Psychiatry Research 357 (2026) 116924

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Factor structure of the Internet Gaming Disorder Scale: an Exploratory Graph Analysis approach in Spanish university gamers

Júlia Gisbert-Pérez, Adrián García-Mollá, José M. Tomás, Manuel Martí-Vilar, Laura Badenes-Ribera *

Faculty of Psychology, University of Valencia, Av. Blasco Ibáñez, 21, Valencia 46010, Spain

ARTICLE INFO

Keywords:
EGA
Factor structure
Validity
IGDS

ABSTRACT

Importance: Internet gaming disorder (IGD) has emerged as a growing concern, particularly among adolescents and young adults. This concern has prompted the development of standardized tools for IGD assessment, such as the Internet Gaming Disorder Scale (IGDS). IGDS is based on the DSM-V diagnostic criteria, and has been mainly used as a unidimensional measure of IGD.
Objective: This study aimed to translate and validate the Spanish version of the IGDS in a sample of university students (N = 274, M_{age}= 21.64 years, SD_{age} = 2.93, % male = 59.7%).
Methods: Exploratory Graph Analysis (EGA) followed by Confirmatory Factor Analysis (CFA) were conducted, and internal consistency and convergent validity were assessed.
Results: EGA identified a bidimensional structure comprising (1) cognitive–emotional symptoms and (2) relational-problem outcomes, which was confirmed through CFA. Both dimensions demonstrated excellent reliability and adequate convergent validity.
Conclusion: The Spanish IGDS is a psychometrically valid instrument for assessing IGD, allowing for an accurate distinction between gaming intensity and functional impairment. These findings challenge the traditional unidimensional perspective and support a biaxial conceptualization of IGD.

1. Introduction

Internet gaming disorder (IGD) is a growing health concern. While gaming is often associated with cognitive, psychological, and social benefits, such as recreation and building social connections (Halbrook et al., 2019; von der Heiden et al., 2019), excessive gaming can lead to negative symptoms that impact both physical and mental health (Király et al., 2023). Excessive gaming can result in a gaming disorder, which shares characteristics with other addictions, such as gambling disorder (Saunders et al., 2017). The World Health Organization (2022; section 6C51, p.1) formally recognized gaming disorder in ICD-11 as “a pattern of gaming behavior characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences”.

The Diagnostic and Statistical Manual of Mental Disorders (5th ed., text rev.; DSM-V-TR, American Psychiatric Association [APA], 2022) includes IGD as a condition for further research. IGD is characterized by significant impairment or distress in several aspects of a person’s life due to gaming behaviors. DSM-V-TR includes nine IGD symptoms, such as (1) preoccupation with gaming, (2) withdrawal symptoms when gaming is not possible (sadness, anxiety, irritability), (3) tolerance, (4) inability to reduce or quit gaming, (5) giving up other activities due to gaming, (6) continuing gaming despite problems, (7) deceiving family members or others about gaming time, (8) the use of gaming to relieve negative moods, and (9) risk, having jeopardized or lost a job or relationship due to gaming (APA, 2022). To be diagnosed with IGD, an individual must experience five or more of these symptoms related to gaming within one year.

Two meta-analyses of IGD prevalence estimated an overall prevalence of between 1.96–3.05 % (95 % CI: [2.38, 3.91]; Stevens et al., 2021) and 3.3 % (95 % CI: [2.6–4.0]; Kim et al., 2022), with lower estimates with adjusted prevalence estimations (1.96 %, 95 % CI: [0.19, 17.12], Stevens et al., 2021; 1.4 %, 95 % CI: [0.9–1.9], King et al., 2022). Both studies identified countries of study, age group, and gender as

* Corresponding author.
E-mail address: laura.badenes@uv.es (L. Badenes-Ribera).

https://doi.org/10.1016/j.psychres.2025.116924
Received 3 December 2025; Accepted 23 December 2025
Available online 24 December 2025

sources of prevalence variability. IGD seems to be a more severe concern in early stages, with an estimated prevalence of 4.6 % in adolescence and young adults (Fam, 2018) and 6.1 % in young adults (Gisbert-Pérez et al., 2025). Moreover, males have a higher prevalence of IGD than females (6.8 % and 1.3 %, respectively; Wang and Cheng, 2021). As a result, mental health professionals face several controversies and opportunities when assessing and treating IGD (Carbonell et al., 2020).

The inclusion of IGD in the DSM-V (APA, 2013) and the increasing prevalence fostered the development of instruments to assess and diagnose IGD. Such instruments include the 10-item Internet Gaming Disorder Test (IGDT-10; Király et al., 2017), the 9-item short form of the Internet Gaming Disorder Scale (IGDS9-SF; Pontes and Griffiths, 2015), the Video Game Scale for Children (VGS-C; Donati et al., 2019), and the 27-item and 9-item Internet Gaming Disorder Scale (IGDS; Lemmens et al., 2015), among others. The systematic review of IGD instruments by King et al. (2020) highlighted five IGD instruments with better psychometric properties. One of these is the IGDS by Lemmens et al. (2015), which covers all nine DSM-5 IGD criteria (preoccupation, tolerance, withdrawal, persistence, escape, problems, deception, displacement, and conflict). IGDS has been validated in population between 13 and 40 years (Lemmens et al., 2015) and in children and adolescents (12–17 years; Paschke et al., 2021).

The IGDS scale has been translated and validated in several languages, including Arabic (Baiumy et al., 2018), Turkish (Evren et al., 2017), and Chinese (Lei et al., 2020). While there is a preliminary Spanish translation of the 27-item dichotomous IGDS scale (Hidalgo, 2022), there has not yet been a study that translates and validates the 9-item IGDS scale into Spanish. This highlights a gap in the literature and emphasizes the need for a psychometrically validated Spanish version of the 9-item IGDS scale.

