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Internet gaming in university students: Structural equation modeling of ADHD symptomatology, personality dimensions and sociodemographic correlates

Burak Okumuş¹, Makbule Esen Öksüzoğlu²

¹ Department of Psychiatry, Faculty of Medicine, Uşak University. Uşak / Türkiye

<https://orcid.org/0000-0003-3591-6927>

² Department of Child and Adolescent Psychiatry, Faculty of Medicine, Kastamonu University. Kastamonu / Türkiye

<https://orcid.org/0000-0001-7338-5114>

Corresponding Author:

Burak Okumuş, okumusband@gmail.com

Abstract

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This study investigated determinants of internet gaming among university students by jointly modelling ADHD symptom dimensions and DSM-5-based maladaptive personality domains. A total of 258 participants aged 18–30 years ($M = 22.1$, $SD = 2.3$) completed the IGDS9-SF, ASRS-v1.1, and the PID-5-SF. Pearson correlations and multivariate structural equation modelling (SEM) were used to test age- and sex-adjusted direct and indirect pathways. Internet gaming severity correlated positively with Detachment ($r=.261$, $p<.01$), Antagonism ($r=.271$, $p<.01$), Disinhibition ($r=.236$, $p<.01$), and Psychoticism ($r=.272$, $p<.01$); correlations with ADHD dimensions were small and non-significant (Inattentiveness: $r=.086$; Hyperactivity/Impulsivity: $r=.079$; both $ps>.05$). In SEM, Inattentiveness was associated with Negative Affectivity ($\beta=.16$, $p=.03$), Detachment ($\beta=.52$, $p<.01$), Disinhibition ($\beta=.61$, $p<.01$), and Psychoticism ($\beta=.47$, $p<.01$), whereas internet gaming was directly associated with only by Detachment ($\beta=.18$, $p<.01$). Detachment also mediated the association between Inattentiveness and internet gaming. Sex showed a strong direct association with internet gaming ($\beta=.46$, $p<.01$) and additional indirect effects via personality domains; age was inversely associated with internet



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gaming ($\beta=-.14$, $p=.01$). Model fit indices indicated excellent fit: $\chi^2(2)=0.117$, $p=.943$; RMSEA=.000 (90% CI=.000-.023; p close=.969); CFI = 1.000; TLI = 1.062; SRMR = .002. Findings suggest that internet gaming is shaped less by the proximal effects of ADHD per se and more by enduring interpersonal withdrawal tendencies—exemplified by Detachment—highlighting the value of integrating personality assessment with ADHD management to refine risk stratification and to inform targeted, socially focused prevention and treatment.

Introduction

The internet is widely utilised across various domains, including education, information access, communication, and entertainment, and its use has grown particularly prominent among young adults, whose engagement with digital platforms has increased markedly in recent years [1]. The acceleration of digital technologies has rendered online gaming a routine facet of daily life [2]. In parallel with these trends, digital gaming has become ubiquitous and a routinely chosen leisure pursuit among adolescents and young adults [3]. Psychiatric classification first engaged this phenomenon in the DSM-5, which listed Internet Gaming Disorder (IGD) in Section III as a condition warranting further study [4]. The ICD-11 later formalized IGD within “disorders due to addictive behaviors,” underscoring its significance as a global public health concern [5].

University students traverse a developmentally sensitive period characterized by ongoing identity consolidation, escalating academic demands, expanding autonomy, and cumulative psychosocial stressors. Within this context, online gaming may function as a coping strategy or as a form of experiential avoidance [6]. Nonetheless, excessive or dysregulated gaming is associated with adverse outcomes, including disturbances in personality functioning, attentional dysregulation, and heightened impulsivity [7,8].

Symptoms of attention-deficit/hyperactivity disorder (ADHD)—particularly inattention and impulsivity—are frequently implicated in IGD and excessive online gaming [9]. Difficulties sustaining attention and increased impulsivity heighten responsiveness to the rapid, continuous, reward-dense features of online games, undermining self-regulation; among individuals with ADHD features, this dynamic amplifies the appeal of gaming and the risk of addictive use [9–11]. Because ADHD symptoms persist into adulthood in up to 60% of cases, their phenotypic overlap with IGD has substantial academic and psychosocial implications, making the assessment of ADHD symptomatology especially pertinent in university samples [12]. ADHD symptomatology also may be linked to the differentiation and consolidation of personality dimensions throughout development [13]. Accumulating evidence suggests that both ADHD symptom severity and personality traits make independent contributions to the ADHD–IGD linkage [14]; consequently, explanatory models of problematic gaming should address these domains concurrently and in an integrated framework [7,14].

