RESEARCH

Psychometric properties of the Problematic Online Gaming Questionnaire (POGQ) in a Moroccan sample of university students

Samira Abbouyi[1*], Samira Bouazza[1], Jaouad El Hilaly[2], Mohammed El Amine Ragala[1,3], Karima El Rhazi[1] and Btissame Zarrouq[1,3*]

Abstract

Background The Problematic Online Gaming Questionnaire (POGQ) instrument consists of 18 items with a six-factor structure. This questionnaire is widely utilized to measure the degree of problematic online gaming, but the scale has not, up to date, been validated in Arabic language. This study aimed to assess POGQ scale validity and reliability in Moroccan context.

Methods The research was conducted from April to June 2023 using an online questionnaire. The selected sample involved Moroccan university students. Data were analyzed in two successive phases. First, exploratory factor analysis (EFA) was used to assess the factor structure in the first sample (n1 = 143). Then, this structure was confirmed in the second sample (n2 = 313) using confirmatory factor analysis (CFA).

Results The EFA and CFA results demonstrated that the POGQ has a six-factor structure explained 72% of the total variance. The results of this analysis provided an optimal fit to the data confirming a good performance of the measurement model (χ^2 = 243.6; CFI = 0.981; TLI = 0.976; RMSEA = 0.048; NFI = 0.964; IFI = 0. 981; SRMR = 0.022). The instrument showed sufficient reliability and convergent validity demonstrated by acceptable values of composite reliability (CR = 0.68–0.90), and average variance extracted (AVE = 0.50–0.75), respectively. Finally, the Arabic version of POGQ was found to have a high test–retest reliability.

Conclusions The Arabic version of POGQ revealed adequate psychometric properties. As a result, the instrument might be used to measure the degree of problematic online gaming. The use of the POGQ is expected to further promote research on online game dependence treatment and prevention.

Keywords Problematic online gaming questionnaire (POGQ), Psychometric properties, Validity, Reliability, Moroccan context, Arabic language

*Correspondence:
Samira Abbouyi
samira.abbouyi@usmba.ac.ma
Btissame Zarrouq
btissame.zarrouq@usmba.ac.ma
[1]Laboratory of Epidemiology and Research in Health Sciences, Faculty of Medicine, Pharmacy and Dental Medicine, Sidi Mohamed Ben Abdellah University, KM 2.200 Route Sidi Harazem, 30070 Fez, Morocco
[2]Laboratory of Pedagogical and Didactic Engineering of Sciences and Mathematics, Regional Center of Education and Training (CRMEF) of Fez. Rue Koweit, P.B 49 Agdal, 30050, Fez, Morocco
[3]Teachers Training College (Ecole Normale Superieure), Department of Biology and Geology, Sidi Mohamed Ben Abdellah University, P. B 5206 Bensouda, 30030, Fez, Morocco

Background

Digital technologies have become extensively utilized worldwide [1]. With the increasing use of these technologies, an increasing minority of individuals have been found to exhibit problematic behaviors associated with them [2]. In fact, it seems that each new digital technology and platform generates a small group of individuals who experience difficulties with the technology, which some researchers describe as addictions [3, 4]. The initial paper on internet addiction was published by Griffiths [5], who, like Young [6], used it to describe individuals who spent excessive amounts of time online, neglecting other aspects of their lives. However, more than two decades later, the term has evolved into an umbrella term primarily used to describe addictions on the Internet rather than to the Internet. Now, terms such as "problematic," "addictive," "pathological," and "compulsive" are commonly used in conjunction with Internet and smartphone use in general [6–13], as well as specific online activities such as online shopping [14], online gambling [15, 16], online pornography [17], and online gaming [2].

The World Health Organization (WHO) formally recognized gaming disorder (GD) as a disorder due to addictive behaviors in May 2019, incorporating it into the eleventh revision of the International Classification of Diseases (ICD-11) under the category "Disorders due to substance use or addictive behaviors" [18]. This decision, rooted in accumulated evidence, was the outcome of extensive discussions among global experts [19, 20]. According to the ICD-11 definition of GD, a diagnosis requires meeting three clinical manifestation criteria and one functional impairment criterion [18]. Furthermore, these behavioral patterns and impairments must persist for at least 12 months, except in cases where severe symptoms are present.