For this study, the 9-item IGDS with polytomous response (Likert 0–5) version was selected. Higher scores indicate more problematic gaming behavior. For the diagnosis of gaming disorder, the recommended cut-off point established by the researchers is the presentation of five or more criteria over 12 months, based on the DSM-5 recommendation (APA, 2013; Lemmens et al., 2015). This criterion, assumed from the DSM-5 (>5), showed high specificity and adequate sensitivity (Bernaldo-de-Quirós et al., 2020). Assuming this cut-off point, Lemmens et al. (2015) identified three types of players: normal, at-risk, and disordered. Regarding its structure, Lemmens et al. (2015) reported unidimensionality according to the fit indices of a Confirmatory Factor Analysis (CFA) and excellent consistency with a Cronbach's alpha of 0.93. IGDS has also been adequate in several reliability generalization meta-analyses (Gisbert-Pérez et al., 2022; Yoon et al., 2021). In the case of the shortened 9-item versions of the IGDS, the polytomous response option showed higher mean reliability scores. Convergent validity is supported by small to medium correlations of IGDS scores with psychological constructs such as impulsivity, antisocial behavior, anger control, hyperactivity, loneliness, emotional distress, low self-esteem, life satisfaction, and prosocial behavior (Lemmens et al., 2015; Schivinski et al., 2018; Wartberg et al., 2019).

Previous research has studied the psychometric properties of different IGDS versions, generally supporting the unidimensionality of the scale. Coșa et al. (2024) analyzed the measurement invariance of the one factor model proposed by the author of the IGDS in a sample of Romanian adolescents and their parents. Their results showed that the one-factor IGDS model fit well in both the self-reported and parent-reported versions. Lei et al. (2020) compared the performance of the IGDS Mandarin Chinese version using binary and polytomous items, the one-factor structure was retained in both versions through EFA and CFA in a sample of adolescents and adults. It should be noted that most studies assumed the unidimensionality of the scale established by the authors, such as the measurement invariance carried out by Ali et al. (2022) which demonstrated an equal functioning of the scale across different countries. However, the unidimensionality reported in the original IGDS study has not always been consistently replicated across studies. Paschke et al. (2021) explored the psychometric properties of the IGDS in three samples of children and adolescents, where the results did not support unidimensionality using CFA. Ono et al. (2025) conducted a validation of the IGDS for the Chinese population. Although the overall sample showed adequate CFA fit indices, they were not acceptable in its clinical and healthy subsamples.

Given the inconsistent results found in the previous literature, further investigation of the IGDS factor structure is needed. The lack of consensus may be due to differences in the methodologies used to examine dimensionality, including both EFA and CFA. Simulation studies have shown that these techniques do not estimate well underlying dimensions (Garrido et al., 2013; Lubbe, 2019; Montoya and Edwards, 2020). For this reason, it is worth exploring alternative approaches to analyze the dimensionality of the IGDS.

A robust alternative for scale validation is Exploratory Graph Analysis (EGA). EGA is a technique derived from network psychometrics (Golino and Epskamp, 2017). Network psychometrics utilizes network modeling techniques to analyze scale dimensionality through the Gaussian graphical model (GGM; Lauritzen, 1996) and clustering techniques (Pons and Latapy, 2006). GGM estimates the joint distribution of random variables (Lauritzen, 1996; Epskamp et al., 2017). Based on partial correlation coefficients, EGA produces a network plot that depicts item clusters and their strength of association (Golino et al., 2020). Simulation studies have shown that EGA is more accurate in dimensionality analysis compared to traditional methods used in (exploratory) factor and principal component analysis (Golino and Epskamp, 2017; Golino et al., 2020).

The main objective of this study is to translate and validate the 9-item IGDS in a Spanish young adult sample. To the best of our knowledge, this represents the first adaptation and validation of the 9-item IGDS into Spanish. Given the inconsistencies in the factorial study of the IGDS, and the evidence obtained from the use of EGA versus the usual methods of studying dimensionality, this study aims to explore the dimensionality of the IGDS with EGA and confirm this dimensionality using CFA. Additionally, internal consistency and convergent validity evidence is provided.

2. Method

2.1. Procedure

Study data were collected through a cross-sectional survey using LimeSurvey. Before the survey, all participants gave informed consent, and they were free to withdraw from the study at any time without giving any reason. The study adhered to the ethical standards of both the institutional and national research committee, the 1964 Declaration of Helsinki, and its subsequent amendments, or comparable ethical standards. The study was reviewed and approved by the Ethics Committee of the University of Valencia (code 2023-MAG- 2988759).

2.2. Participants

Data for this study was gathered by convenience sampling. The sample consisted of a total of 274 university students in Spain during the 2022–2024 academic years. Inclusion criteria were (1) current video game players, and (2) being 18 or older. Their mean age was 21.64 years ($SD = 2.93$). Regarding gender, 38.1 % were female, 59.7 % were male and 2.2 % were non-binary. The sample was randomly split in two subsamples. Following the recommendations of Del Rey et al. (2021), we ensured that both subsamples were balanced based on sociodemographic characteristics through *t*-test for age and Pearson's Chi-squared test for gender and occupation. Sociodemographic data from both subsamples are displayed in Table 1.

Table 1
Means, percentages and standard deviations of the sociodemographic data for both subsamples.

	Mean (±SD) or %		Statistic test	*p*
	Subsample 1	Subsample 2		
Age	21.46 (±2.81)	21.82 (±3.05)	$t(272) = -1.03$	.303
Gender			χ^2 (3) = 2.12	.548
Female	39.7 %	36.5 %		
Male	57.4 %	62.0 %		
Non-Binary	2.9 %	1.5 %		
Occupation			χ^2 (3) = 0.975	.807
Only study	63.5 %	65.7 %		
Only work	12.4 %	8.8 %		
Study and work	22.6 %	24.1 %		
None of the above	1.5 %	1.5 %		

Note. SD = Standard deviation. Missing data from sociodemographic were excluded for this analysis.

