BMC Psychiatry

RESEARCH

Open Access

Classifying problematic gaming using a latent profile approach based on personality traits in Chinese young adolescent

Jingyue Hao[1†], Zhenjiang Liao[1†], Qiuping Huang[2], Xinxin Chen[1], Shuhong Lin[1], Yongyan Shi[1], Yifan Li[1], Yin Tang[1], Xuhao Wang[1] and Hongxian Shen[1*]

Abstract

Background Internet gaming has gained widespread popularity in China, yet the classification of problematic gaming subtypes based on personality traits remains limited. This study aimed to employ latent profile analysis (LPA) to identify distinct groups of online gamers and compare key variables across these groups.

Methods An online survey was conducted within 5593 internet gaming users, including a demographic questionnaire, queries on internet gaming usage, the Video Gaming Dependency Scale, and the Chinese Big Five Inventory-brief version. LPA was applied to identify distinct user groups, followed by an examination of associations between profile membership and auxiliary variables.

Results LPA identified three gamer categories for problematic gaming: "high-risk" (64.78%), "medium-risk" (3.22%), and "low-risk" (32%). High-risk gamers allocated more time and financial resources to gaming for escapism and leisure purposes. The medium-risk group sought enjoyable experiences, exhibiting traits that were intermediate between the high- and low-risk groups. High-risk gamers demonstrated elevated levels of neuroticism, accompanied by lower scores in other Big Five personality traits. In contrast, medium-risk gamers scored low across all Big Five dimensions, while low-risk gamers achieved higher scores in all traits except neuroticism. Notably, the low-risk group reported forming the fewest new online friendships, despite sharing similar social motivations with the other groups.

Conclusion Traits such as low neuroticism and high conscientiousness serve as protective factors against gaming addiction, while being unmarried or an only child provides additional safeguards. Conversely, increased time and financial investment in gaming activities are associated with a heightened risk of addiction. These findings are crucial for identifying high-risk gamers and informing the development of targeted interventions.

Keywords Problematic gaming, Internet gaming use characteristics, Personality traits (big five model), Chinese adolescent gamers, Latent profile analysis

†Jingyue Hao and Zhenjiang Liao contributed equally and share the first author.

*Correspondence:
Hongxian Shen
shenhx2018@csu.edu.cn
Full list of author information is available at the end of the article

© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

Introduction

Gaming addiction, characterized by an inability to regulate gaming behavior and its prioritization despite negative consequences, has emerged as a significant behavioral issue. Its inclusion in the DSM-5 in 2013 [1] and subsequent classification as a disease in the ICD-11 in 2019 [2], alongside gambling disorders, underscores its growing recognition. The proliferation of digital devices has contributed to a notable increase in gaming addiction rates. Studies have revealed a 23% addiction rate among gamers, with ADHD identified as a potential risk factor [3]. According to the American Medical Association, approximately 90% of U.S. youth engage in computer gaming, with around 15% exhibiting addiction [4]. The problem is even more pronounced in South Korea and China, with addiction rates reaching as high as 29.4% [5]. This research found a 12% addiction rate in East Asia [6], while in China, 80% of adolescents interact with digital media, resulting in a 14% addiction rate [7]. Although gaming addiction brings many problems, gaming has been associated with social benefits and cognitive enhancements, including memory improvement [8]. Therefore, the ability to distinguish between regular and addicted gamers holds considerable importance.

In the I-PACE model, psychological constitutions serve as predisposing factors that can lead to gaming disorder. Specifically, the model emphasizes the interplay between individual characteristics, behavioral patterns, and contextual factors in the development of addictive behaviors. Gaming motivation is one of the key interacting factors and may serve as an important indicator for determining appropriate intervention strategies. Numerous motivations related to digital gaming have been identified, such as the need for competence, competition, achievement, escapism, interpersonal relationships, role-playing, fantasy, entertainment, and social interaction [9]. Researchers have also identified certain motivations that predict gaming disorder, such as escapism [10], where the desire to escape from the real world leads players to immerse themselves for extended periods in the more captivating virtual worlds. Social interaction is another recognized motivation [11], with players becoming deeply engaged in the social aspects of online gaming, shifting their time away from offline relationships, such as those with family and friends. It is evident that players with certain motivations may be more susceptible to gaming disorder.

In this context, the Big Five Personality Traits represent a significant measurement tool for understanding psychological constitutions relevant to gaming behaviors [12]. The Big Five model delineates personality characteristics across five dimensions: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness [13]. A substantial body of research supports the premise that personality traits are closely linked to various psychological disorders and addictive behaviors. Genevieve F Dash's research identified a correlation between high neuroticism, low agreeableness, and low conscientiousness with several disorders [14]. Furthermore, low extraversion was associated with nicotine and cannabis use, while low openness was linked specifically to cannabis use [15]. Kotov et al. established a connection between high neuroticism and low conscientiousness with substance use disorders [16]. In the realm of gaming addiction, Wang et al. found that low conscientiousness and openness were related to problematic gaming behaviors [17]. Conversely, Braun's work identified low neuroticism among regular gamers [18]. Dieris-Hirche et al. reported that problematic gamers exhibited higher neuroticism along with lower levels of extraversion, conscientiousness, and openness, albeit no significant difference in agreeableness [19]. Our previous research established a correlation between online gaming, heightened neuroticism, and diminished conscientiousness [20].