Personality traits are fundamental determinants of how individuals appraise environmental demands and of their propensity for risk-taking. Within the DSM-5 Alternative Model for Personality Disorders (AMPD), the maladaptive trait domains of negative affectivity, detachment, antagonism, and disinhibition are emphasized as prominent predictors of addictive behaviors [15]. ADHD symptoms have been linked to elevated novelty seeking in both adults [16,17] and children [18]. Additionally, harm avoidance shows a significant positive association, particularly among adults with [16,17]. Converging evidence from the Five-Factor Model indicates that neuroticism is a consistent positive predictor of problematic internet use, whereas extraversion tends to be protective [19–21]. Individuals



high in neuroticism may preferentially engage with online contexts as a form of compensatory social interaction, whereas greater extraversion is associated with reliance on face-to-face networks and may confer relative protection against Internet Gaming Disorder (IGD) [22,23]. Collectively, the evidence suggests that dispositional personality traits and the burden of ADHD symptoms jointly condition vulnerability to problematic internet gaming. Moreover, accumulating clinical work suggests that IGD is heterogeneous and may comprise distinct subtypes with differing correlates and clinical implications [24].

Examining the combined effects of ADHD symptom dimensions, maladaptive personality traits, and demographic factors on IGD is of clear clinical and preventive relevance. Accordingly, the present study investigates these associations in a university sample. It uses structural equation modelling (SEM)—an analytic framework that enables the simultaneous and integrative evaluation of multiple predictors—to estimate both direct and indirect pathways. SEM is particularly well-suited to delineate the shared contributions of ADHD symptom patterns and maladaptive personality domains to problematic gaming, while accounting for the interrelations among these constructs. Four hypotheses were specified: (1) IGD will be positively associated with maladaptive personality domains, including Negative Affectivity, Detachment, Antagonism, Disinhibition, and Psychoticism; (2) IGD will be positively associated with ADHD symptoms, encompassing Inattention and Hyperactivity/Impulsivity; (3) maladaptive personality domains and ADHD symptoms will predict IGDS9-SF total scores through both direct and mediated effects; and (4) demographic variables (age and sex) will contribute to the prediction of IGD. By integrating maladaptive personality domains within the DSM-5 AMPD and ADHD symptom dimensions into a single structural model, this study aims to clarify the psychological determinants of problematic gaming during emerging adulthood and to extend the current literature. Specifically, controlling for age and sex in university students, we test whether AMPD maladaptive personality domains mediate the association between ADHD symptom dimensions and IGDS9-SF total scores.

Materials and Methods

Participants

The study sample comprised 258 university students aged 18–30 years ($M = 22.1$, $SD = 2.3$). Inclusion criteria were: 1) current enrollment as a university student within the 18–30 age range; 2) provision of informed consent; 3) no condition that would impede completion of the online self-report measures; and 4) absence of a diagnosed psychiatric disorder. Psychiatric diagnosis history was assessed via a single self-report item ('Have you been diagnosed with any psychiatric disorder by a physician?'). This item was used solely to screen for self-reported diagnosis history and does not constitute a structured diagnostic assessment. Participants were recruited via social media groups administered by official departmental representatives. Participation was voluntary, and data were collected using Google Forms.

Procedure

Prior to enrollment, participants received standardized information about the study's purpose and procedures and provided electronic informed consent. Data were collected anonymously via a secure online survey platform (Google Forms). Responses were first exported to Microsoft Excel and subsequently imported into IBM SPSS Statistics for analysis. The study protocol was reviewed and approved by the Uşak University Non-Interventional Clinical Research Ethics Committee (Approval No. 531-531-09; January 9, 2025). All procedures complied with institutional and national regulations and adhered to the principles of the World Medical Association's Declaration of Helsinki and its subsequent amendments.



Measures

A structured form developed by the research team was used to obtain basic demographic and clinical characteristics of the participants. A structured sociodemographic and clinical questionnaire was used to capture age, sex, marital status, educational attainment, and employment status. Participants also reported their current living arrangements (e.g., residing with parents, in a dormitory or hostel, living alone, or sharing with friends) and household income. Clinical history was ascertained, including past and current psychiatric diagnoses, general medical comorbidities, and use of commonly encountered psychoactive substances (tobacco, alcohol, caffeine). These variables facilitated comprehensive characterization of the cohort and were incorporated as covariates in subsequent analyses when appropriate.

The Internet Gaming Disorder Scale–Short Form (IGDS9-SF): The IGDS9-SF assesses the burden and functional impact of Internet Gaming Disorder over the preceding 12 months across both online and offline gaming. The instrument comprises nine items that correspond one-to-one with the DSM-5 diagnostic criteria and are rated on a five-point Likert scale (1 = “never” to 5 = “very often”); higher total scores indicate greater IGD severity [25].