2.3. Instruments

The Internet Gaming Disorder Scale (IGDS; Lemmens et al., 2015) is a nine-item self-reported scale developed to assess IGD based on DSM-V criteria (APA, 2013). IGDS was translated to Spanish and evaluated in eight steps (Wild et al., 2005): 1) Forward translation: two translators unfamiliar with the IGDS but knowledgeable about gaming disorder and fluent in English independently translated the English version into Spanish; 2) Reconciliation of items: a third native Spanish translator fluent in English reviewed the two translations to generate an optimal translation from them. He evaluated the quality and clarity of the translation for the general public, selecting the best translation and suggesting alternatives when necessary to make it linguistically and culturally appropriate; 3) Backward translation: a fourth translator back-translated the reconciled version into English; 4) Back translation review: the original version was compared with the backward translated version; 5) Cognitive debriefing: a pilot test was conducted with 10 university students to evaluate intelligibility, interpretation, relevance and cognitive equivalence of the translation, as well as subsequent debriefing. During the debriefing, the interviewing researcher went through each item of the questionnaire asking the students if the translation was difficult to answer, confusing, difficult to understand, or offensive; 6) Finalization and proofreading: grammatical and spelling checking; 7) Validation of the final translated questionnaire and reliability assessment; 8) Inclusion of the final report (e.g., item 1 "*¿Ha habido ocasiones en las que solo pensabas en el momento de jugar a videojuegos?*", item 2 "*¿Te has sentido insatisfecho porque querías jugar más?*"). The nine items are scored on a six-point Likert scale ranging from 0 (never) to 5 (every day or almost every day). In this study, higher scores indicate a greater presence of symptoms indicative of disordered gaming. In addition to the IGDS Spanish version, sociodemographic variables related to age, gender and educational level were collected.

Internet Gaming Disorder Scale-Short Form (IGDS9-SF; Pontes and Griffiths, 2015; Spanish version of Maldonado-Murciano et al., 2020). IGDS9-SF assesses IGD based on DSM-V criteria (APA, 2013). It consists of nine items scored on a five-point Likert scale ranging from 1 (never) to 5 (very often). In this study, higher scores indicate higher levels of disordered gaming symptoms.

2.4. Data analysis

We assessed structural validity, internal consistency and convergent validity of the Spanish version of the IGDS. Studying the structure of scales to determine the number of dimensions has typically been problematic, as it requires subjective decision-making on the part of the researcher (Sass and Schmitt, 2010). As noted by Haslbeck and Van Bork (2024), two classical and predominant strategies had been used for the selection of the number of dimensions when estimating (exploratory) factor and/or component analysis. The first one is based on the study of the pattern of eigenvalues of the covariance matrix. The second approach considers it a model selection problem, so several fit indexes are observed to select the number of dimensions. To overcome the subjectivity issues in this selection, we split the sample in two subsamples for cross-validation. Firstly, an Exploratory Graph Analysis (EGA) was performed in the first subsample (n = 137) to explore the number of clusters of items and their distribution. Secondly, two Confirmatory Factor Analysis (CFA) was performed in the second subsample (n = 137): a one-factor model reflecting the original theoretical structure and a second model to validate the structure found by EGA in the previous analysis.

The Exploratory Graph Analysis (EGA) model was estimated using a polychoric correlation matrix to account for the ordinal nature of the items. The estimation method was a variant of Least Absolute Shrinkage and Selection Operator (LASSO; Tibshirani, 1996), the Graphical LASSO (GLASSO; Friedman et al., 2007) which is one of the most commonly employed in networks psychometrics. The *Walktrap* algorithm was used for community detection, as it demonstrated to be the most accurate algorithm for small sample sizes and low number of nodes (Christensen et al., 2023). Consistency of structure was assessed through the bootstrapped version of EGA and it is operationalized as the proportion of occasions that each dimension is estimated equally across a set of replicate samples (Christensen et al., 2020). Additionally, we employed variable redundancy analysis (UVA; Christensen et al., 2023) to address items' redundancy.

The estimation method employed for the two CFA models was DWLS (Diagonally Weighted Least Squares), due to is largely known to perform better than ML (Maximum Likelihood) when using categorical non-normal data (Li, 2016; Mîndrilă, 2010). We employed the chi-square statistic (χ^2), the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), the Standardized Root Mean Square Residual (SRMR), and the Root Mean Squared Error of Approximation (RMSEA) as measures of fit. Acceptable model fit is considered with values of CFI and TLI being equal or greater than 0.90, and RMSEA and SRMR values equal or lower than 0.08 (Hu and Bentler, 1999).

Analyses were carried out using the R packages *EGAnet* (Golino and Christensen, 2019) and *lavaan* (Rosseel, 2012), while descriptive statistics were calculated in SPSS 29. Regarding internal consistency, it was estimated using the Composite Reliability Index (CRI) in order to overcome some limitations of Cronbach's alpha (Hancock and An, 2018). Convergent validity was assessed by estimating the correlation coefficients among the dimensions extracted in our study and the scores calculated from the translation carried out by Maldonado-Murciano et al. (2020) from the scale developed by Pontes and Griffiths (2015). In addition, the Average Variance Extracted (AVE) was calculated as a measure of convergent validity. Average Variance Extracted (AVE) represents, for each latent factor j, the proportion of variance in its indicators that is captured by the factor relative to the variance attributable to measurement error. Following Fornell and Larcker (1981), AVE values $\geq$ 0.50 are typically taken as evidence of adequate convergent validity.