Research employing latent profile analysis (LPA) to model subtypes of the Big Five/Five Factor Model further underscores the relevance of this study. Most studies have concentrated on addiction symptoms, typically classifying individuals into three clusters, wherein neuroticism emerges as the most significant trait for classification, while openness is identified as the least distinctive trait. This indicates that a deeper understanding of how these personality traits interact within the context of gaming addiction is crucial, thereby strengthening the rationale for examining the proposed variables in our current study. By analyzing the interplay of personality traits through LPA, this research aims to contribute to both theoretical advancements and practical applications in understanding and mitigating gaming-related issues [21].

Limited research has employed mixed modeling techniques such as Latent Profile Analysis (LPA) or Latent Class Analysis (LCA) to categorize the risks associated with problematic gaming based on the Big Five personality traits [22]. Unlike traditional methods, these models identify latent subgroups characterized by similar internal patterns but distinct responses across groups, offering enhanced flexibility that is not constrained by the rigid assumptions of traditional statistical frameworks.

Categorizing diverse online gamers based on their personality traits has significant implications for informing personalized treatment strategies. Furthermore, these traits are correlated with the functioning of serotonergic and dopaminergic systems [23], indicating potential physiological distinctions between problematic gaming players and casual players. Analyzing these traits may

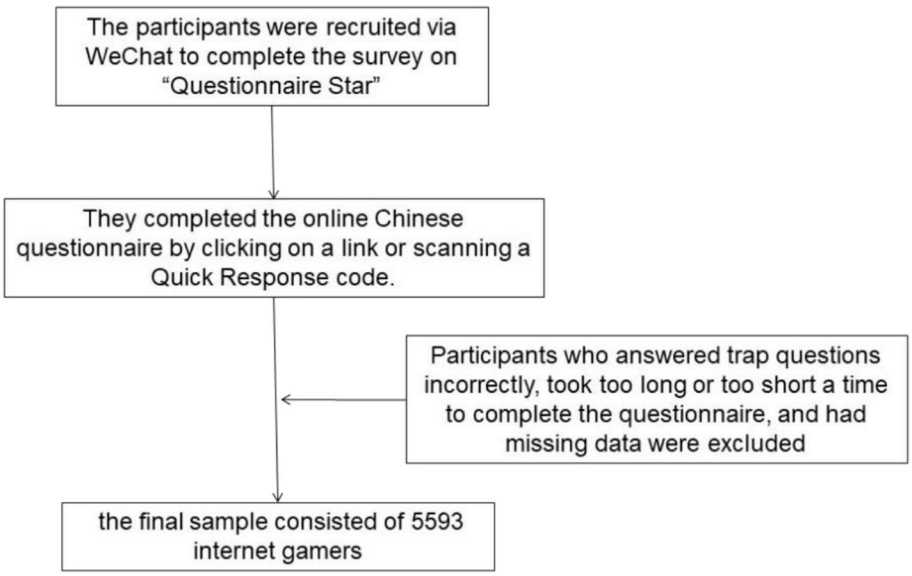

Fig. 1 Flowchart of participants recruitment

also reveal factors that explain gaming behaviors, such as playtime and expenditure [24].

The primary objective of this study is to employ Latent Profile Analysis (LPA) to classify the risks associated with problematic gaming based on personality traits. Specifically, we hypothesize that distinct gamer profiles will emerge, characterized by varying levels of risk for gaming addiction. We anticipate that individuals classified as high-risk gamers will demonstrate significantly higher levels of neuroticism and lower levels of conscientiousness compared to medium- and low-risk gamers. Conversely, we expect that low-risk gamers will exhibit higher levels of agreeableness and openness to experience. Furthermore, we propose that gaming motivations, such as escapism and entertainment-seeking, will be more prevalent among high-risk gamers than among their lower-risk counterparts. By validating these hypotheses, this research aims to deepen the understanding of the interaction between personality traits and gaming behaviors, ultimately informing targeted interventions for individuals at different levels of risk for gaming addiction.

Materials and methods

Participants

Convenience sampling was employed in this study. Researchers invited Chinese Internet game users to participate in an online survey conducted from October 2019 to November 2019. Participants were recruited via WeChat to complete the survey on "Questionnaire Star"—a widely used online questionnaire platform. They accessed the survey by clicking on a link or scanning a QR code. Upon arriving at the website, participants were presented with a brief introduction to the study's background, purpose, and voluntary participation, along with assurances of anonymity and confidentiality. They were informed that they could withdraw from the study at any time. At the bottom of the first page, participants had the option to choose "reject" to quit the survey or "accept" to proceed to the next page and continue filling out the questionnaire. Anyone with access to the internet who understands Chinese and is at least 15 years old could participate (Fig. 1).

We received a total of 6,324 responses. A total of 342 questionnaires were removed due to repetitive or outlier response times, while 389 questionnaires were discarded for responding with the same answer on ten consecutive questions. After excluding cases due to missing values, the final sample consisted of 5593 internet gamers whose mean age was 19.38 (SD = 1.63 years, range = 15–25 years), and 59.5% were male ($n = 3326$) (Table 1).