The Adult ADHD Self-Report Scale (ASRS-v1.1): The ASRS-v1.1 is an 18-item self-report measure indexing DSM-IV-TR Criterion A symptoms of attention-deficit/hyperactivity disorder, developed under the auspices of the World Health Organization. It includes a six-item screening subset derived via stepwise logistic regression from the complete 18-item pool. The Turkish version has demonstrated sound reliability and validity in university student samples [26]. Responses are recorded on a five-point Likert-type scale ranging from 0 (“never”) to 4 (“very often”).

Personality Inventory for DSM-5—Short Form (PID-5-SF): This 25-item instrument assesses maladaptive personality trait domains as delineated in Section III of the DSM-5 [4,27]. It yields five higher-order domains—negative affectivity, detachment, antagonism, disinhibition, and psychoticism [15]—each represented by five items. Responses are rated on a four-point Likert scale (0 = “very false or often false” to 3 = “very true or often true”); higher scores indicate greater expression of maladaptive traits. The PID-5-SF has shown strong psychometric properties across diverse cultural settings, including robust convergent validity with related measures of psychopathology. The Turkish adaptation demonstrated good internal consistency (Cronbach’s $\alpha = .776$) [28].

Statistical analyses

All statistical analyses were performed in SPSS (Version 28.0) and Stata (Version 17). Descriptive statistics were used to profile the sample’s sociodemographic characteristics: continuous variables are reported as means with standard deviations, and categorical variables as counts with percentages (Table 1). Pearson product–moment correlations quantified bivariate associations among IGDS, ASRS, and PID-5-SF domain scores (Table 2). For each association, the correlation coefficient (r) and corresponding p value are presented; two-tailed statistical significance was defined a priori as $p < 0.05$.

To delineate direct and indirect relationships among ADHD symptom dimensions, personality traits, demographic variables (age, sex), and IGDS scores, a structural equation model was estimated in Stata (Figure 1). Inattention and hyperactivity/impulsivity were specified as exogenous predictors; the five maladaptive personality domains (negative affectivity, detachment, antagonism, disinhibition, psychoticism) as mediators; and IGDS score as the primary outcome. Age and sex were modeled as covariates with both direct paths to the outcome and indirect paths through the mediators. Sex was coded as 0 = female and 1 = male; therefore, positive standardized coefficients indicate higher values among males compared with females. Model adequacy was assessed using a suite of indices, including the χ^2 goodness-of-fit test, RMSEA, CFI, TLI, SRMR, and the AIC and BIC information criteria. A priori



benchmarks for good fit were a non-significant χ^2 ($p > .05$), RMSEA $< .06$, SRMR $< .08$, and CFI/TLI $> .95$.

Results

The study sample consisted of 258 participants with a mean age of 22.1 years ($SD = 2.3$) (see Table 1). The sample was predominantly female (63.6%), with males comprising 36.4%. Nearly all participants were single (98.4%); 1.2% were married and 0.4% divorced. Regarding residence, 47.7% lived alone, 25.2% resided in dormitory/hostel settings, 14.0% lived with their parents, and 13.2% cohabited with friends. The vast majority were unemployed (88.4%), while 11.6% were employed. In terms of substance use, 67.4% of the participants reported no tobacco use, and 32.6% reported current tobacco use. Alcohol consumption was reported by 24.8% of the sample, whereas 75.2% did not consume alcohol. Caffeine use was uncommon: 8.1% of participants reported consumption, whereas 91.9% reported no use. Substance use other than tobacco or alcohol was reported by 2.7% of participants; the remaining 97.3% reported no such use. With respect to monthly family income, 46.1% of participants reported an income between 17,000 and 50,000 units, 29.8% between 50,000 and 80,000, 17.1% between 80,000 and 130,000, and 7.0% above 130,000.

Table 1. Sociodemographic characteristics of the sample (N = 258, 100%).

		N = 258 (%100)			N = 258 (%100)
Age, (years), mean (SD)		22.1 (2.3)	Tobacco Use	None	174 (67.4%)
Gender	Female	164 (63.6%)		Present	84 (32.6%)
	Male	94 (36.4%)	Alcohol Use	None	194 (75.2%)
Marital Status	Single	254 (98.4%)		Present	64 (24.8%)
	Married	3 (1.2%)	Caffein Intake	None	237 (91.9%)
	Divorced	1 (.4%)		Present	21 (8.1%)
Living Arrangements	With parents	36 (14.0%)	Substance Use	None	251 (97.3%)
	In a dormitory or hostel	65 (25.2%)		Present	7 (2.7%)
	At home with friends	34 (13.2%)	Monthly Family Income	17000-50000	119 (46.1%)
	Alone	123 (47.7%)		50000-80000	77 (29.8%)
Employment Status	Employed	30 (11.6%)		80000-130000	44 (17.1%)
	Unemployed	228 (88.4%)	> 130000	18 (7.0%)	