Prior to its inclusion in the ICD-11, the American Psychiatric Association outlined preliminary diagnostic criteria for internet gaming disorder (IGD) in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in 2013 [15]. According to the guidelines outlined in the DSM-5, clinical diagnosis of IGD requires the fulfillment of at least five out of nine criteria within a 12-month period. These nine criteria encompass: [1] developing preoccupation with Internet games, [2] experiencing withdrawal symptoms when the Internet game is unavailable, [3] developing tolerance with increased time spent on Internet games, [4] inability to control participation in Internet games, [5] loss of interest in previous hobbies and entertainment due to Internet games, [6] persistent engagement in Internet games despite being aware of the negative impacts (i.e., psychosocial problems), [7] lying to family members, therapists, and others about the amount of time spent on Internet gaming, [8] using Internet games as a means of escape from negative moods or feelings, and [9] losing significant relationships or other opportunities (e.g., job/career or education) due to excessive Internet gaming.

While the DSM-5 and ICD-11 assert a commonality between disordered gaming, substance use, and gambling disorders [21], the diagnostic criteria for GD continue to be a topic of contention. A Delphi expert consensus method was applied to assess the diagnostic validity, clinical utility, and prognostic value of DSM-5 and ICD-11 criteria for GD [22]. Involving 29 international experts, the three-round survey revealed consensus on certain DSM-5 Internet Gaming Disorder criteria, emphasizing their validity, clinical utility, and prognostic value. However, some criteria, such as tolerance and deception, were considered less relevant. Notably, specific DSM-5 criteria, like escapism/mood regulation and tolerance, were viewed as unable to distinguish between problematic and non-problematic gaming, risking the pathologization of the latter. In contrast, ICD-11 diagnostic guidelines for GD, with the exception of a criterion related to diminished non-gaming interests, were generally regarded as possessing high diagnostic validity, clinical utility, and prognostic value [22].

Research has shown that IGD is linked to specific personality traits such as psychopathology [23–25], neuroticism [23, 26], poor psychological wellbeing [24, 27, 28], impulsivity [24, 29, 30], lower academic performance [31, 32], lower social connectedness [28, 33], poor interpersonal relationships [15, 30], and poor sleep quality [31, 34]. Studies have also examined the relationship between IGD and mental health, especially psychological distress [25, 35]. Empirical studies have demonstrated that IGD has been associated with depression [36–39], anxiety [38, 39], and social anxiety [40–42]. In light of these findings, it can be concluded that IGD exhibits a range etiological spectrum. Moreover, there is a forecast that IGD will emerge as a noteworthy health concern for a minority of individuals in the foreseeable future. Studies have further shown that adolescents and emerging adults, especially males, are identified as a demographic at risk for developing IGD [25, 43].

The prevalence of Internet Gaming Disorder (IGD) globally ranges widely, from 0.7 to 27.5%, influenced by factors such as study design, measurement methods, and demographic factors, with younger individuals exhibiting higher rates than older age groups and males reporting a higher prevalence than females [44]. A comprehensive review of 160 studies, utilizing 35 different diagnostic methods, demonstrated a prevalence range of 0.21–57.5%, influenced by geography, gender, and age groups [45]. Specific populations have been investigated, revealing distinct patterns. A meta-analysis of 16 worldwide studies published before 2017 found a pooled prevalence of 4.6% among adolescents, varying from 0.6

to 19.9%, with higher rates observed among males [46]. Research on children indicates a 1.5% addiction prevalence among those aged 13 to 16 years [47]. Among medical students, the pooled prevalence of IGD is 6.2% [48]. In nine African countries, 30% of gamers were addicted, 30% were problematic, 8% were engaged, and 32% were non-problematic, while Morocco showed figures of 27.53% addicted, 27.14% problematic, 8.57% engaged, and 36.76% non-problematic [49].