Sample characteristics

This study specifically recruited Chinese adolescents aged 15 to 25 due to the heightened vulnerability of this demographic to Problematic Gaming Disorder (PGD). Previous research indicates that younger individuals, particularly adolescents, may be predisposed to higher risks of PGD due to factors such as social influence, developmental stage, and increased emotional investment in gaming. By focusing on this age group within the Chinese context, we aim to gather insights into the specific gaming behaviors and personality traits of adolescents,

Table 1 Sample characteristics ($N=5593$)

		Mean	SD	*N* (%)
Age		19.38	1.63	
Gender	Male			3326(59.5)
	Female			2267(40.5)
Education	Primary school			4(0.1)
	Junior high school			17(0.3)
	Senior high school			2274(40.7)
	University			3233(57.8)
	Master's degree or above			65(1.2)
Relationship status	Single			5465(97.7)
	Couple			128(2.3)
Family structure	being an only child			2750(49.2)
	having siblings			2843(50.8)
Gaming use characteristics				
Money spent on gaming/month(yuan)		68.26	151.10	3311(59.2)
Game genre	strategy			3311(59.2)
	action-shooter			680(12.2)
	Brain and skill			889(15.9)
	RPGs			713(12.7)
Daily gaming time(hours)		1.88	1.32	
Device	Mobile			4082(73)
	PC			1511(27)
Long-term game partners	none			1992(35.6)
	$3 > N \geq 1$			1845(33.0)
	$6 > N \geq 3$			1069(19.1)
	$N \geq 6$			687(12.3)
VGDS		2.41	2.51	
Addiction	No			4559(81.5)
	Yes			1034(18.5)
Motives				
Seeking pleasure	No			3838(68.6)
	Yes			1755(31.4)
Escaping reality	No			4955(88.6)
	Yes			638(11.4)
Coping with negative emotions	No			3214(57.5)
	Yes			2379(23.5)
Passing time	No			1853(33.1)
	Yes			3740(66.9)
Making friends	No			4505(80.5)
	Yes			1088(19.5)

VGDS The Chinese version of the Video Gaming Dependency Scale

thereby informing tailored interventions and preventive measures.

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013. All procedures involving human subjects/patients were approved by Clinical Research Ethics Committee of Second Xiangya Hospital of Central South University(2020)No:004.

Measures

We collected socio-demographic data, including age, sex, and marital status. Gaming characteristics examined comprised game genre, primary gaming devices, monthly spending, daily playtime over the past year, and gaming

motivation. Game genres featured included Strategy, Adventure, Battle Royale, and RPGs. Primary gaming devices were mobile phones or computers. Monthly spending including in-game micro transactions, physical goods related to games and payment network fees. Gaming motivations, assessed through multiple-choice questions, encompassed sensation-seeking and escapism.

Problematic gaming was assessed by the Chinese version of Video Gaming Dependency Scale (VGD-S), which was revised from the English version developed by Rehbein et al., covering all nine criteria of the DSM-5. For each criterion, there were two items. Participants were asked to choose each of the 18 descriptive items they had experienced in the past 12 months on a four-point Likert scale ranging from 1 (total disagreement) to 4 (full agreement). A criterion was met if at least one of the two items was answered with 4 (full agreement). Participants who endorsed five or more of the nine criteria were classified with IGD (range: 0–9) [25]. The VGD-S was evaluated in a sample of 11,003 German students, aged 13–18, demonstrating good reliability of Cronbach's a with 0.93. The Chinese version of the VGD-S yielded an internal consistency of 0.92 in this research.

Personality traits were assessed using the 40-item brief version of the Chinese Big Five Inventory (CBF-PI-B) [26]. Each of the Big Five personality traits—conscientiousness, extraversion, agreeableness, neuroticism, and openness—was measured with eight items corresponding to each dimension. Responses were recorded on a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree), demonstrating reliability for the Chinese population (Cronbach's $\alpha = 0.87$). The Cronbach's α values for neuroticism, conscientiousness, agreeableness, openness to experience, and extraversion were 0.859, 0.779, 0.745, 0.781, and 0.780, respectively [27].

For quality control in our online survey, we implemented attention-check questions, excluded repetitive or outlier response times, and removed participants who selected the same answer for ten consecutive questions. This dataset was also utilized in a previous article by the authors [28].

Statistical analysis

This study employed a cross-sectional latent profile analysis with a dual aim: (1) to identify the underlying risks of problematic gaming based on the mean scores of the Chinese Big Five Inventory, and (2) to assess the relationships between personality traits and various auxiliary variables. Initially, latent profile analysis (LPA) models ranging from one to nine profiles were fitted, and the results were compared to determine the optimal number of profiles.

Table 2 Fit statistics to identify the optimal number of latent profiles

Model	Npar=k	LL	BIC	AIC	SABIC
1-Cluster	10	-93494.487	187075.267	187008.974	187043.49
2-Cluster	16	-91692.975	183524.018	183417.95	183473.175
3-Cluster	22	-90338.064	180865.971	180720.127	180796.062
4-Cluster	28	-89976.585	180194.79	180009.171	180105.815
5-Cluster	34	-89621.286	179535.967	179310.572	179427.925
6-Cluster	40	-89471.501	179288.174	179023.003	179161.066
7-Cluster	46	-89333.129	179063.205	178758.259	178917.031
8-Cluster	52	-89265.745	178980.211	178635.489	178814.971
9-Cluster	58	-89198.725	178897.948	178513.45	178713.641
Model	Entropy	Small least class%	LMR *p*-value		
1-Cluster	——	100%	——		
2-Cluster	0.656	40.41%	0		
3-Cluster	0.826	3.22%	0		
4-Cluster	0.833	3.15%	0		
5-Cluster	0.77	5.02%	0.0025		
6-Cluster	0.745	2.47%	0		
7-Cluster	0.753	1.88%	0		
8-Cluster	0.752	1.81%	0.6676		
9-Cluster	0.762	0.97%	0.409		

