may be more likely to rely on online activities, including gaming, to obtain stimulation, social contact, and mood regulation.

Loneliness is a subjective experience of perceived discrepancy between desired and actual social relationships. It is conceptually distinct from objective social isolation: students may be socially surrounded yet still experience loneliness when relationships do not meet their emotional or belongingness needs. Loneliness has been repeatedly linked to problematic Internet use and gaming-related problems. Compensatory Internet-use theory suggests that individuals may turn to online activities to compensate for unmet psychosocial needs; however, such compensation can become maladaptive when online engagement replaces rather than supplements offline adjustment.

Self-control is a central regulatory capacity that enables individuals to inhibit impulses, delay gratification, and act consistently with long-term goals. Lower self-control has been associated with multiple forms of maladaptive behavior, including problematic digital media use and addictive behavior. In the context of gaming, low self-control may make it harder for

students to stop playing, regulate time online, resist immediate rewards, or disengage from competitive and immersive game environments. The current model therefore places self-control closer to IGD symptoms than loneliness: loneliness may increase vulnerability, while self-control may determine whether that vulnerability translates into dysregulated gaming behavior.

The present study examined a serial mediation model in which perceived social support was expected to relate to lower IGD symptoms through lower loneliness and higher self-control. The model tested three specific indirect pathways: perceived social support → loneliness → IGD symptoms; perceived social support → self-control → IGD symptoms; and perceived social support → loneliness → self-control → IGD symptoms. We hypothesized that perceived social support would be negatively associated with loneliness, loneliness would be negatively associated with self-control and positively associated with IGD symptoms, and self-control would be negatively associated with IGD symptoms.

Methods

Participants and Procedure

Participants were 509 Chinese college students recruited through an online questionnaire. The study focused on a normal college-student population rather than a clinically diagnosed sample. All participants completed the questionnaire voluntarily and provided informed consent before responding. The analytic dataset contained no missing values for the variables reported in this manuscript. The sample included 360 men (70.7%) and 149 women (29.3%). Participants ranged in age from 18 to 30 years ($M = 20.27$, $SD = 1.45$). In terms of ethnicity, 341 participants were Han Chinese (67.0%) and 168 were from ethnic minority groups (33.0%). Detailed demographic information is shown in Table 1.

Measures

Perceived social support. Perceived social support was assessed using a self-report social support scale. Higher scores indicated greater perceived availability of social support. If the exact instrument was the Multidimensional Scale of Perceived Social Support or a Chinese adaptation, replace this generic description with the validated instrument name and citation. In the present sample, the scale demonstrated excellent internal consistency (Cronbach's alpha = .952).

Loneliness. Loneliness was assessed using a self-report loneliness measure, with higher scores indicating greater subjective loneliness. If the UCLA Loneliness Scale or its Chinese adaptation was used, specify the exact version and cite the original and Chinese validation studies. In the present sample, the scale demonstrated good internal consistency (Cronbach's alpha = .875).

Self-control. Self-control was assessed using a self-report self-control scale. Higher scores indicated stronger regulatory capacity. The Self-Control Scale developed by Tangney et al. (2004) is commonly used in this area; before submission, verify whether this was the exact version used and add the Chinese validation citation. In the present sample, the scale demonstrated good internal consistency (Cronbach's alpha = .874).

Internet gaming disorder symptoms. IGD symptoms were assessed using a self-report scale designed to capture gaming-related problems. Because the present sample was nonclinical and recruited online, the outcome should be described as IGD symptoms rather than a clinical diagnosis. In the present sample, the scale demonstrated excellent internal consistency (Cronbach's alpha = .920).

Statistical Analysis

Internal consistency was evaluated using Cronbach's alpha. Descriptive statistics and Pearson correlations were first examined. The serial mediation model was tested using the PROCESS macro for SPSS, version 4.1, Model 6. Perceived social support was entered as the independent variable, loneliness as the first mediator, self-control as the second mediator, and IGD symptoms as the dependent variable. Gender, age, and pre-college residence were entered as covariates. Indirect effects were evaluated with 5,000 bootstrap samples and 95% percentile bootstrap confidence intervals. An indirect effect was considered statistically significant when its 95% bootstrap confidence interval did not include zero. Because the design was cross-sectional, the mediation model was interpreted as a statistical indirect-effect model rather than evidence of temporal or causal mediation.