Pearson correlation analyses were conducted to examine the relationships among scores from the IGDS, the ASRS, and the PID-5-SF (see Table 2). IGDS scores showed positive, statistically significant associations with all maladaptive personality domains: detachment ($r = .261, p < .01$), antagonism ($r = .271, p < .01$), disinhibition ($r = .236, p < .01$), psychoticism ($r = .272, p < .01$), and with the PID-5-SF total score ($r = .305, p < .01$). By contrast, correlations between IGDS and ADHD symptom dimensions were small and did not reach significance— inattention ($r = .086$), hyperactivity/impulsivity ($r = .079$), and ASRS total ($r = .090$). The ASRS total score correlated strongly with both inattention ($r = .903, p < .01$) and hyperactivity/impulsivity ($r = .920, p < .01$) subscales. Furthermore, ASRS total scores were significantly correlated with all PID-5-SF domains, including negative affectivity ($r = .423, p < .01$), detachment ($r = .231, p < .01$), antagonism ($r = .278, p < .01$), disinhibition ($r = .488, p < .01$), and psychoticism ($r = .529, p < .01$), as well as the total PID-5-SF score ($r = .568, p < .01$). Among the PID-5-SF traits, all domain scores were significantly intercorrelated ($r = .161$ to $.539$, all $p < .01$), and each was significantly associated with the PID-5-SF total score, with correlations ranging from $r = .610$ to $r = .828$ (all $p < .01$). These findings suggest that maladaptive personality traits are moderately to strongly interrelated and that higher levels of disinhibition, antagonism, and psychoticism are particularly associated with greater ADHD symptomatology and problematic gaming behaviors.

Table 2. Correlation matrix among variables from the Internet Gaming Disorder Scale - Brief Form (IGDS), Adult ADHD Self-Report Scale (ASRS), and Personality Inventory for DSM-5 – Short Form (PID-5-SF).

		IGDS	ASRS			PID-5-SF					
			IA	H/I	Total	NA	DE	AN	DI	PS	Total
IGDS		1									
ASRS	IA	.086	1								
	H/I	.079	.663**	1							
	Total	.090	.903**	.920**	1						
PID-5-SF	NA	.039	.387**	.385**	.423**	1					
	DE	.261**	.347**	.087	.231**	.291**	1				
	AN	.271**	.199**	.304**	.278**	.161**	.237**	1			
	DI	.236**	.546**	.353**	.488**	.198**	.366**	.352**	1		
	PS	.272**	.536**	.434**	.529**	.410**	.539**	.414**	.509**	1	
	Total	.305**	.586**	.457**	.568**	.624**	.700**	.610**	.694**	.828**	1

IGDS = Internet Gaming Disorder Scale - Brief Form, ASRS = Adult ADHD Self-Report Scale, PID-5-SF = Personality Inventory for DSM-5 – Short Form, IA = Inattentiveness, H/I = Hyperactivity/Impulsivity, NA = Negative affectivity, DE = Detachment, AN = Antagonism, DI = Disinhibition, PS = Psychoticism. * $p < .05$, ** $p < .01$; Pearson Correlation Coefficients

A SEM was tested to examine the direct and indirect effects of ADHD symptom dimensions (inattentiveness and hyperactivity/impulsivity), personality traits (negative affectivity, detachment, antagonism, disinhibition, and psychoticism), and demographic variables (age and sex) on IGDS. The initial hypothetical model is depicted in Figure 1, and the final path model with standardized regression coefficients is presented in Figure 2.