3. Results

3.1. Exploratory graph analysis

In this section, we explored the dimensionality of IGDS employing EGA. Unlike the theoretical structure of IGDS, the resulting network consisted in two moderate correlated clusters of items as can be observed in Fig. 1. Cluster 1 was composed of items 1, 2, 3 and 5, while the remaining items were classified on cluster 2. A qualitative evaluation of the items reveals that cluster 1 includes items related to cognitive and emotional symptoms. Conversely, the items in cluster 2 refer to relational aspects, such as family, friends and partners.

Then, we studied replicability within this sample of this structure

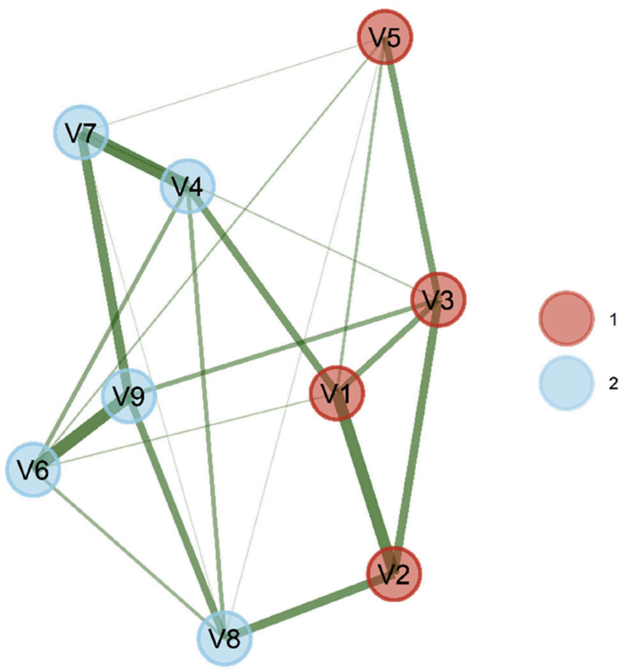

Fig. 1. EGA estimated network for the data on subsample 1.

using bootstrapped EGA. Over the 500 iterations, the two-dimensional solution was identified as the most likely model 41.8 % of the time. This was followed by one-dimensional solutions, which appeared 34 % of the time, and three-dimensional solutions, which appeared 23 % of the time. As shown in the specific results for each item, while the items in cluster 2 (except for item 8, which had a replicability percentage of 42 %) had a replicability frequency close to 50 %, the items in cluster 1 had replicability frequencies of 82 % or higher. The network loadings and the replicability ratio of each item in its dimension are shown in Table 2.

Lastly, we employed variable redundancy analysis (UVA; Christensen et al., 2023) to study the items redundancy based on weighted topological overlap (wTO, Zhang and Horvath, 2005). The results showed that items 6 and 9 present a high degree of redundancy (wTO = 0.306), this implies that both items reported very similar information. Additionally, two other pairs of items had wTO values greater than 0.25: items 4 and 7 (wTO = 0.291), as well as items 1 and 2 (wTO = 0.272). However, it was decided to maintain the numer of items of the original scale, and none of the items were removed.

3.2. Confirmatory factor analysis

In order to verify whether the structure identified by the EGA was consistent with the data, two CFAs were conducted on the second subsample: a one-factor model reflecting the original theoretical structure, and a two-factor model based on the EGA clustering methodology. As shown in Table 3, the two-factor model exhibited a superior fit in comparison to the one-factor model. In this two-factor solution, correlation between factors was 0.794 ($p < .001$).

Table 2
Network loadings and percentage of replicability per item in dimensions on subsample 1.

Items	Network loadings		Percentage of Replicability
	Cluster 1	Cluster 2	
Preoccupation	.513		98 %
Tolerance	.495		97 %
Withdrawal	.530		96.6 %
Persistence		.453	49.4 %
Escape	.247		81.8 %
Problems		.430	54.2 %
Deception		.487	54 %
Displacement		.332	42 %
Conflict		.613	55.4 %

3.3. Reliability and convergent validity

Internal consistency and convergent validity for the two-factor structure were assessed through different indices. To test reliability, Composite Reliability Index (CRI) was calculated for each latent factor. Both factors showed good reliability with CRI values near to 0.90. Regarding convergent validity, all standardized factor loadings were statistically significant and above 0.70. In addition, the Average Variance Extracted (AVE) for both factors were above 0.50, indicating adequate convergence among items. Also, correlation coefficients among dimensions from our scale and the translation by Maldonado-Murciano et al. (2020) were high and statistically significant. The coefficient between the scores for the cognitive and emotional symptoms dimension was $r = 0.65$ ($p < .001$) and between the scores for social related issues was $r = 0.74$ ($p < .001$). Standardized factor loadings, CRI and AVE are displayed on Table 4.

4. Discussion

This study aimed to examine the psychometric properties of the Spanish version of the Internet Gaming Disorder Scale (IGDS). To our knowledge, this study is the first to validate the Spanish version of this scale, and also the first to employ network psychometrics to explore its structure, given that most studies assume unidimensionality of the IGDS as established by Lemmens et al. (2015). This is relevant, as the IGDS is one of the few screening measures for IGD based on DSM-V criteria and one of the most widely employed.

As aforementioned, we explored the structure employing Exploratory Graph Analysis technique in subsample 1, which suggested a bidimensional structure consisting of two moderately correlated clusters: one reflecting cognitive–emotional symptoms (including items 1, 2, 3 and 5) and the second one representing relational difficulties (including items 4, 6, 7, 8 and 9). This structure was subsequently confirmed through Confirmatory Factor Analysis (CFA), where the two-factor model shown superior fit compared to the original one-factor solution in subsample 2.

The internal consistency of both dimensions was high, with composite reliability values approaching 0.90, indicating excellent reliability. Furthermore, the strong standardized factor loadings (all above 0.70) and average variance extracted (AVE) values exceeding 0.50 support adequate convergent validity. In addition, correlation coefficient with IGDS dimensions were high and statistically significant for both dimensions: cognitive and emotional symptoms ($r = 0.65$, $p < .001$)) and social related issues ($r = 0.74$, $p < .001$). Taken together, these results suggest that the IGDS demonstrates robust psychometric properties, with a stable and interpretable two-factor structure in this Spanish sample.