Results

Demographic Characteristics

The sample consisted of 509 Chinese college students. Men accounted for 70.7% of the sample and women accounted for 29.3%. The mean age was 20.27 years ($SD = 1.45$). Most participants were Han Chinese (67.0%), with the remaining 33.0% representing several ethnic minority groups. Details are reported in Table 1.

Table 1

Demographic characteristics of the sample

Characteristic	Category	n	%
Gender	Male	360	70.7

	Female	149	29.3
Age	M (SD)	20.27 (1.45)	Range: 18-30
Ethnicity	Han Chinese	341	67.0
	Ethnic minority	168	33.0
	Miao	45	8.8
	Tujia	39	7.7
	Bouyei	22	4.3
	Dong	22	4.3
	Gelao	11	2.2
	Yi	8	1.6
	Other minority groups	21	4.1

Note. Other minority groups included Manchu, Mongolian, Hui, Bai, Li, Shui, Dongxiang, and Mulam participants.

Percentages are based on N = 509.

Correlations among Core Variables

All four focal measures showed good to excellent internal consistency, with Cronbach's alpha values ranging from .874 to .952. The correlation matrix supported the proposed model. Perceived social support was negatively correlated with loneliness and IGD symptoms and positively correlated with self-control. Loneliness was positively correlated with IGD symptoms and negatively correlated with self-control. Self-control was negatively correlated with IGD symptoms.

Table 2*Reliability coefficients and Pearson correlations among the focal variables*

Variable	Cronbach's alpha	1	2	3	4
1. Perceived social support	.952	-			
2. Loneliness	.875	-.544**	-		
3. Self-control	.874	.263**	-.448**	-	
4. IGD symptoms	.920	-.202**	.335**	-.354**	-

Note. Cronbach's alpha values are reported in the alpha column. IGD = Internet gaming disorder. ** $p < .01$, two-tailed.

Serial Mediation Analysis

The first regression equation showed that perceived social support significantly and negatively predicted loneliness, $B = -0.392$, $SE = 0.027$, $p < .001$. The model explained 29.9% of the variance in loneliness. In the second equation, loneliness significantly and negatively predicted self-control, $B = -0.528$, $SE = 0.059$, $p < .001$, whereas the direct path from perceived social support to self-control was nonsignificant after loneliness and covariates were included, $B = 0.031$, $p = .466$. This model explained 22.7% of the variance in self-control. In the final equation, loneliness positively predicted IGD symptoms, $B = 0.137$, $SE = 0.034$, $p < .001$, and self-control negatively predicted IGD symptoms, $B = -0.135$, $SE = 0.024$, $p < .001$. The direct effect of perceived social support on IGD symptoms was nonsignificant after the two mediators

were entered, $B = -0.008$, $p = .732$. This model explained 16.8% of the variance in IGD symptoms. The complete regression results are presented in Table 3.

Table 3

Regression results for the serial mediation model

Outcome	Predictor	B	SE	t	p	95% CI	β
Loneliness	Perceived social support	-0.392	0.027	-14.559	< .001	[-0.445, -0.339]	-.544
	Gender	0.940	0.724	1.298	.195	[-0.483, 2.362]	.049
	Age	0.147	0.228	0.647	.518	[-0.300, 0.595]	.024
	Residence	0.029	0.048	0.609	.543	[-0.065, 0.123]	.023
Self-control	Perceived social support	0.031	0.043	0.729	.466	[-0.053, 0.115]	.034
	Loneliness	-0.528	0.059	-8.960	< .001	[-0.644, -0.412]	-.420
	Gender	-3.429	0.960	-3.572	< .001	[-5.314, -1.543]	-.141
	Age	-0.545	0.302	-1.808	.071	[-1.137, 0.047]	-.071
IGD symptoms	Residence	-0.086	0.063	-1.353	.177	[-0.210, 0.039]	-.053
	Perceived social support	-0.008	0.023	-0.342	.732	[-0.053, 0.037]	-.017
	Loneliness	0.137	0.034	3.991	< .001	[0.070, 0.204]	.209
	Self-control	-0.135	0.024	-5.581	< .001	[-0.182, -0.087]	-.259
	Gender	-0.364	0.525	-0.692	.489	[-1.396, 0.668]	-.029
	Age	0.172	0.164	1.053	.293	[-0.149, 0.493]	.043
	Residence	-0.022	0.034	-0.644	.520	[-0.089, 0.045]	-.026