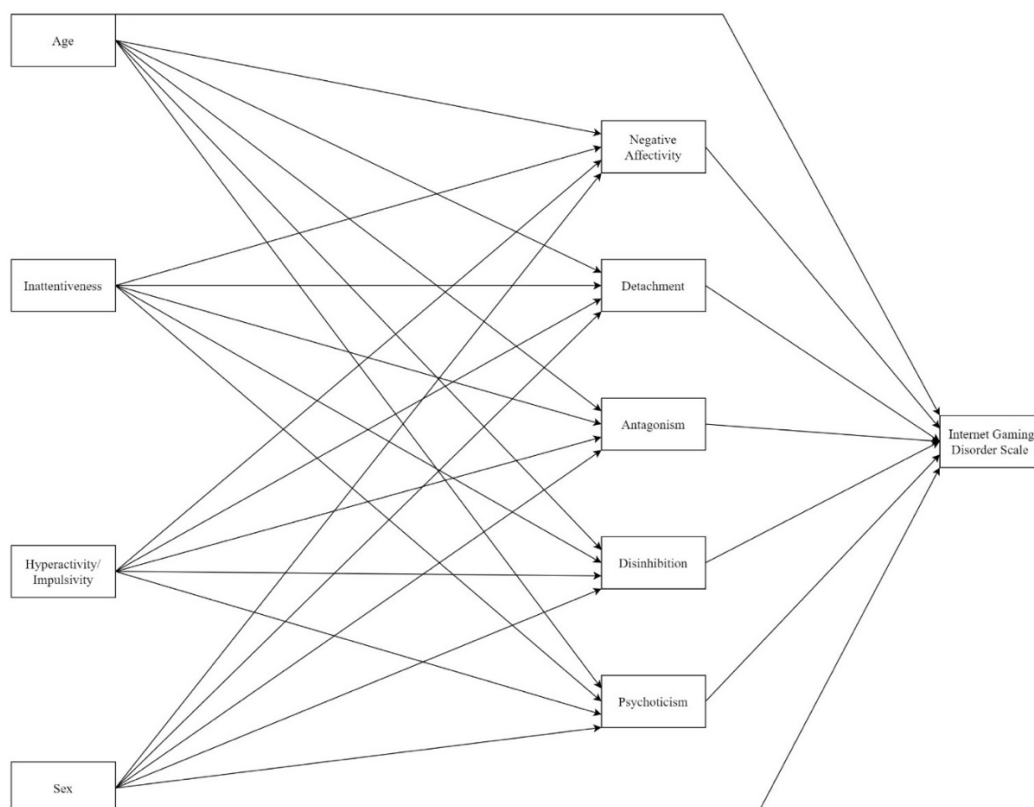


Figure 1. Path model illustrating associations between ADHD symptom dimensions, maladaptive personality traits, demographics, and internet gaming disorder.

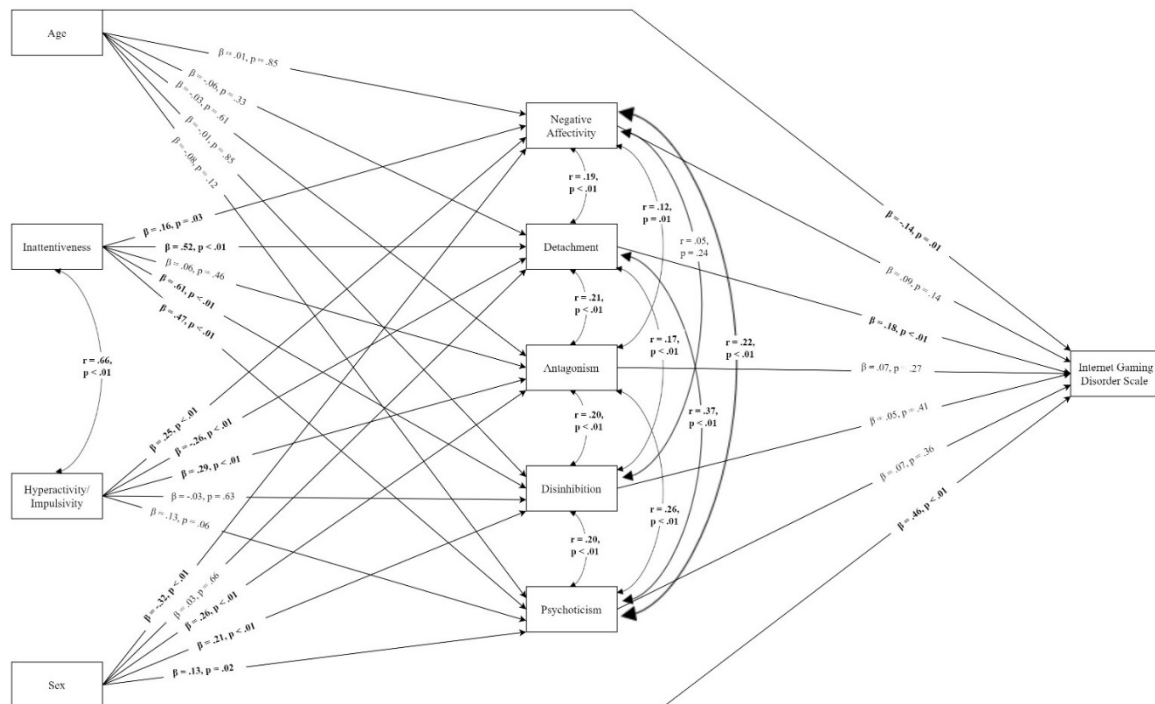


Figure 2. Path model demonstrating direct and indirect effects of inattentiveness, hyperactivity/impulsivity, personality traits, age, and sex on internet gaming disorder.