To obtain reliable prevalence data, it is crucial to utilize psychometrically validated measurement tools [50]. Unfortunately, there is a lack of such tools, and many questionnaires have been adapted from other measures without undergoing rigorous reliability and validity testing. These include tools based on Internet addiction (e.g., Internet Addiction Test) [6], pathological gambling (using DSM-IV criteria), or behavioral addictions [51, 52]. Another challenge is that many existing tools primarily focus on Massively Multiplayer Online Role Playing Games (MMORPGs) [53, 54].

The Problematic Online Gaming Questionnaire (POGQ), which consists of 18 items with a six-factor structure is widely utilized to measure the degree of problematic online gaming. By employing this scale, it becomes possible to comprehend the individual and social issues caused by online games across six factors: preoccupation, overuse, immersion, social isolation, interpersonal conflict, and withdrawal. The POGQ serves as a valuable measurement tool and aids in the investigation of clinical problems such as social isolation, interpersonal conflict, and withdrawal. Furthermore, the POGQ has been translated into Japanese [55], Finnish [56], Italian [57], Hungarian [58], shortened [59], and applied in various regions and cultures, expanding its applicability. In the Arab community such as Morocco, research on problematic online gaming is still in its early stages, and this topic remains largely unexplored. One reason for this is the lack of a comprehensive set of indicators for assessing symptoms related to problematic online gaming. Hence, it is necessary to translate the POGQ and validate an Arabic version to tackle the issues associated with online gaming. Consequently, this study aimed to adapt an Arabic version of POGQ scale, and explore its validity and reliability properties in Moroccan context.

Methods
Study design and participants
Various recommendations have been proposed for determining sample size based on participant-to-item ratios. Cattelle (1978) and Hogarty et al. (2005) propose a minimum ratio of 3 [60, 61], while Everitt (1975) and Henson and Roberts (2006) argue for a ratio exceeding 10 [62, 63]. The commonly used guideline suggests a participant-to-item ratio of 10:1 [64, 65], with an ideal ratio of 20:1

[61]. Although Costello and Osborne (2005) advocate for larger sample sizes for more accurate results [66], there is no consensus on the required size for performing EFA [61]. Hair et al. (2014) recommend a sample size larger than 100 and at least five times as many observations as variables [67]. However, these guidelines face criticism for neglecting item communality, overestimation of factors, and loading sizes [68, 69]. Instead, it is recommended that researchers recruit as a large sample as practical because sample adequacy cannot be determined until after the data have been analysed [63]. Worthington and Whittaker (2006) propose that if item communalities are ≥0.50 or there are 10:1 items per factor with loadings around 0.40, a sample size of 150–200 may be sufficient. For higher communalities (≥0.60) or a minimum of 4:1 items per factor with factor loadings above 0.60, then smaller samples may be adequate [70]. Based on these recommendations, the sample size in this cross-sectional study, conducted between April and June 2023 among Moroccan university students aged 18 years or above, included 456 subjects in the final analysis, meeting the suggested sample size criteria. Additionally, gathering over 100 people was deemed necessary for the analysis criteria of test–retest reliability [71].

Measures
Problematic online gaming was assessed using the Problematic Online Gaming Questionnaire (POGQ). The POGQ instrument was developed by Demetrovics et al. (2012). It comprises 18 items using a 5-point Likert scale (from 1=never to 5=always), with higher scores reflecting a greater tendency toward online problematic gaming. This scale measures six dimensions of problematic use: Preoccupation (two items) refers to daydreaming and obsessive thinking about the online gaming; immersion (four items) refers to losing track of time and dealing excessively with games; withdrawal (four items), refers to experiencing withdrawal symptoms when unable to play; overuse (three items) refers to elongated gaming time and incapacity to control gaming limits; interpersonal conflicts (two items) refer to conflict with one's environment due to excessive play; and the last dimension, social isolation (three items) refers to preference of gaming over social relationships and activities.

Translation process
The POGQ scale was translated back and forth between English and Arabic. First, an Arabic version of the translation was made by two independent translators. Then, The Arabic version was then translated back into English by two separate translators without consulting the original English text. Finally, the differences between the two English versions of the POGQ (i.e., the original and back-translated versions) were discussed, and only minor

discrepancies were found. These discrepancies were discussed until a consensus was reached. After it was estimated as satisfying, the committee decided on the final Arabic version. 20 university students pre-tested this POGQ version in order to evaluate whether that it was clear. No item was found to be difficult to understand. Therefore, no revision was made after the pilot.