Note. N = 509. IGD = Internet gaming disorder. Residence refers to pre-college residence. Gender, age, and residence were entered as covariates.

Table 4

Model summary for each regression equation

Outcome	R	R ²	MSE	F	df	p
Loneliness	.547	.299	54.844	53.803	4, 504	< .001
Self-control	.477	.227	96.048	29.573	5, 503	< .001

IGD symptoms	.410	.168	28.058	16.892	6, 502	< .001
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Note. All regression equations were statistically significant.

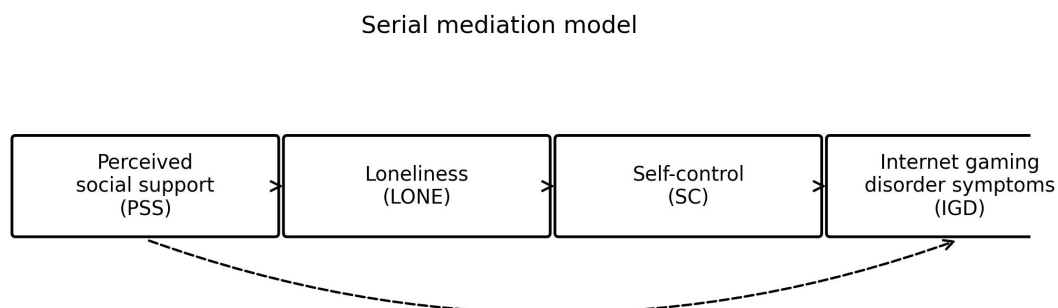
Table 5

Direct and indirect effects of perceived social support on IGD symptoms

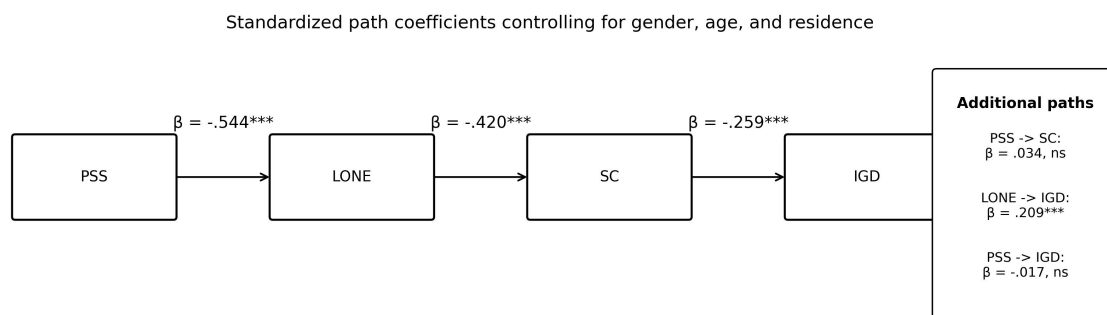
Effect path	Effect	Boot SE	95% Boot CI	Completely standardized effect	95% Boot CI
Direct effect: PSS → IGD	-0.008	0.023	[-0.053, 0.037]	-.017	-
Total indirect effect	-0.086	0.014	[-0.113, -0.060]	-.182	[-.237, -.127]
PSS → Loneliness → IGD	-0.054	0.013	[-0.080, -0.028]	-.114	[-.169, -.059]
PSS → Self-control → IGD	-0.004	0.006	[-0.017, 0.007]	-.009	[-.035, .014]
PSS → Loneliness → Self-control → IGD	-0.028	0.006	[-0.041, -0.016]	-.059	[-.087, -.035]

Note. Bootstrap samples = 5,000. CI = confidence interval. Indirect effects were significant when the 95% bootstrap confidence interval did not include zero.