Npar number of estimated parameters, *LL* log likelihood, *BIC* Bayesian information criterion, *AIC* Akaike information criterion, *SABIC* sample-size adjusted Bayesian information criterion, *LMR p-value* P-values of the Lo-Mendell-Rubin Adjusted Likelihood Ratio test

After identifying the best-fitting LPA model, the relationships between the personality trait profiles and auxiliary variables expected to have a relationship with the respondents' latent profile membership were explored. Differences in demographic characteristics, Internet gaming use characteristics, and CBF-PI-B scores among the four genre groups were compared and analyzed using variance (distribution of continuous variables) or chi-square (χ 2) tests (categorical variables). The significance level was set at $p < 0.05$, and all statistical analyses were performed using Mplus 8.0 and SPSS 23.0.

Ethics

The Ethics Committee of Second Xiangya Hospital of Central South University approved the study protocol. Before completing the questionnaire, the participants had to indicate whether they refused or agreed to participate in the research. Only those willing to participate in the study could continue to answer the questionnaire.

Results

Latent profile analysis

An LPA was conducted to identify respondents' underlying personality traits (Table 2). The log likelihood (LL), Bayesian information criterion (BIC), Akaike information

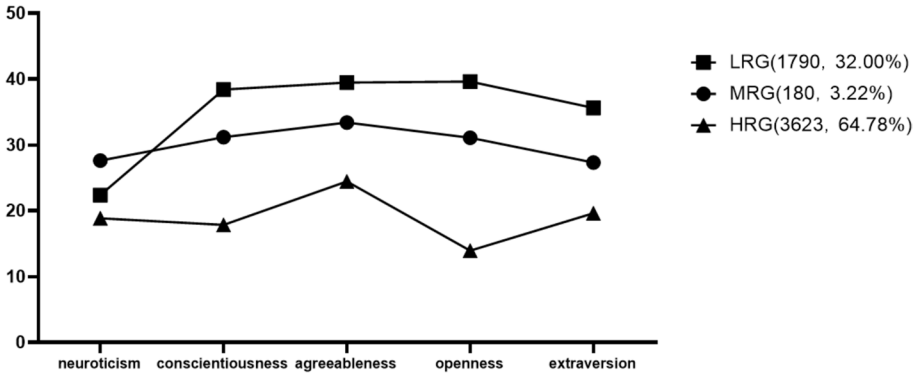

Fig. 2 The mean scores of the big five personality traits within each latent profile

criterion (AIC), and sample-size adjusted Bayesian information criterion (SABIC); values decreased as the number of profiles increased. Then, the number of profiles can be selected as an elbow point [29], which shows a relatively large decrease in the values instead of the minimum. The changes in the IC from three to four profiles were much smaller than those in the other changes, which can be considered as an evident elbow point.

Such a decreasing pattern in IC values is often found in situations such as the violation of the local independence assumption; that is, profile indicators are correlated given profile memberships [30].

When careful consideration was given to the interpretability of the solutions, the 3-profile model was superior to the others in explaining heterogeneity. Moreover, the model with five profiles produced at least one profile, including less than 1–5% of the respondents; therefore, the 3-profile model was the most appropriate model in this study.

The latent profile probabilities (i.e., profile sizes) and the mean scores of personality traits within each profile are shown in Fig. 2. Each latent profile was labeled based on the personality trait score pattern.

Profile 1 included 3.22% ($n=180$) of respondents whose personality trait scores were generally lower than those of other profiles; they were labeled as medium-risk gamers (MRG). Profile 2 comprised 64.78% ($n=3623$) of the respondents; their personality trait scores were generally between Profile 1 and Profile 3, except for neuroticism; they were labeled high-risk gamers (HRG). Profile 3, consisting of 32% of respondents ($n=1790$), had generally higher personality trait scores compared to other profiles, except for neuroticism. This profile was labeled as low-risk gamers (LRG).

To further understand the characteristics of each profile, we examined the associations between latent profile membership and auxiliary variables in Table 3. Demographic covariates such as age, sex, marital status, and family situation significantly affected profile membership. However, education did not show a significant effect. In the moderate-risk group, males account for 75.6%, and females account for 24.4%, making the proportion of males significantly higher than females. The proportions of females in the low-, moderate-, and high-risk group are 36.00%, 24.4%, and 45.6%, respectively, with the highest proportion of females found in the high-risk group. Regardless of the group, there were more males than females. Most participants were unmarried, and the marriage rate was notably higher in the moderate- and high-risk groups than in the low-risk group. Among all participants, half were only child, and the other half had siblings. The proportion of only children was slightly lower overall, but in the low-risk group, it exceeded the proportion of participants with siblings, reaching the highest proportion.

The association between latent profile membership and all psychological and gaming/leisure-related distal outcomes was statistically significant in Table 3. However, equipment and one of the gaming motivators, making friends, did not show significance. In the low-risk group, the level of gaming involvement, such as money spent on gaming per month (in yuan) and daily gaming time (in hours), was the lowest. Strategy games were the most popular genre overall, but the high-risk group had a lower proportion of strategy games compared to the other two groups, while RPGs showed a significant increase in the high-risk group. Device usage also varied among the three groups, with a notable increase in the proportion of mobile gamers in the high-risk group.