Data collection

In this study, data were collected with an online questionnaire; filling it out took about 10 minutes. To assemble our sample, we identified and recruited ten individuals, aptly named 'seeds'. These 'seeds' were not randomly selected; rather, they were specifically chosen to ensure a diverse representation in terms of age, gender, and academic level to our target population. Each 'seed' played a pivotal role by acting as a disseminator of the questionnaire link within the student community. These individuals employed a multi-faceted approach, leveraging platforms like WhatsApp groups, Facebook groups, and other social media channels. This strategic dissemination aimed to reach different regions of Morocco and various spheres of the student population, fostering participation from a broad spectrum of potential respondents with diverse geographic backgrounds.

The inclusion criteria for this study involved game users aged 18 years or above, enrolled in a Moroccan university. Individuals not meeting these criteria were excluded from participation.

All participants volunteered to take part in the study, and no financial incentives or compensation were provided for their involvement. Prior to their participation, we obtained electronic informed consent from each participant, ensuring their agreement to continue and participate in the study. Following this, we asked for some sociodemographic data, such as age, gender, residence, and the year of study in the university. Moreover, they were asked to report about the Internet usage time per day. This section was followed by the Arabic version of the Problematic Online Gaming Questionnaire (POGQ). All these items were answered via a Google form between April 23, 2023, and June 18, 2023. To verify the test–retest reliability of the Arabic version of POGQ, participants were selected from the initial sample based on their voluntary participation and willingness to provide responses for the follow-up assessment. We ensured a diverse representation by including individuals from different demographic backgrounds, including age, gender, and academic levels. Those who had completed the initial questionnaire and expressed their consent for the retest were invited to participate in the follow-up assessment approximately two weeks after their initial response. This process aimed to capture a reliable and varied subset of the original participants for assessing the test-retest reliability of the Arabic version of POGQ. This study has been approved by the hospital-university ethics committee of Sidi Mohamed Ben Abdellah University (N°16/22).

Data analysis

The statistical analyses were conducted using IBM SPSS statistics software version 25 software and JASP version 16 software. Correlations were evaluated by the Pearson coefficient r. Exploratory Factor Analysis (EFA) was performed to explore the factor structure of the Arabic version of the POGQ on the first sample (n1=143), which was randomly selected from the initial participant pool. Principal axis factoring (PAF) with a promax rotation was used as an extraction method. To determain the number of factors to retain during the Exploratory Factor Analysis (EFA), we employed the Kaiser-Guttman criterion, retaining factors with eigenvalues surpassing 1. Additionally, elements with a factor loading exceeding 0.40 were retained, while others were excluded [72–74]. The goodness of fit was assessed by the root-meansquare error of approximation (RMSEA), Tucker Lewis Fit Index (TLI), and chi square ($\chi2$). Moreover, a confirmatory factor analysis was carried out to confirm the factor structure of the Arabic version of the POGQ on the second sample (n2=313). The goodness of fit was evaluated using RMSEA and its 90% confidence interval (90% CI), p value smaller than 0.05 for test of chi-square ($\chi2$), standardized root-meansquare residual (SRMR), comparative fit index (CFI), and Tucker Lewis Fit Index (TLI). The reliability was assessed by Cronbach's alpha coefficient. Furthermore, the internal consistency and convergent validity were estimated by computing Composite Reliability (CR) and Average Variance Extracted (AVE) correspondently. The test-retest reliability was evaluated using the Intraclass Correlation Coefficient (ICC). This coefficient ranges from 0 to 1, with values below 0.5 indicating poor reliability, 0.5 to 0.75 denoting moderate reliability, 0.75 to 0.9 indicating good reliability, and any value surpassing 0.9 signifying excellent reliability [75].