Bootstrap results showed that the total indirect effect of perceived social support on IGD symptoms was significant, Effect = -0.086, Boot SE = 0.014, 95% Boot CI [-0.113, -0.060]. Two specific indirect effects were significant. First, perceived social support was indirectly associated with lower IGD symptoms through lower loneliness, Effect = -0.054, 95% Boot CI [-0.080, -0.028]. Second, the serial indirect pathway through loneliness and self-control was significant, Effect = -0.028, 95% Boot CI [-0.041, -0.016]. The indirect path through self-control alone was not significant, Effect = -0.004, 95% Boot CI [-0.017, 0.007].

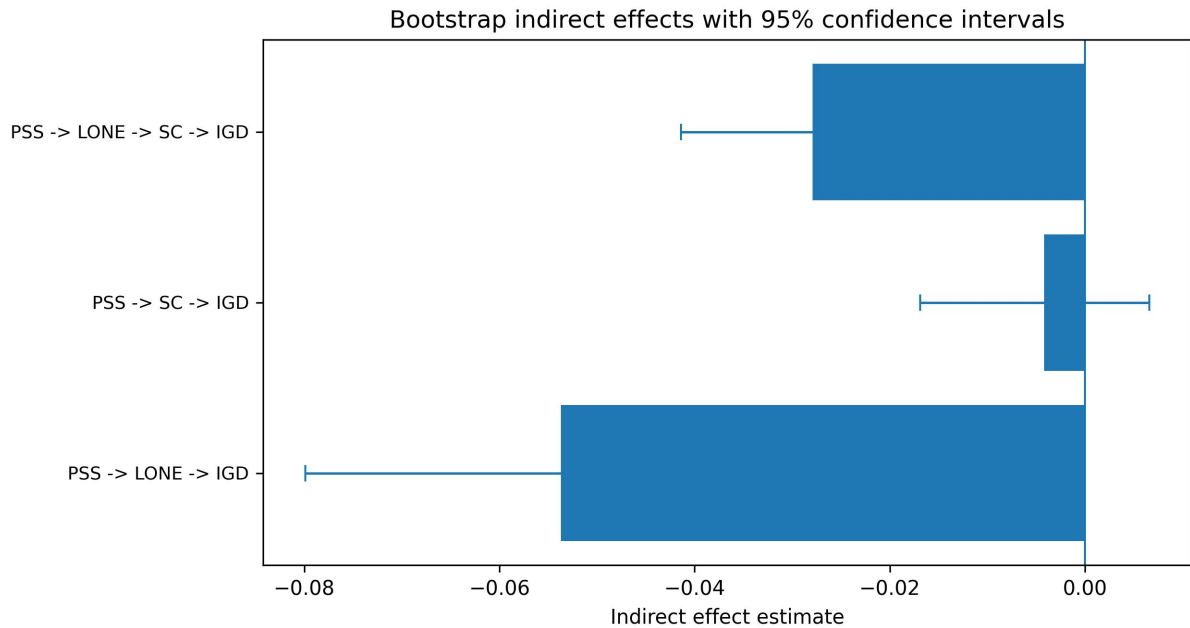
Figure 1. Conceptual serial mediation model.

Note. PSS = perceived social support; LONE = loneliness; SC = self-control; IGD = Internet gaming disorder symptoms.

Figure 2. Standardized path coefficients in the final mediation model.

Note. *** $p < .001$. ns = nonsignificant.

Note. Additional direct paths are displayed in the coefficient panel. Gender, age, and residence were controlled but are not displayed.

Figure 3. Bootstrap indirect effects and 95% confidence intervals.