The three groups exhibited significant differences in their motivations for gaming. The high-risk group tended to engage in gaming to escape reality, cope with negative emotions, and pass time, while the moderate-risk group primarily sought pleasure. There were no significant differences among the groups in terms of making friends, but the proportion of actual friends made through

Table 3 Associations between latent profile membership and auxiliary variables

Variable	LRG	MRG	HRG	F/χ2 (df)	*P*
Age	19.28	19.24	19.44	6.618(2)	0.001
Gender				48.092(2)	<0.001
Male	64.00%	75.60%	56.40%		
Female	36.00%	24.40%	43.60%		
Education				7.167(8)	0.519
Junior high school	0.10%	0.00%	0.10%		
Senior high school	0.30%	0.60%	0.30%		
University	41.10%	40.60%	40.50%		
Master's degree or above	56.90%	57.80%	58.20%		
Junior high school	1.70%	1.10%	0.90%		
Relationship status				21.512(2)	<0.001
Single	99.10%	97.80%	97.00%		
Couple	0.90%	2.20%	3.00%		
Family structure				26.734(2)	<0.001
Being an only child	54.20%	48.30%	46.70%		
Having siblings	45.80%	51.70%	53.30%		
Money spent on gaming/month(yuan)	51.14	72.1	76.52	17.053(2)	<0.001
Game genre				15.002(6)	0.02
Strategy	60.30%	67.80%	58.20%		
Action-shooter	13.00%	8.90%	11.90%		
Brain and skill	15.40%	15.00%	16.20%		
RPGs	11.30%	8.30%	13.70%		
Daily gaming time(hours)	1.72(1.207)	1.97(1.257)	1.95(1.371)	19.171(2)	<0.001
Device				2.115(2)	0.347
Mobile	71.90%	71.10%	73.60%		
PC	28.10%	28.90%	26.40%		
Long-term game partners				41.082(6)	<0.001
None	34.00%	33.90%	36.50%		
$3 > N \geq 1$	31.10%	30.00%	34.10%		
$6 > N \geq 3$	18.90%	18.90%	19.20%		
$N \geq 6$	15.90%	17.20%	10.20%		
VGDS	1.65(1.936)	1.89(3.014)	2.81(2.643)	137.636(2)	<0.001
Addiction				169.199(2)	<0.001
No	91.20%	82.80%	76.60%		
Yes	8.80%	17.20%	23.40%		
Seeking pleasure				7.010(2)	0.03
No	71.00%	66.70%	67.50%		
Yes	29.00%	33.30%	32.50%		
Escaping reality				103.176(2)	<0.001
No	94.90%	87.80%	85.50%		
Yes	5.10%	12.20%	14.50%		
Coping with negative emotions				9.867(2)	0.007
No	59.90%	62.80%	56.00%		
Yes	40.10%	37.20%	44.00%		
Passing time				13.399(2)	0.001
No	35.70%	40.00%	31.50%		
Yes	64.30%	60.00%	68.50%		
Making friends				2.086(2)	0.352
No	79.40%	80.60%	81.10%		
Yes	20.60%	19.40%	18.90%		

VGDS The Chinese version of the Video Gaming Dependency Scale

gaming was lowest in the high-risk group and highest in the low-risk group.

Discussion and conclusions

The primary objectives of this study were twofold: (1) to classify online players into distinct groups based on the big Five, differentiating problem players from leisure players, and (2) to compare various psychological and game/leisure-related variables across these groups. By classifying gaming groups, researchers can better understand the characteristics of different gaming groups, which can also help us identify people who are more likely to develop gaming disorder at an early stage, so as to facilitate timely intervention and treatment. Through LPA, three potential clusters emerged: (1) LRG, (2) MRG, and (3) HRG.

The LRG cluster exhibited personality traits characterized by low neuroticism and high levels of conscientiousness, agreeableness, openness, and extraversion. In comparison to the HRG and MRG clusters, LRG members spent less time (mean = 1.72, $p < 0.001$) and money (mean = 51.14, $p < 0.001$) on gaming. Their gaming motives were less driven by a desire to escape reality or seek pleasure. Although the motivation to make friends did not significantly differ among the three clusters, LRG members had a higher number of friends made through gaming. Additionally, LRG members exhibited the lowest frequency of meeting criteria for Video Game Dependency Syndrome (VGDS) and had the lowest likelihood of gaming addiction.

In contrast, the HRG cluster displayed high levels of neuroticism and moderate levels of conscientiousness, agreeableness, openness, and extraversion. Among the three clusters, HRG members dedicated the most time to gaming (mean = 1.95, $p < 0.001$) and spent the most money on gaming (mean = 76.52, $p < 0.001$). They possessed multiple gaming motives, such as escaping reality, alleviating negative emotions, and passing time, but they formed the fewest number of friendships through gaming. HRG members met the majority of VGDS criteria and exhibited the highest likelihood of experiencing gaming addiction problems.

The MRG cluster had low neuroticism scores and medium scores in conscientiousness, agreeableness, openness, and extraversion. They ranked in the middle range for VGDS diagnosis and gaming addiction rates, similar to the HRG cluster. The primary motivation for gaming among MRG members was entertainment.