Results

Demographic data

This study involved two samples of Moroccan university students. The first (n1=143) was analyzed by EFA, while the second (n2=313) was tested by CFA. Within the first sample, more than half of the participants were female (55.9%), whereas in the second sample, the percentage of female participants was 46.6%. Regarding their living arrangements, a significant proportion of participants in both samples resided with their parents (62.9% in the first sample and 65.8% in the second sample), and a considerable majority of the participants were single (79.7% in the first sample and 89.1% in the second) (Table 1).

Table 1 Sociodemographic characteristics of participants (N = 456)

Participants characteristics	n1 = 143	n2 = 313
	n (%)	n (%)
Gender		
Female	80 (55.9)	146 (46.6)
Male	63 (41.1)	167 (53.4)
Age		
18–20	28 (19.6)	76 (24.3)
21–23	31 (21.7)	84 (26.8)
24–26	29 (20.3)	72 (23.0)
More than 26	55 (38.5)	81 (25.9)
Marital status		
Single	114 (79.7)	279 (89.1)
Married	28 (19.6)	33 (10.5)
Divorced	1 (0.7)	1 (0.3)
University Level		
Freshman or Sophomore	33 (23.1)	84 (26.8)
junior	66 (46.2)	143 (45.7)
Master	37 (25.9)	67 (21.4)
PhD student	7 (4.9)	19 (6.1)
Study specialty		
Scientific	60 (42.0)	144 (46.0)
Medical	11 (7.7)	21 (6.7)
Literary	28 (19.6)	59 (18.8)
Technical	9 (6.3)	25 (8.0)
Economics	26 (18.2)	38 (12.1)
Law	9 (6.3)	26 (8.3)
Living arrangements		
Alone	24 (16.8)	29 (9.3)
With friends	27 (18.9)	66 (21.1)
With parents	90 (62.9)	206 (65.8)
With other family members	2 (1.4)	12 (3.8)
Internet subscription		
Yes	102 (71.3)	210 (67.1)
No	41 (28.7)	103 (32.9)
Time spent on the Internet (hours)		
<1	3 (2.1)	5 (1.6)
1	5 (3.5)	16 (5.1)
2–3	46 (32.2)	120 (38.3)
4–5	50 (35.0)	94 (30.0)
6 or more	39 (27.3)	78 (24.9)

Exploratory factor analysis

First, before conducting EFA, the appropriateness of the data was assessed using the Kaiser-Meyer-Olkin (KMO) coefficient, which yielded values exceeding 0.91 for all individual items. Additionally, Bartlett's Sphericity Test ($\chi2 = 6564.73$, df = 153, p < 0.001) indicated that the inter-item correlations were substantial enough to justify conducting EFA [76]. A loading threshold of at least 0.40 was initially applied.

Subsequently, EFA was performed on the data from the initial sample (n1 = 143) using principal axis factoring (PAF) as extraction method, with promax rotation.

Extracted factors were determined by the Kaiser-Guttman criterion, retaining those with eigenvalues surpassing 1 and factor loadings above 0.40 [72–74]. No items were eliminated, and six factors resembling the original POGQ version were extracted, explaining 72% of the variance. These six constructs were labeled as Withdrawal (4 items), Social isolation (3 items), Overuse (3 items), Immersion (4 items), Preoccupation (2 items), and Interpersonal conflict (2 items). Factor loadings values were ranged between 0.57 and 0.93 (Table 2; Fig. 1). A loading threshold of at least 0.40 was initially applied. The goodness-of-fit indicators exhibited very favorable results ($\chi2/df = 2.58$, RMSEA = 0.05, TLI = 0.96) [77].

Internal consistency

To evaluate the reliability of the Arabic version of POGQ, we assessed its internal consistency by calculating the Cronbach's α coefficient for each construct (as shown in Table 2). The construct labeled 'interpersonal conflict' exhibited the lowest alpha value of 0.84, while the alphas for the remaining subscales ranged from 0.85 to 0.93. These findings confirm a very strong level of internal consistency across the different constructs. Typically, alpha values should be at least 0.70 to be considered as having good internal consistency, and preferably higher than 0.80 for even stronger consistency. In this case, all of the constructs meet or exceed these criteria, indicating that the Arabic version of POGQ demonstrates excellent reliability (Table 2).