The final model demonstrated several significant paths (see Figure 2). Among the ADHD symptom dimensions, inattentiveness significantly was associated with negative affectivity ($\beta = .16, p = .03$), detachment ($\beta = .52, p < .01$), disinhibition ($\beta = .61, p < .01$), and psychoticism ($\beta = .47, p < .01$), while hyperactivity/impulsivity was significantly associated with negative affectivity ($\beta = .25, p < .01$), detachment ($\beta = -.26, p < .01$), and antagonism ($\beta = .29, p < .01$). In addition, inattentiveness and hyperactivity/impulsivity were highly correlated ($r = .66, p < .01$). Regarding personality traits, detachment ($\beta = .18, p < .01$) was significant positive predictors of IGDS. Other personality traits, including negative affectivity ($\beta = .09, p = .14$), antagonism ($\beta = .07, p = .27$), disinhibition ($\beta = .05, p = .41$), and psychoticism ($\beta = .07, p = .36$), did not demonstrate significant direct effects on IGDS. Sex emerged as a salient demographic predictor. It was inversely associated with negative affectivity ($\beta = -.24, p < .01$) and positively associated with antagonism ($\beta = .26, p < .01$), disinhibition ($\beta = .21, p < .01$), and psychoticism ($\beta = .13, p = .02$). No association was observed with detachment ($\beta = -.03, p = .66$). Furthermore, sex was directly associated with IGDS ($\beta = .46, p < .01$), indicating increased risk among male participants. Age was not significantly associated with any of the latent personality traits (all $p > .05$) but significantly associated with IGDS ($\beta = -.14, p = .01$). In terms of intercorrelations among maladaptive personality traits, significant associations were observed between all traits except for the pairwise relationship between negative affectivity and disinhibition ($r = .05, p = .24$), which did not reach statistical significance.

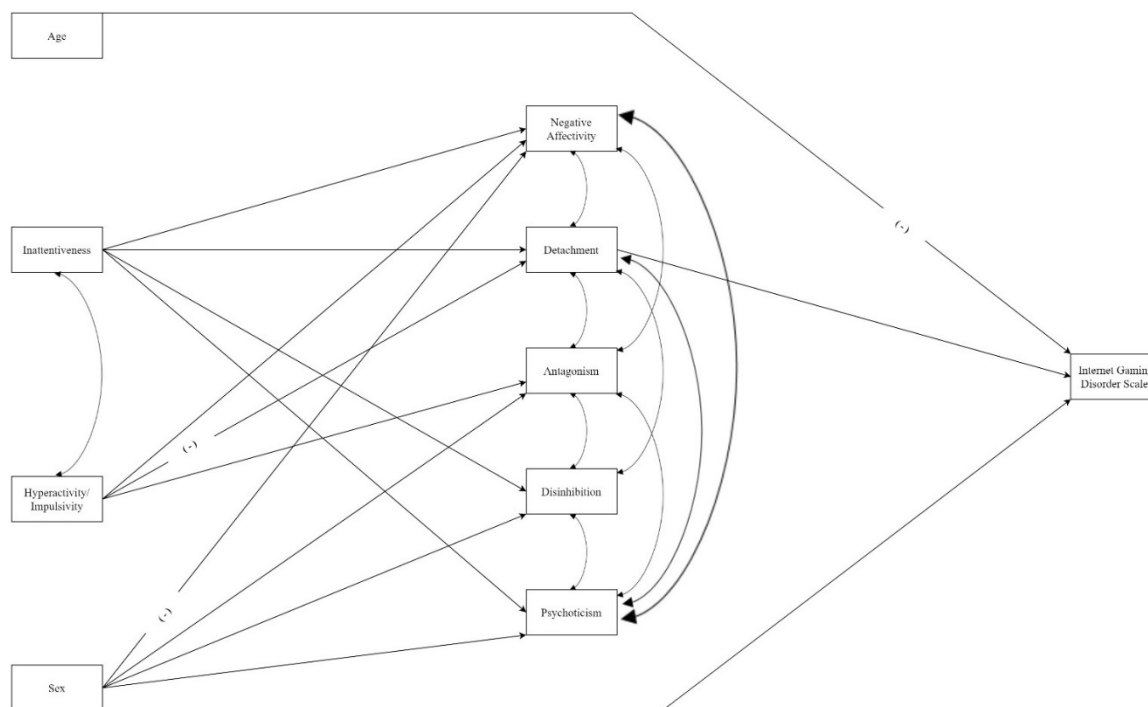


Figure 3. Final model illustrating significant effects of inattentiveness, hyperactivity/impulsivity, sex, and personality traits on internet gaming disorder.

The SEM demonstrated excellent global fit across indices. The χ^2 test was non-significant, $\chi^2(2) = .117$, $p = .943$, indicating no meaningful discrepancy between the observed and model-implied covariance matrices. The RMSEA was .000 (90% CI: .000–.023) with a close-fit probability (pclose) of .969, consistent with a close approximation to the population model. Incremental fit indices were likewise outstanding (CFI = 1.000; TLI = 1.062), surpassing conventional thresholds for good fit (> .95). The SRMR was minimal at .002, reflecting negligible residuals. Taken together, these indices strongly support the conclusion that the hypothesized model provides an excellent representation of the data. In summary, the model is consistent with an indirect association pattern from ADHD symptomatology—inattentiveness and hyperactivity/impulsivity—to IGDS indirectly via personality trait, particularly detachment. Additionally, age exerts a direct effect on IGDS, while sex may operate through IGDS both directly and indirectly through its associations with personality traits (See Figure 3).