Low neuroticism and high conscientiousness are considered relatively established protective factors [23, 31]. Individuals with high neuroticism are widely believed to seek stability and a sense of control, making them more likely to turn to digital environments when they feel incompatible with the external world [31]. This finding aligns with the gaming motivations of the high-risk group, which included escaping reality and coping with negative emotions. High conscientiousness is a protective factor against addiction, owing to individuals' higher commitment to personal goals, greater ability to adhere to schedules, and increased control over their lives, enabling them to adapt better to real-life situations [32]. Consequently, they were less attracted to gaming.

Previous research has shown that personality traits other than these two have conflicting associations with gaming addiction. A meta-analysis of 145 studies found that PGD had no significant correlation with openness to experience but showed a negative correlation with extraversion and agreeableness [33]. Another article, which included 17 studies, found that agreeableness, extraversion, and openness to experience are not universally associated with online gaming [23]. In this study, while neuroticism in the MRG was lower than in the LRG, other personality traits were also lower, ultimately resulting in a significantly higher addiction risk in the MRG than in the LRG. Therefore, high levels of agreeableness, openness, and extraversion are also protective factors against gaming addiction. This is because many problematic internet use tend to use the Internet to avoid negative emotions or relieve stress, and agreeableness is negatively correlated with stress and negative emotions; thus, agreeableness becomes a protective factor for game disorders [34]. Self-preference may also be a mediating factor, and people with low agreeableness may receive rejection and negative comments from friends or their surroundings, resulting in decreased self-preference [32]. Extraversion and openness both may indirectly affect Internet addiction through maladaptive cognition [35]. Both virtual and real activities provide individuals with attractive opportunities to satisfy their curiosity and interests, and such individuals prefer real life to virtual activities. Moreover, openness and extraversion were negatively correlated with positive predictors such as loneliness, depression, and social anxiety, and were more independent, which means that these individuals were less dependent on external factors such as the Internet [35]. Thus, openness to experience and extraversion are negative rather than positive predictors of Internet addiction. Using gaming for enjoyment is a protective factor against gaming addiction, as confirmed by Hamzehzadeh [36]. This may explain why the rate of MRG addiction is lower than that of HRG addiction. In addition, despite no differences in social gaming motivations across the three clusters, LRG made the most friends in games in the past year, followed by MRG, and HRG had the lowest number of friends. In the past year, 36.5% of HRG individuals did

not make any friends in the game, which was the highest proportion among the three groups. In contrast, the proportion of HRG individuals with more than six friends was the lowest, at 10.2%. This study suggests that having more friends in games during the past year acts as a protective factor against Problematic internet use. It suggests that the high agreeableness of LRG plays a role in developing healthy interpersonal relationships, both in real life and online games, allowing them to make more friends in games, even with low game involvement.

Previous research has indicated that gamers with pathologies may seek social support and recognition from other gamers while using online games to escape reality [37]. Therefore, adolescents who are highly addicted to smartphones, social media, and online games may engage in more interpersonal interactions with online friends [38]. Another study also indicated that gaming addiction negatively affects offline friendships, as time spent on social interactions with others decreases while time spent playing games increases. Language and non-verbal communication, active listening, cooperation, and intimacy are all impacted [39].

However, Kateřina Škařupová's research mentioned that individuals with healthy relationships are less likely to develop problematic patterns of online gaming. Gamers' social skills and personality traits, such as lower interpersonal trust and social self-efficacy, contribute more to pathological gaming than actual social motivations for playing games [40]. Therefore, although HRG's motivations for making friends in games are not lower than those of the other two groups, their social skills and personality traits result in them having the fewest friends in games. This also suggests that the number of friends may serve as a potential protective factor against gaming disorder.

Some studies have suggested that single individuals are more likely to suffer from game disorders due to feelings of loneliness [41]. However, in our previous study, individuals who are in a dating or married relationship and those with higher levels of education are more likely to suffer from PGD [20]. This study confirms our previous findings. This may be because the PGD group is older and more likely to be married.

Consistent with previous studies, participants in the PGD group tended to be older. In this study, the HRG had the highest mean age, which could be attributed to young adults and university students having more autonomy and opportunities to use smart devices than younger students do. Consequently, due to their technological proficiency and lack of external supervision, they may be more susceptible to gaming disorders.

Contrary to our expectations, being an only child served as a protective factor against gaming disorders. In this study, the HRG had the highest proportion of non-only child participants, followed by the MRG, whereas the LRG had the highest proportion of only child. Children are more likely to receive attention from their parents but may also experience increased parental control. Previous research suggests that parents with only one child are more likely to exhibit overprotective and intrusive parenting than parents with more than one child [42]. Parental control behaviors, including psychological and behavioral control, have been associated with increased internet and gaming addiction [43]. However, due to China's previous one-child policy and child-centered family norms, strict yet supportive parenting approaches are prevalent. These approaches are widely accepted among Chinese university students [44].

This study is subject to several limitations. Firstly, the reliance on self-report measures introduces the possibility of social desirability bias or response bias, indicating the need for diverse data collection methods. Incorporating clinician rating scales or behavioral assessments would offer a more comprehensive understanding of the phenomenon. Secondly, the study employed a cross-sectional latent profile analysis, highlighting the necessity for future longitudinal research to explore the causal relationships between personality traits, gaming motives, and addictive gaming behaviors. Thirdly, the majority of participants in the study were young unmarried individuals. Fourth, we didn't counterbalance measures in place to counterbalance the potential confounding effects of order. To enhance the generalizability of the findings, it is important for future studies to reevaluate and compare various inter-profile factors using more representative or clinical samples.