Our results challenge the traditional assumption of unidimensionality, aligning with the results of Paschke et al. (2021). As established in

Table 3
Scaled fit indexes for the one-factor and two-factor models tested on subsample 2.

Model	χ^2 (df)	*p*	CFI	TLI	RMSEA	90 % CI	SRMR
One-factor	91.231 (27)	<0.001	.964	.952	.132	.103-0.163	.084
Two-factors	43.401 (26)	<0.05	.990	.986	.070	.030-0.106	.058

Note. Robust fit indices (scaled χ^2, CFI, TLI, and RMSEA) are reported using the DWLS estimator.

Table 4
Factor loadings, composite reliability index and average variance extracted (AVE) on subsample 2.

	Items	Factor 1	Factor 2
Standardized Factor Loadings	*Preoccupation*	.830	
	Tolerance	.904	
	Withdrawal	.893	
	Persistence		.890
	Escape	.708	
	Problems		.723
	Deception		.862
	Displacement		.806
	Conflict		.700
CRI		.903	.897
AVE		.701	.639
Correlation Between Factors		.794	

Note. All factor loadings and the correlation coefficient were statistically significant ($p<.001$). Composite Reliability Index (CRI). Average Variance Extracted (AVE).

the biaxial model of addictive behaviors (Kelly and Hoeppner, 2014; Wakefield, 2015), the combination of endogenous factors and contextual characteristics can lead to the onset and maintenance of addictive behavior disorders. This phenomenon is evidenced by the results obtained from the factor analysis of the IGDS, which reveals the presence of one factor associated with cognitive and emotional symptoms, and a second factor that consolidates items pertaining to relational issues derived by the gaming addictive patterns.

According to the biaxial model, our findings suggest that the presence of gaming-related symptoms alone does not necessarily indicate disordered gaming behavior in this sample. Instead, it is the combination of symptom-based indicators (such as preoccupation, tolerance, and withdrawal) alongside problem-related outcomes (like conflict, deception, and social impairment) that may differentiate between high engagement and pathological gaming. This pattern aligns with the findings of the latent class analysis by Colder Carras and Kardefelt-Winther (2018), who showed that symptoms and life consequences vary among different groups of adolescent gamers. They suggested that individuals experiencing both dimensions should be classified as having IGD.

This bidimensional configuration is further supported by the network analysis conducted by Liu et al. (2022), who identified two distinct clusters of IGD symptoms: one comprising internalizing symptoms (withdrawal, tolerance, preoccupation, and escape), and another comprising externalizing behaviors (conflict, problems, deception, persistence, and displacement) that are directed toward the social environment. Taken together, the biaxial configuration supports the idea that internalized symptoms may precede externalized consequences, indicating a progression from intensive but non-pathological gaming to clinically significant impairment. Overall, this study contributes to a more nuanced understanding of IGD in Spanish university students, supporting the conceptualization of IGD as a multidimensional construct rather than a single continuum of severity.

4.1. Limitations and future directions

This study has several limitations. Firstly, the replicability of the findings appears to be limited, probably due to the relatively small sample size. Secondly, responses to the self-reported IGDS may be subject to a bias towards providing socially desirable answers, particularly among individuals with more severe symptoms, as has been observed in the case of gambling problems (Schell et al., 2021). People tend to minimize their symptoms, leading to less variability in the variables and potentially affecting the factor structure. Thirdly, items 6 and 9 demonstrate a high degree of redundancy (wTO = 0.306) and are qualitatively similar, as they both address social conflicts arising from gaming behavior. Therefore, these items should be combined, or the better-performing item should be retained. In the present study, however, both items were retained in the subsequent analysis because the scale has a small number of items used for diagnosing IGD. Future studies could replicate the current analyses using a larger, more representative sample and include a measure of socially desirable responses to control for bias (Schell et al., 2021).

4.2. Practical implications

The multidimensional approach to the concept of IGD presented in this study has multiple practical implications. This study provides a psychometrically valid tool in Spanish to assess IGD, differentiating between gaming intensity and functional impact, which improves diagnosis, prevention, and the design of specific interventions.

At a clinical level, for example, it suggests that IGD may be more accurately understood as a bidimensional construct comprising internalized (cognitive–emotional) and externalized (problem-related) symptoms. In clinical practice, this suggests that professionals should assess both dimensions separately, rather than relying solely on the presence of five or more symptoms to make a diagnosis. Following the biaxial model of addiction, distinguishing between engaged/intensive and pathological gamers reduces the risk of misdiagnosing functional but engaged gamers.

In terms of preventive measures, early detection strategies and prevention programs can be improved by distinguishing between intensive gaming and problematic gaming. This differentiation allows for the identification of individuals who engage in intensive gaming, enabling the development of strategies to prevent these individuals from developing problematic gaming habits. This approach also may benefit guidelines for clinical intervention by focusing on internalized symptoms, which can be addressed through cognitive-behavioral therapy, including emotional regulation, coping strategies, and psychoeducation (Stevens et al., 2019). On the other hand, social repercussions can be targeted by implementing psychosocial strategies that involve the individual's social environment in the program, such as family (Bonnaire et al., 2019).