Discussion

Using multivariate structural equation modeling, we examined psychological and demographic determinants of problematic internet gaming in a university-based cohort of young adults, with particular emphasis on ADHD symptom dimensions and maladaptive personality domains operationalized in the DSM-5 AMPD (negative affectivity, detachment, antagonism, disinhibition, and psychoticism). Overall, the findings converge on an indirect-risk architecture: ADHD symptomatology—especially inattentiveness—showed robust associations with multiple maladaptive trait domains, yet demonstrated no meaningful direct association with IGD at the bivariate level, and only detachment emerged as a unique proximal predictor of IGD in the final model. This pattern suggests that ADHD-related liability may be expressed in problematic gaming primarily via personality-linked pathways (most notably detachment), while demographic factors contribute additional explanatory value; male sex was a strong predictor of higher IGD scores, and age showed a modest inverse

association. As the data are cross-sectional, these pathways should be interpreted as correlational mechanisms rather than causal processes. Consistent with our a priori hypotheses, Hypothesis 1 was supported, with IGDS9-SF total scores correlating significantly with several maladaptive trait domains. Hypothesis 2 was not supported, as ADHD dimensions exhibited small, non-significant bivariate associations with IGDS9-SF total scores. The limited support for Hypothesis 2 warrants consideration of several plausible explanations. This null finding may reflect attenuation of ADHD-related symptom variance due to diagnosis-based exclusion criteria; shared method variance and measurement constraints inherent to self-report instruments (which may preferentially capture subjective distress rather than proximal executive control deficits); the university-specific contextual normalization of gaming as a leisure activity or coping strategy; and unmeasured moderators or confounders (e.g., gaming motivations and genres, offline social connectedness and loneliness, sleep disturbance, and internalizing symptoms). Hypothesis 3 received partial support: detachment mediated the inattentiveness–IGD association, whereas other personality domains did not show significant direct effects on IGD. Finally, Hypothesis 4 was supported, with both sex and age demonstrating significant associations with IGDS9-SF total scores.

In this cohort, greater IGDS9-SF total scores correlated positively with maladaptive trait domains—most notably detachment, antagonism, disinhibition, and psychoticism. Among ADHD symptom dimensions, the link between inattentiveness and internet gaming was most strongly mediated by the DSM-5 Detachment domain. Mediation via Detachment is compatible with the I-PACE model and accounts of compensatory internet use: interpersonal withdrawal and avoidance of intimacy amplify avoidance expectancies and a preference for online social interaction, thereby sustaining problematic gaming [29]. Detachment—marked by interpersonal withdrawal, restricted emotional intimacy, and limited investment in social relationships—appears to heighten vulnerability to problematic gaming. This pattern is consistent with prior evidence that individuals characterized by elevated detachment/introversion preferentially engage with online contexts in lieu of in-person social relationships. It highlights the clinical salience of interpersonal dysfunction in maintaining IGD [30]. It also converges with SEM findings in adult gamer samples and is consistent with meta-analytic evidence linking IGD to low extraversion [30-32].

In contrast to much of the prior literature, ADHD symptom dimensions were not directly associated with internet gaming severity in this cohort. This pattern suggests that ADHD contributes to problematic gaming primarily by shaping relatively stable trait liabilities, rather than acting as a proximal risk factor per se. Such an account may help reconcile discrepant findings: whereas some studies report robust direct associations, others implicate intermediary constructs—most notably impulsivity and hostility—as the operative pathways [33]. Given cultural specificities and the complexity of the evidence base, current scholarship emphasizes a dynamic, bidirectional, and context-dependent interplay among the intrinsic features of online games, the sequelae of excessive use, and co-occurring psychopathological processes [7,34].

Demographic factors also significantly influence internet gaming behaviour. Male participants had significantly higher IGD scores, consistent with a substantial body of literature indicating greater vulnerability among males [35]. A confluence of psychological and sociocultural mechanisms likely underpins this pattern: males more frequently prefer competitive, achievement-oriented genres; in many contexts—including Türkiye—gaming carries greater social legitimacy for young men than for young women; and industry marketing and design practices remain disproportionately oriented toward male consumers [36]. Prevailing gender norms and cultural stereotypes frequently construct gaming as a “masculine” activity, fostering earlier exposure to online games during childhood and adolescence among boys [35,36]. Early initiation, in turn, has been associated with more intensive engagement and more severe gaming trajectories in later years, which may help explain observed sex/gender differences [35,37,38]. These pathways can be further reinforced by parental and peer encouragement, as well as by

gendered disparities in leisure opportunities [39]. Age is another salient determinant: younger students tend to exhibit higher IGDS9-SF total scores—a vulnerability that, from a developmental standpoint, plausibly reflects ongoing maturation of executive control and emotion-regulatory systems and, in turn, heightened sensitivity to the rewarding and immersive properties of online games [6].