In conclusion, this study utilized latent profile analysis (LPA) to classify the risk of problematic gaming into three groups based on the Big Five personality traits: high-risk gamers (HRG), medium-risk gamers (MRG), and low-risk gamers (LRG). Low levels of neuroticism, conscientiousness, openness, agreeableness, and extraversion emerged as protective factors against gaming addiction. Factors such as being unmarried, being an only child, playing games for pleasure, spending less money, and dedicating less time to gaming were associated with a lower likelihood of experiencing gaming addiction. These findings can assist in the identification of high-risk gamers and guide early interventions tailored to players with varying levels of risk. Moreover, the implications of this research extend beyond academic inquiry; they provide valuable insights for mental health professionals, educators, and policymakers. By understanding the personality traits associated with problematic gaming, stakeholders can develop targeted prevention programs that foster resilience and adaptive gaming habits among youth. Furthermore, this study

highlights the need for increased public awareness regarding the potential risks of gaming addiction. By promoting healthy gaming behaviors and providing resources for at-risk individuals, society can mitigate the negative impacts of gaming while still allowing for its enjoyment as a form of entertainment. The research contributes to the growing body of literature on gaming behavior and personality, emphasizing the importance of a nuanced approach to understanding how individual differences can influence gaming experiences. Ultimately, this knowledge can lead to more effective interventions that not only address gaming addiction but also enhance overall psychological well-being among gamers.

Acknowledgements
We would like to thank Editage (www.editage.cn) for English language editing.

Authors' contributions
Zhenjiang Liao and Jingyue Hao contributed equally to this paper.All authors made substantial contributions to this study. ZL, JH and HS conceptualized anddesigned the research, wrote the first draft of the manuscript, and contributed to the finalmanuscript. QH, YL, and SL prepared the assessment tools. XC, YS, YT and XW performed the experiments and undertook the statistical analysis. All authors critically reviewed content and approved final version for publication.

Funding
This work was supported by National Natural Science Foundation of China (81971249) and National Natural Science Foundation of Hunan Province(2023JJ40476).

Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The studies involving human participants were reviewed and approved by Clinical Research Ethics Committee of Second Xiangya Hospital of Central South University (2020)No:004. The patients/participants provided their informed consent to participate in this study.

Consent for publication
There are no details on individuals reported within the manuscript, consent for publication of images not be required.

Competing interests
The authors declare no competing interests.

Author details
[1]Department of Psychiatry, National Clinical Research Center for Mental Disorders, The Second Xiangya Hospital of Central South University, Changsha, China. [2]Department of Applied Psychology, School of Humanities and Management, Hunan University of Chinese Medicine, Changsha, China.

Received: 15 April 2024 Accepted: 31 January 2025
Published online: 06 February 2025

References

1. Messent P. DSM-5. Clin Child Psychol Psychiatry. 2013;18(4):479–82.
2. The L. ICD-11. Lancet. 2019;393(10188):2275.
3. Mathews CL, Morrell H, Molle JE. Video game addiction, ADHD symptomatology, and video game reinforcement. Am J Drug Alcohol Abuse. 2019;45(1):67–76.
4. Bowden-Jones H, et al. Gambling disorder in the UK: key research priorities and the urgent need for independent research funding. Lancet Psychiatry. 2022;9(4):321–9.
5. Byeon G, et al. Associations between game use and mental health in early adulthood: a nationwide study in Korea. J Affect Disord. 2022;297:579–85.
6. Liao Z, et al. Prevalence of gaming disorder in East Asia: a comprehensive meta-analysis. J Behav Addict. 2022;11(3):727–38.
7. Wang M, Xu Q, He N. Perceived interparental conflict and problematic social media use among Chinese adolescents: the mediating roles of self-esteem and maladaptive cognition toward social network sites. Addict Behav. 2021;112:106601.
8. Whitbourne SK, Ellenberg S, Akimoto K. Reasons for playing casual video games and perceived benefits among adults 18 to 80 years old. Cyberpsychol Behav Soc Netw. 2013;16(12):892–7.
9. Zanetta Dauriat F, Zermatten A, Billieux J, et al. Motivations to play specifically predict excessive involvement in massively multiplayer online role-playing games: evidence from an online survey. Eur Addict Res. 2011;17(4):185–9.
10. Demetrovics Z, Urbán R, Nagygyörgy K, et al. Why do you play? The development of the motives for online gaming questionnaire (MOGQ). Behav Res Methods. 2011;43(3):814–25.
11. Zhong ZJ, Yao MZ. Gaming motivations, avatar-self identification and symptoms of online game addiction. Asian J Commun. 2012;23(5):555–73.
12. McCrae RR, John OP. An introduction to the five-factor model and its applications. J Pers. 1992;60(2):175–215.
13. Brand M, Young KS, Laier C, Wölfling K, Potenza MN. Integrating psychological and neurobiological considerations regarding the development and maintenance of specific internet-use disorders: an Interaction of person-affect-cognition-execution (I-PACE) model. Neurosci Biobehav Rev. 2016;71:252–66.
14. Dash GF, Martin NG, Slutske WS. Big five personality traits and illicit drug use: specificity in trait-drug associations. Psychol Addict Behav. 2023;37(2):318–30.
15. Dash GF, et al. Big five personality traits and alcohol, nicotine, cannabis, and gambling disorder comorbidity. Psychol Addict Behav. 2019;33(4):420–9.
16. Kotov R, et al. Linking big personality traits to anxiety, depressive, and substance use disorders: a meta-analysis. Psychol Bull. 2010;136(5):768–821.
17. Wang H, et al. The alteration of gray matter volume and cognitive control in adolescents with internet gaming disorder. Front Behav Neurosci. 2015;9:64.
18. von der Heiden JM, et al. The Association between Video Gaming and Psychological Functioning. Front Psychol. 2019;10:1731.
19. Larrieu M, Billieux J, Décamps G. Problematic gaming and quality of life in online competitive videogame players: identification of motivational profiles. Addict Behav. 2022;133:107363.
20. Liao Z, et al. Prevalence of internet gaming disorder and its association with personality traits and gaming characteristics among Chinese adolescent gamers. Front Psychiatry. 2020;11:598585.
21. Yin K, et al. Personality profiles based on the FFM: a systematic review with a person-centered approach. Personality and individual differences. 2021. p. 180.
22. Briggs D. The SAGE handbook of quantitative methodology for the social sciences. Appl Psychol Meas. 2006;30(5):447–51.
23. Akbari M, et al. The big five personality traits and online gaming: a systematic review and meta-analysis. J Behav Addict. 2021;10(3):611–25.
24. Yang Q, et al. Effect of online game policy on smartphone game play time, addiction, and emotion in rural adolescents of China. BMC Psychiatry. 2023;23(1):814.
25. Rehbein F, et al. Prevalence of internet gaming disorder in German adolescents: diagnostic contribution of the nine DSM-5 criteria in a statewide representative sample. Addiction. 2015;110(5):842–51.
26. Zhang X, Wang MC, He L, Jie L, Deng J. The development and psychometric evaluation of the Chinese big five personality Inventory-15. PLoS One. 2019;14(8):e0221621.
27. Liu C, Ren L, Rotaru K, et al. Bridging the links between big five personality traits and problematic smartphone use: a network analysis. J Behav Addict. 2023;12(1):128–36.