CRediT authorship contribution statement

Júlia Gisbert-Pérez: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Adrián García-Mollá:** Conceptualization, Formal analysis, Methodology, Writing – review & editing. **José M. Tomás:** Formal analysis, Methodology, Writing – review & editing. **Manuel Martí-Vilar:** Investigation, Writing – review & editing. **Laura Badenes-Ribera:** Investigation, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

J. G.-P. reports financial support was provided by Spain Ministry of Science Innovation and Universities (FPU22/03053). A. G.-M. reports financial support was provided by Spain Ministry of Science Innovation and Universities (PRE2022-102085). The other authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Ali, A.M., Al-Amer, R., Atout, M., Ali, T.S., Mansour, A.M.H., Khatatbeh, H., Alkhamees, A.A., Hendawy, A.O., 2022. The nine-item Internet Gaming Disorder Scale (IGDS9-SF): its psychometric properties among Sri Lankan students and measurement invariance across Sri Lanka, Turkey, Australia, and the USA. Healthcare 10 (3), 490. https://doi.org/10.3390/healthcare10030490.

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental disorders: DSM-5, fifth ed. Am. Psychiatr. Publ., Arlington, VA https://doi.org/10.1176/appi.books.9780890425596.

American Psychiatric Association, 2022. Diagnostic and Statistical Manual of Mental Disorders, fifth ed., text rev. Am. Psychiatr. Publ., Arlington, VA https://doi.org/10.1176/appi.books.9780890425787.

Baiumy, S., Elella, E.A., Hewedi, D., Elkholy, H., 2018. Internet Gaming Disorder Scale: arabic version validation. Middle East Curr. Psychiatry 25 (1), 13–15. https://doi.org/10.1097/01.xme.0000526696.50303.

Bernaldo-De-Quiros, M., Labrador-Mendez, M., Sanchez-Iglesias, I., Labrador, F.J., 2020. Instrumentos de medida del trastorno de juego en internet en adolescentes y jóvenes según criterios DSM-5: una revisión sistemática [Measurement instruments of online gaming disorder in adolescents and young people according to DSM-5 criteria: a systematic review]. Adicciones 32 (4), 291.

Bonnaire, C., Liddle, H., Har, A., Nielsen, P., Phan, O., 2019. Why and how to include parents in the treatment of adolescents presenting internet gaming disorder? J. Behav. Addict. 8, 201–212. https://doi.org/10.1556/2006.8.2019.27.

Carbonell, X., 2020. The diagnosis of video game addiction in the DSM-5 and the ICD-11: challenges and opportunities for clinicians. Pap. Psicol. 41 (3), 211–218. https://doi.org/10.23923/pap.psicol2020.2935.

Christensen, A.P., Garrido, L.E., Golino, H., 2023a. Unique variable analysis: a network psychometrics method to detect local dependence. Multivar. Behav. Res. 58 (6), 1165–1182. https://doi.org/10.1080/00273171.2023.2194606.

Christensen, A.P., Garrido, L.E., Guerra-Peña, K., Golino, H., 2023b. Comparing community detection algorithms in psychometric networks: a Monte Carlo simulation. Behav. Res. Methods 56 (3), 1485–1505. https://doi.org/10.3758/s13428-023-02106-4.

Christensen, A.P., Golino, H., Silvia, P.J., 2020. A psychometric network perspective on the validity and validation of personality trait questionnaires. Eur. J. Pers. 34 (6), 1095–1108. https://doi.org/10.1002/per.2265.

Colder Carras, M., Kardefelt-Winther, D., 2018. When addiction symptoms and life problems diverge: a latent class analysis of problematic gaming in a representative multinational sample of European adolescents. Eur. Child Adolesc. Psychiatry 27 (4), 513–525. https://doi.org/10.1007/s00787-018-1108-1.

Coşa, I.M., Dobrean, A., Balazsi, R., 2024. Measurement invariance of the Lemmens Internet Gaming Disorder Scale-9 across age, gender, and respondents. Psychiatr. Q. 95 (1), 137–155. https://doi.org/10.1007/s11126-024-10066-x.

Del Rey, R., Ojeda, M., Casas, J., 2021. Validation of the sexting behavior and motives questionnaire (SBM-Q). Psicothema 33 (2), 287–295. https://doi.org/10.7334/psicothema2020.207.

Donati, M.A., Sanson, F., Mazzarese, M., Primi, C., 2019. Assessing video game habits and pathological behaviour in children through a new scale: psychometric properties of the video-gaming scale-for-children (VGS-C). Psychology 10, 2190–2208. https://doi.org/10.4236/psych.2019.1016139.

Epskamp, S., Rhemtulla, M., Borsboom, D., 2017. Generalized network psychometrics: combining network and latent variable models. Psychometrika 82, 904–927. https://doi.org/10.1007/s11336-017-9557-x.

Evren, C., Dalbudak, E., Topcu, M., Kutlu, N., Evren, B., 2017. The psychometric properties of the Turkish version of the Internet Gaming Disorder Scale. Dusunen Adam - J. Psychiatry Neurol. Sci. 30 (4), 316–324.

Fam, J.Y., 2018. Prevalence of Internet Gaming Disorder in adolescents: a meta-analysis across three decades. Scand. J. Psychol. 59 (5), 524–531. https://doi.org/10.1111/sjop.12459.

Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 18 (1), 39–50. https://doi.org/10.1177/002224378101800104.

Friedman, J., Hastie, T., Tibshirani, R., 2007. Sparse inverse covariance estimation with the graphical lasso. Biostatistics 9 (3), 432–441. https://doi.org/10.1093/biostatistics/kxm045.

Garrido, L.E., Abad, F.J., Ponsoda, V., 2013. A new look at Horn's parallel analysis with ordinal variables. Psychol. Methods 18 (4), 454–474. https://doi.org/10.1037/a0030005.

Gisbert-Pérez, J., Martí-Vilar, M., Merino-Soto, C., Vallejos-Flores, M., 2022. Reliability Generalization Meta-Analysis of Internet Gaming Disorder Scale. Healthcare 10 (10), 1992. https://doi.org/10.3390/healthcare10101992.

Golino, H.F., Epskamp, S., 2017. Exploratory graph analysis: a new approach for estimating the number of dimensions in psychological research. PLoS One 12 (6), e0174035. https://doi.org/10.1371/journal.pone.0174035.