Test–retest reliability

A total of 102 participants (41 male, 61 female) were included in the test-retest reliability analysis of the Arabic version of POGQ, which fulfilled the criteria for being excellent, with ICC (2, 1) = 0.973, p < 0.001, and 95% CI = 0.967–0.979.

Confirmatory factor analysis

To test the original six-factor model of the POGQ we conducted a confirmatory factor analysis (CFA). The results of this analysis provided an optimal fit to the data ($\chi^2 = 243.6$, p < 0.001, df = 120; RMSEA = 0.048 [0.039–0.056]) (Table 3; Fig. 1).

In the six-factor model, the factor loadings of the POGQ in both the EFA and CFA samples ranged from 0.57 to 0.93, further demonstrating that all the items effectively measured the problematic online gaming construct. Moreover, it underscores the scale's robust psychometric properties and a solid factor structure. Furthermore, the reliability and convergent validity of the instrument were substantiated, with consistently high values for the Composite Reliability (CR) ranging from 0.68 to 0.90 and the Average Variance Extracted (AVE) ranging from 0.50 to 0.75, as detailed in Table 4. These

Abbouyi *et al. BMC Psychology*   (2023) 11:395

Page 6 of 11

Table 2 Factor loadings for the CFA of the Arabic version of POGQ

Items	Factors [a]					
	WI	SI	OV	IM	PR	IC
POGQ14	0.83					
POGQ 18	0.82					
POGQ 9	0.76					
POGQ 3	0.77					
POGQ 16		0.93				
POGQ 6		0.87				
POGQ 12		0.79				
POGQ 4			0.89			
POGQ 10			0.82			
POGQ 15			0.77			
POGQ 2				0.88		
POGQ 8				0.69		
POGQ 17				0.65		
POGQ 13				0.57		
POGQ 1					0.84	
POGQ 7					0.76	
POGQ 11						0.79
POGQ 5						0.64
Mean (SD)	1.58 (0.76)	1.58 (0.86)	1.59 (0.86)	1.87 (0.85)	1.65 (0.83)	1.62 (0.89)
Cronbach's alpha	0.89	0.93	0.92	0.86	0.85	0.84
Variance explained (Total = 72%)	15%	14%	13%	14%	08%	08%

[a]Abbreviations for the original POGQ subscales: WI Withdrawal; SI Social isolation; OV Overuse; IM Immersion; PR Preoccupation; IC Interpersonal conflict

Table 3 Overall fit indices of the CFA model

Fit index	$x2/df$	RMSEA	SRMR	GFI	NFI	CFI	TLI
Observed Value	2.03	0.048	0.022	0.940	0.964	0.981	0.976
Level of acceptance	< 3	< 0.05	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90

$x2$ Chi-square test; df Degrees of freedom; RMSEA Root Mean Square Error of Approximation; CFI Comparative Fit Index; SRMR Standardized Root Mean Square Residual; TLI Tucker-Lewis Index; NFI Normed Fit Index; GFI Goodness of fit Index

findings affirm the entire process of factor analysis and demonstrate that the POGQ instrument fits the data quite well.

Discussion

Using a sample of Moroccan university students, the present study sought to conduct a psychometric validation of the Arabic version of the POGQ in an attempt to create an instrument with sound psychometric properties that could be applied in the Arab cultural context to stimulate research on problematic online gaming. According to this aim, the POGQ was tested in a cross-sectional study using an online survey to recruit online gamers. This scale includes 18 items divided into six dimensions: preoccupation, overuse, immersion, social isolation, interpersonal conflict, and withdrawal. The POGQ was assessed in terms of validity and reliability from several levels. In regard to the structural validity of POGQ was evaluated using both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The EFA and CFA results demonstrated that the POGQ

has a six-factor structure explained 72% of the total variance and is more than sufficient, further supporting the six-dimensional factor structure of the POGQ found in previous studies [55–58].