28. Liao Z, Chen X, Huang S, et al. Exploring the associated characteristics of internet gaming disorder from the perspective of various game genres. Front Psychiatry. 2023;13:1103816.
29. Kim SY. Determining the number of latent classes in single- and multiphase growth mixture models. Struct Equ Model. 2014;21(2):263–79.
30. Oberski DL. Beyond the number of classes: separating substantive from non-substantive dependence in latent class analysis. Adv Data Anal Classif. 2016;10(2):171–82.
31. Marengo D, et al. A meta-analysis on individual differences in primary emotional systems and big five personality traits. Sci Rep. 2021;11(1):7453.
32. Kircaburun K, Griffiths MD. Instagram addiction and the big five of personality: the mediating role of self-liking. J Behav Addict. 2018;7(1):158–70.
33. Chew P. A meta-analytic review of internet gaming disorder and the big five personality factors. Addict Behav. 2022;126:107193.
34. Mak KK, et al. Associations of personality traits with internet addiction: a cross-cultural meta-analysis with a multilingual approach. Cyberpsychol Behav Soc Netw. 2021;24(12):777–98.
35. Tian Y, et al. Associations among the big five personality traits, maladaptive cognitions, and internet addiction across three time measurements in 3 months during the COVID-19 pandemic. Front Psychol. 2021;12:654825.
36. Hamzehzadeh M, et al. Psychometric assessment of the motives for online gaming questionnaire among Iranian gamers. Psychiatry Investig. 2022;19(5):333–40.
37. Kaczmarek LD, Drążkowski D. MMORPG escapism predicts decreased well-being: examination of gaming time, game realism beliefs, and online social support for offline problems. Cyberpsychol Behav Soc Netw. 2014;17(5):298–302.
38. Yang SY, et al. Does smartphone addiction, social media addiction, and/or internet game addiction affect adolescents' interpersonal interactions? Healthcare (Basel). 2022;10(5):963.
39. Škařupová K, Blinka L. Interpersonal dependency and online gaming addiction. J Behav Addict. 2016;5(1):108–14.
40. Nalwoga V, Kizito S, Kigongo E, Atwine P, Kabunga A. The lived experiences of individuals and coping strategies in the context of internet gaming disorder: a qualitative study within higher education setting in Uganda. Neuropsychiatr Dis Treat. 2024;20:823–34 PMID: 38601069; PMCID: PMC11005923.
41. Mallorquí-Bagué N, et al. Internet gaming disorder and online gambling disorder: clinical and personality correlates. J Behav Addict. 2017;6(4):669–77.
42. Khadaroo A, MacCallum F. Parenting of adolescent single children: a mixed-methods study. J Fam Issues. 2021;42(12):2896–919.
43. Lin S, et al. The association between parental psychological control, deviant peer affiliation, and internet gaming disorder among chinese adolescents: a two-year longitudinal study. Int J Environ Res Public Health. 2020;17(21):8197.
44. Hwang W, et al. A multidimensional construct of helicopter parenting and college students' game and social media addictive behaviors: a cross-cultural study in South Korea and China. Front Psychol. 2022;13:1022914.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.