Gisbert-Pérez, J., Longobardi, C., Martí-Vilar, M., Mastrokoukou, S., & Badenes-Ribera, L. (2025). Prevalence of Internet gaming disorder in young adults: a systematic review and meta-analysis. *Addictive behaviors, 174*, 108576. Advance online publication. doi:10.1016/j.addbeh.2025.108576.

Golino, H., Christensen, A.P., 2019. EGAnet: exploratory graph analysis – a framework for estimating the number of dimensions in multivariate data using network psychometrics [dataset]. doi:10.32614/cran.package.eganet.

Golino, H., Shi, D., Christensen, A.P., Garrido, L.E., Nieto, M.D., Sadana, R., Thiyagarajan, J.A., Martinez-Molina, A., 2020. Investigating the performance of exploratory graph analysis and traditional techniques to identify the number of latent factors: a simulation and tutorial. Psychol. Methods 25 (3), 292–320. https://doi.org/10.1037/met0000255.

Halbrook, Y.J., O'Donnell, A.T., Msetfi, R.M., 2019. When and how video games can be good: a review of the positive effects of video games on well-being. Perspect. Psychol. Sci. 14 (6), 1096–1104. https://doi.org/10.1177/1745691619863807.

Hancock, G.E., Hepworth, T., Wembridge, K., 2018. Accuracy and reliability of knee goniometry methods. J. Exp. Orthop. 5 (1), 1–10. https://doi.org/10.1186/s40634-018-0161-5.

Haslbeck, J.M.B., Van Bork, R., 2024. Estimating the number of factors in exploratory factor analysis via out-of-sample prediction errors. Psychol. Methods 29 (1), 48–64. https://doi.org/10.1037/met0000528.

Hidalgo, D.S., 2022. In: Estudios preliminares para una adaptación lingüística y conceptual de los ítems de la Escala de Trastorno de Juego por Internet (IGDS) [Conference presentation]. XIV Congreso Internacional de Investigación y Práctica Profesional en Psicología, Univ. Buenos Aires, Buenos Aires, Argentina.

Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. 6 (1), 1–55. https://doi.org/10.1080/10705519909540118.

Kelly, J.F., Hoeppner, B., 2014. A biaxial formulation of the recovery construct. Addict. Res. Theory 23 (1), 5–9. https://doi.org/10.3109/16066359.2014.930132.

Kim, H.S., Son, G., Roh, E.B., Ahn, W.Y., Kim, J., Shin, S.H., Chey, J., Choi, K.H., 2022. Prevalence of gaming disorder: A meta-analysis. Addict. Behav. 126, 107183. https://doi.org/10.1016/j.addbeh.2021.107183.

King, D.L., Chamberlain, S.R., Carragher, N., Billieux, J., Stein, D., Mueller, K., Potenza, M.N., Rumpf, H.-J., Saunders, J., Starcevic, V., Demetrovics, Z., Brand, M., Lee, H.K., Spada, M., Lindenberg, K., Wu, A.M.S., Lemenager, T., Pallesen, S., Achab, S., Kyrios, M., Delfabbro, P.H., 2020. Screening and assessment tools for gaming disorder: a comprehensive systematic review. Clin. Psychol. Rev. 77, 101831. https://doi.org/10.1016/j.cpr.2020.101831.

Király, O., Koncz, P., Griffiths, M.D., Demetrovics, Z., 2023. Gaming disorder: a summary of its characteristics and aetiology. Compr. Psychiatry 122, 152376. https://doi.org/10.1016/j.comppsych.2023.152376.

Király, O., Tóth, D., Urbán, R., Demetrovics, Z., Maraz, A., 2017. Intense video gaming is not essentially problematic. Psychol. Addict. Behav. 31 (7), 807–817. https://doi.org/10.1037/adb0000316.

Lauritzen, S.L., 1996. Graphical Models. Oxford Univ. Press, Oxford. https://doi.org/10.1093/oso/9780198522195.001.0001.

Lei, W., Liu, K., Zeng, Z., Liang, X., Huang, C., Gong, K., He, W., Xiang, B., Zhang, J., Zheng, X., Chen, J., 2020. The psychometric properties of the Chinese version internet gaming disorder scale. Addict. Behav. 106, 106392. https://doi.org/10.1016/j.addbeh.2020.106392.

Lemmens, J.S., Valkenburg, P.M., Gentile, D.A., 2015. The internet gaming disorder scale. Psychol. Assess. 27 (2), 567–582. https://doi.org/10.1037/pas0000062.

Li, C., 2016. The performance of ML, DWLS, and ULS estimation with robust corrections in structural equation models with ordinal variables. Psychol. Methods 21 (3), 369–387. https://doi.org/10.1037/met0000093.

Liu, D., Lemmens, J., Hong, X., Li, B., Hao, J., Yue, Y., 2022. A network analysis of internet gaming disorder symptoms. Psychiatry Res. 311, 114507. doi:10.1016/j.psychres.2022.114507.

Lubbe, D., 2019. Parallel analysis with categorical variables: impact of category probability proportions on dimensionality assessment accuracy. Psychol. Methods 24 (3), 339–351. https://doi.org/10.1037/met0000171.

Maldonado-Murciano, L., Pontes, H.M., Griffiths, M.D., Barrios, M., Gómez-Benito, J., Guilera, G., 2020. The Spanish version of the Internet Gaming Disorder Scale-Short Form (IGDS9-SF): further examination using item response theory. Int. J. Environ. Res. Public Health 17 (19), 7111. https://doi.org/10.3390/ijerph17197111.

Mîndrilă, D., 2010. Maximum likelihood (ML) and diagonally weighted least squares (DWLS) estimation procedures: a comparison of estimation bias with ordinal and multivariate non-normal data. Int. J. Digit. Soc. 1 (1), 60–66. https://doi.org/10.20533/ijds.2040.2570.2010.0010.