These findings indicate that, in university settings, clinical responses to problematic gaming should not be confined to assessing gaming behavior alone. Routine evaluation should also encompass personality functioning—particularly detachment—and ADHD symptom dimensions (inattention and hyperactivity/impulsivity) to refine risk stratification and inform case formulation and management. The mediating role of detachment highlights the clinical utility of interventions that directly address social withdrawal, restricted capacity for emotional intimacy, and diminished interpersonal engagement, including structured efforts to enhance social connectedness; psychoeducation and skills-based training targeting interpersonal effectiveness; and cognitive-behavioral strategies that strengthen self- and emotion-regulation. Although ADHD symptoms were not directly associated with IGDS9-SF total scores in bivariate analyses, their strong links with maladaptive trait domains suggest potential clinical relevance for targeting attentional and self-regulatory difficulties; however, the cross-sectional design precludes causal inference. Finally, the associations of male sex and younger age with higher IGD scores support culturally sensitive screening, early psychoeducation, and preventive “digital hygiene” initiatives within campus-based mental health services.

Methodologically, this study advances the field by leveraging SEM to interrogate complex constellations of direct and indirect pathways. The excellent model fit indicates close correspondence between the hypothesized structure and the observed data, providing robust support for the framework linking ADHD symptomatology, maladaptive personality traits, and IGD. This strategy extends beyond simple correlational designs and strengthens the inferential rigor of the findings.

Limitations

Several limitations warrant consideration. First, the cross-sectional design precludes temporal ordering and therefore does not permit causal inference regarding the proposed indirect pathways from ADHD symptom dimensions to IGD via maladaptive personality traits. Although the SEM results are consistent with an indirect-risk architecture, the observed associations may also reflect reverse or reciprocal processes—for example, sustained problematic gaming could contribute to interpersonal withdrawal or exacerbate attentional difficulties over time. Longitudinal and cross-lagged designs are needed to adjudicate directionality and to test developmental sequencing more rigorously.

Second, all variables were assessed using online self-report instruments, which increases the risk of shared method variance and reporting biases (e.g., recall error, impression management, and differential item interpretation). Future studies would benefit from multi-informant approaches and the inclusion of clinician-rated assessments, structured diagnostic interviews, and/or behavioural indices of attention and impulsivity.

Third, the sampling frame was limited to a university-based young-adult cohort and excluded participants reporting a prior psychiatric diagnosis. While this strategy may have reduced heterogeneity and potential confounding by treatment status, it also constrains external validity and may attenuate symptom–outcome associations, particularly for ADHD–IGD links. Relatedly, psychiatric history was assessed via a single self-report item, which may introduce misclassification; subsequent research should incorporate validated screening batteries or structured assessments to characterise diagnostic status more precisely.

Fourth, although the study captured core constructs central to contemporary IGD models (ADHD dimensions and AMPD maladaptive trait domains), several potentially informative mechanisms were



not measured, including emotion regulation capacity, stress and coping styles, reward sensitivity, gaming motives (e.g., escapism, achievement), comorbid internalizing symptoms, sleep disruption, and objective markers of gaming exposure (time, genre, monetization involvement), inclusion of these variables could clarify whether detachment is a primary mediator or a proxy for broader interpersonal, motivational, or affect-regulatory processes that sustain gaming-related impairment.

Conclusion

In this university-based cohort, ADHD symptomatology—especially inattention—was related to problematic gaming predominantly through maladaptive personality pathways, with detachment emerging as the central mediator and the only trait domain exerting a unique proximal effect on IGD in the final model. This profile supports a multidimensional conceptualisation of IGD in which neurodevelopmental symptom liability is expressed through trait-level vulnerabilities and shaped by demographic context. Detachment, defined by interpersonal withdrawal and restricted emotional intimacy, appears to represent a clinically actionable mechanism through which attentional difficulties may translate into gaming-related impairment; within contemporary accounts of problematic internet use (e.g., I-PACE and compensatory use models), gaming may function as an avoidant or compensatory strategy in the context of diminished offline engagement. Demographically, male sex and younger age further characterised elevated risk, consistent with developmental and sociocultural influences on gaming exposure and reinforcement. Taken together, these findings argue for an integrative clinical approach in university settings that extends beyond symptom counts or gaming frequency to include routine assessment of maladaptive personality functioning—particularly detachment—alongside ADHD symptom dimensions, thereby strengthening risk stratification, informing case formulation, and guiding socially oriented prevention and intervention targets focused on interpersonal disengagement and social withdrawal.

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Conflict of interest

The authors declare no conflict of interest.

Data availability statement

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

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