Furthermore, the reliability of POGQ was evaluated with Cronbach α internal consistency reliability coefficient. In the social sciences, an internal consistency reliability coefficient of 0.70 and above is considered sufficient for such scales [78]. In the original study, the POGQ showed adequate reliability (α of 0.93), whereas Cronbach's alphas ranged between 0.84 and 0.93 in subsequent studies [55–59]. It was 0.84 for the Hungarian version [58] and 0.91 for the Italian [57], Japanese [55] and the short version [59] and 0.87 for the Finnish version. Consistent with these reliability findings previously reported, the Arabic version reached similar results regarding the reliability of the POGQ (Cronbach's alpha of 0.95).

The POGQ exhibited high internal consistency, with alpha coefficients exceeding 0.8, indicating strong reliability and high test-retest reliability, measured by the
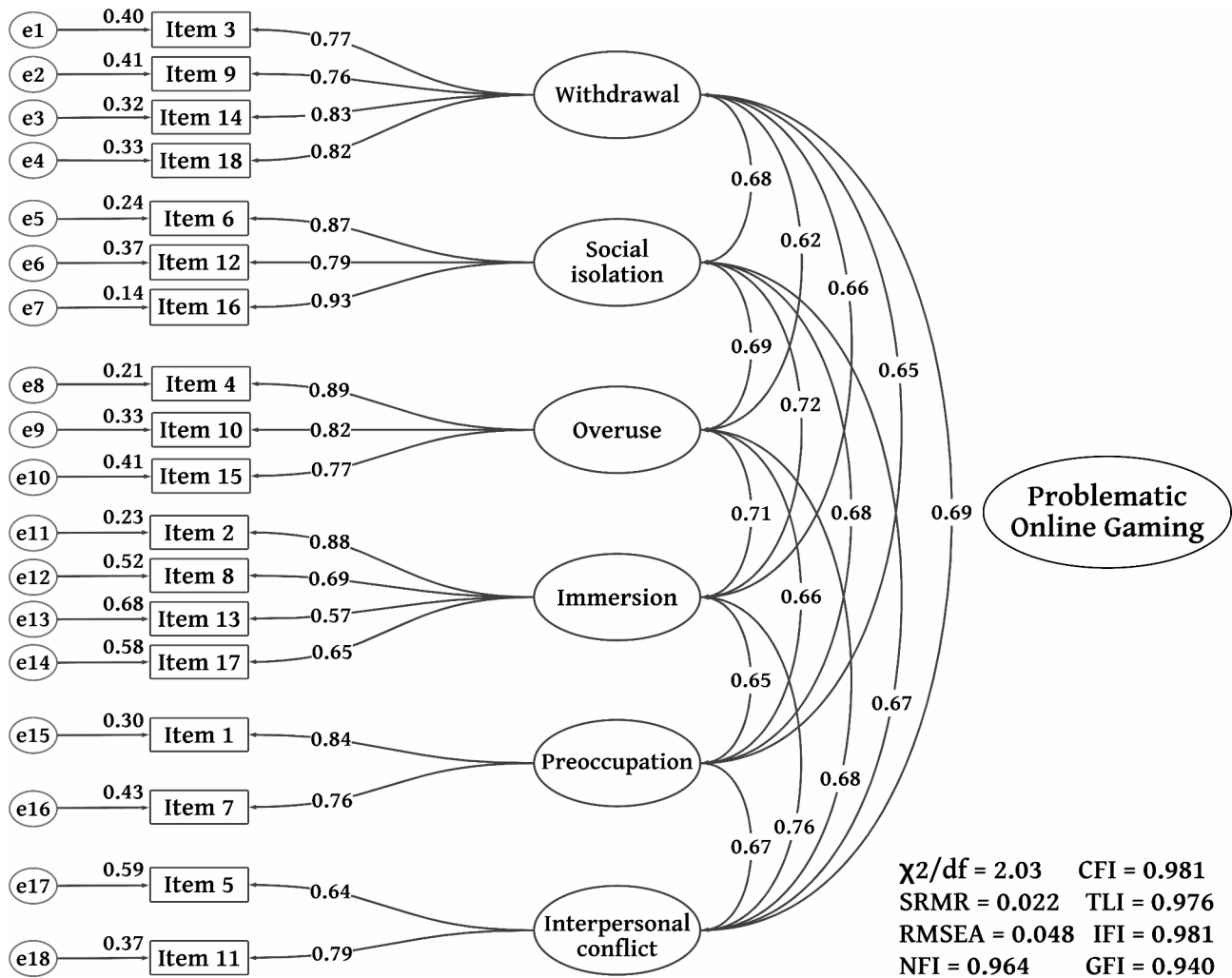
Fig. 1 CFA measurement model χ2 Chi-square test; df Degrees of freedom; RMSEA Root Mean Square Error of Approximation; CFI Comparative Fit Index; SRMR Standardized Root Mean Square Residual; TLI Tucker-Lewis Index; IFI Incremental Fit Index; NFI Normed Fit Index; GFI Goodness of Fit Index