Montoya, A.K., Edwards, M.C., 2020. The poor fit of model fit for selecting number of factors in exploratory factor analysis for scale evaluation. Educ. Psychol. Meas. 81 (3), 413–440. https://doi.org/10.1177/0013164420942899.

Ono, K., Tokushige, M., Hiratani, N., Kaneko, K., Hamamura, T., Miyamoto, Y., Tateno, M., Ito, M., Takano, A., 2025. Reliability and validity of the Japanese version of the Internet Gaming Disorder Scale for Children (IGDS-C). Neuropsychopharmacol. Rep. 45 (1). https://doi.org/10.1002/npr2.12518.

Paschke, K., Sack, P.M., Thomasius, R., 2021. Validity and psychometric properties of the Internet Gaming Disorder Scale in three large independent samples of children and adolescents. Int. J. Environ. Res. Public Health 18 (3), 1095. https://doi.org/10.3390/ijerph18031095.

Pons, P., Latapy, M., 2006. Computing communities in large networks using random walks. J. Graph Algorithms Appl. 10 (2), 191–218. https://doi.org/10.7155/jgaa.00124.

Pontes, H.M., Griffiths, M.D., 2015. Measuring DSM-5 Internet gaming disorder: development and validation of a short psychometric scale. Comput. Hum. Behav. 45, 137–143. https://doi.org/10.1016/j.chb.2014.12.006.

Rosseel, Y., 2012. lavaan: an R package for structural equation modeling. J. Stat. Softw. 48 (2), 1–36. https://doi.org/10.18637/jss.v048.i02.

Sass, D.A., Schmitt, T.A., 2010. A comparative investigation of rotation criteria within exploratory factor analysis. Multivar. Behav. Res. 45 (1), 73–103. https://doi.org/10.1080/00273170903504810.

Saunders, J.B., Hao, W., Long, J., King, D.L., Mann, K., Fauth-Bühler, M., Rumpf, H., Bowden-Jones, H., Rahimi-Movaghar, A., Chung, T., Chan, E., Bahar, N., Achab, S., Lee, H.K., Potenza, M., Petry, N., Spritzer, D., Ambekar, A., Derevensky, J., Poznyak, V., 2017. Gaming disorder: its delineation as an important condition for diagnosis, management, and prevention. J. Behav. Addict. 6 (3), 271–279. https://doi.org/10.1556/2006.6.2017.039.

Schell, C., Godinho, A., Cunningham, J.A., 2021. Examining change in self-reported gambling measures over time as related to socially desirable responding bias. J. Gambl. Stud. 37 (3), 1043–1054. https://doi.org/10.1007/s10899-020-09970-1.

Schivinski, B., Brzozowska-Woś, M., Buchanan, E.M., Griffiths, M.D., Pontes, H.M., 2018. Psychometric assessment of the Internet Gaming Disorder diagnostic criteria: an item response theory study. Addict. Behav. Rep. 8, 176–184. https://doi.org/10.1016/j.abrep.2018.06.004.

Stevens, M.W., Dorstyn, D., Delfabbro, P.H., King, D.L., 2021. Global prevalence of gaming disorder: a systematic review and meta-analysis. Aust. N. Z. J. Psychiatry 55 (6), 553–568. https://doi.org/10.1177/0004867420962851.

Stevens, M.W., King, D.L., Dorstyn, D., Delfabbro, P.H., 2019. Cognitive-behavioral therapy for Internet gaming disorder: a systematic review and meta-analysis. Clin. Psychol. Psychother. 26 (2), 191–203. https://doi.org/10.1002/cpp.2341.

Tibshirani, R., 1996. Regression shrinkage and selection via the lasso. J. R. Stat. Soc. Ser. B Methodol. 58 (1), 267–288.

Von Der Heiden, J.M., Braun, B., Müller, K.W., Egloff, B., 2019. The association between video gaming and psychological functioning. Front. Psychol. 10, 1731. https://doi.org/10.3389/fpsyg.2019.01731.

Wakefield, J.C., 2015. DSM-5 substance use disorder: how conceptual missteps weakened the foundations of the addictive disorders field. Acta Psychiatr. Scand. 132 (5), 327–334. https://doi.org/10.1111/acps.12446.

Wang, H.-Y., Cheng, C., 2021. New perspectives on the prevalence and associated factors of gaming disorder in Hong Kong community adults: a generational approach. Comput. Hum. Behav. 114, 106574. https://doi.org/10.1016/j.chb.2020.106574.

Wartberg, L., Kriston, L., Zieglmeier, M., Lincoln, T., Kammerl, R., 2019. A longitudinal study on psychosocial causes and consequences of Internet Gaming Disorder in adolescence. Psychol. Med. 49 (2), 287–294. https://doi.org/10.1017/S003329171800082X.

Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A., Erikson, P., ISPOR Task Force for Translation and Cultural Adaptation, 2005. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR Task Force for translation and cultural adaptation. Value Health 8 (2), 94–104. https://doi.org/10.1111/j.1524-4733.2005.04054.x.

World Health Organization, 2022. ICD-11: International classification of diseases, 11th Revision. World Health Organization, Geneva. https://icd.who.int/.

Yoon, S., Yang, Y., Ro, E., Ahn, W.Y., Kim, J., Shin, S.H., Chey, J., Choi, K.H., 2021. Reliability, and convergent and discriminant validity of gaming disorder scales: a meta-analysis. Front. Psychol. 12, 764209. https://doi.org/10.3389/fpsyg.2021.764209.

Zhang, B., Horvath, S., 2005. A general framework for weighted gene co-expression network analysis. Stat. Appl. Genet. Mol. Biol. 4 (1). https://doi.org/10.2202/1544-6115.1128.