Note. Confidence intervals crossing zero indicate nonsignificant indirect effects.

Discussion

This study examined whether loneliness and self-control serially mediated the association between perceived social support and IGD symptoms among Chinese college students. The results supported the main interpersonal-self-regulatory pathway. Higher perceived social support was associated with lower loneliness, loneliness was associated with lower self-control and higher IGD symptoms, and self-control was associated with lower IGD symptoms. The direct effect of perceived social support on IGD symptoms was nonsignificant after loneliness and self-control were included, whereas the total indirect effect and two specific indirect effects were significant.

The strongest indirect pathway was the loneliness pathway. Students reporting lower perceived social support tended to report greater loneliness, which in turn was associated with more severe IGD symptoms. This finding is consistent with the view that IGD-related behaviors can serve compensatory functions when offline interpersonal needs are not sufficiently met. Gaming environments may provide rapid access to social interaction, achievement, identity expression, and emotional escape. These short-term rewards may be particularly attractive to lonely students, even when gaming becomes excessive or interferes with academic and daily functioning.

The significant serial pathway further suggests that loneliness may be linked to IGD symptoms partly because it undermines self-control. Loneliness is not merely a social state; it can involve negative affect, attentional bias toward social threat, rumination, and reduced motivation for effortful regulation. Under these conditions, students may find it more difficult to resist immediate gaming rewards or disengage from online gaming contexts. This interpretation is compatible with the I-PACE model, which highlights the interaction of affective responses and executive-control processes in addictive online behaviors.

The nonsignificant indirect pathway through self-control alone is theoretically important. Perceived social support did not directly predict self-control once loneliness was included. This pattern suggests that social support may not translate into self-regulatory capacity automatically; rather, its relevance for self-control may depend on whether support reduces loneliness or improves emotional connectedness. In other words, social support may protect against IGD symptoms less by directly increasing self-discipline and more by reducing loneliness, which then supports better self-regulation.

The findings have practical implications for college mental-health work. Interventions for IGD symptoms should not focus only on reducing gaming time or strengthening individual willpower. For students with low perceived social support, interventions may need to address loneliness, belongingness, and offline relationship quality. Programs that combine social connectedness training, peer support, and self-control strategies may be more effective than approaches targeting gaming behavior alone. At the same time, because this study was cross-sectional, intervention implications should be tested in longitudinal or experimental designs before strong practical claims are made.

Several limitations should be noted. First, the cross-sectional design prevents causal inference. Although the tested order is theoretically grounded, alternative models are possible; for example, IGD symptoms may increase loneliness or reduce perceived social support over time. Second, all measures were self-reported, which may introduce common-method bias and response-style effects. Third, the sample was recruited online and had a relatively high proportion of male students; this may limit generalizability. Fourth, the present manuscript is based on scale-level outputs provided for analysis. The final submission should include exact scale names, Chinese versions, item numbers, response anchors, scoring procedures. Finally, IGD symptoms were assessed as self-reported symptom severity in a normal college population; the findings should not be interpreted as evidence about clinically diagnosed gaming disorder.

Despite these limitations, the study provides a coherent model linking interpersonal resources to IGD symptoms through loneliness and self-control. The results suggest that loneliness is the central psychological bridge between low perceived social support and IGD symptoms, while self-control further explains part of this association. The findings add to the

literature by integrating social support, loneliness, and executive self-regulation within a serial mediation framework among Chinese college students.

Conclusion

Among Chinese college students, lower perceived social support was associated with higher IGD symptoms through greater loneliness and the serial pathway from loneliness to lower self-control. The findings support an interpersonal-self-regulatory explanation of IGD symptoms and suggest that loneliness may be a key target for future prevention and intervention research.

Declarations

Informed Consent

All participants provided informed consent before completing the online questionnaire.

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This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The author(s) declare no conflict of interest.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request, subject to ethical and privacy restrictions.

Authors' Contributions

Qingqing Yang contribution statement according to the target journal requirements. For example: Conceptualization, data curation, formal analysis, methodology, writing-original draft, and writing-review and editing.

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