Table 4 Composite reliability, average variance extracted, and correlations between factors

Factors	CR	AVE	Correlation between factors[a]					
			WI	SI	OV	IM	PR	IC
Withdrawal	0.87	0.63	1	0.68	0.62	0.66	0.65	0.69
Social isolation	0.90	0.75		1	0.69	0.72	0.68	0.67
Overuse	0.87	0.68			1	0.71	0.66	0.68
Immersion	0.79	0.50				1	0.65	0.76
Preoccupation	0.78	0.64					1	0.67
Interpersonal conflict	0.68	0.52						1

CR Composite Reliability; AVE Average Variance Extracted

[a]Abbreviations for the original POGQ subscales: WI Withdrawal; SI Social isolation; OV Overuse; IM Immersion; PR Preoccupation; IC Interpersonal conflict

intraclass correlation coefficient (0.97), further supported the stability of the instrument over time. Convergent validity was evident through substantial Average Variance Extracted (AVE) values ranging from 0.50 to 0.75, indicating the POGQ's ability to measure the intended construct consistently. These findings align with other studies validating the POGQ. For instance, the Italian version demonstrated robust convergent validity when correlated with the Problematic Internet Use Questionnaire Short Form (PIUQ-6; r ¼ 0.68, p<0.001) and the Global Severity Index (GSI; r ¼ 0.51, p<0.001) [57]. The Japanese version, in a similar vein, established convergent validity through associations with time spent on online gaming (r=0.309, p<0.001), the Game Addiction

Scale for Adolescents (GAS7; r=0.824, p<0.001), and the EuroQol 5 Dimension 5-level (EQ-5D-5 L; r=0.291, p<0.001) [55]. The findings of the present study indicate that the Arabic version of POGQ is a valid and reliable scale can provide a valid and reliable measure of Problematic online gaming with excellent diagnostic accuracy that can be used in research and for diagnostic purposes among young adult male and female gamers. Overall, previous validity studies for the POGQ [55–59] were corroborated by the findings of this research.

The POGQ scale validated in this study assesses the problematic use of online games through six dimensions, namely preoccupation, immersion, withdrawal, overuse, interpersonal conflicts, and social isolation. These factors offer valuable insights into the dimensions of online gaming behavior that may align with the diagnostic criteria outlined in the 11th Revision of the (ICD-11) for gaming disorder. The factors of preoccupation and immersion reflect a cognitive preoccupation and intense involvement with online gaming, respectively. These align with the ICD-11 criterion of impaired control over gaming, emphasizing the persistent and escalating nature of gaming behavior that interferes with other aspects of life. Withdrawal symptoms, as indicated by the withdrawal factor, and overuse, characterized by elongated gaming time and a lack of control, correspond to the ICD-11's emphasis on continued or escalated gaming despite negative consequences. These factors highlight the potential dependency on gaming and the manifestation of withdrawal-like symptoms when unable to play. The factors of interpersonal conflicts and social isolation emphasize the impact of problematic gaming on social functioning. These align with the ICD-11's recognition of gaming disorder as a pattern of behavior where gaming takes precedence over other interests and daily activities, leading to conflicts with the environment and withdrawal from real-life social interactions. In the broader context of the ICD-11, the identified factors of the POGQ provide a nuanced understanding of the dimensions of gaming behavior that may warrant clinical attention. Cognitive-behavioral therapies can be recommended in the management of Problematic online gaming as they allow a focus on these aspects in addition to addressing underlying comorbidities such as depression [79–81]. However, it is important to normalize practices, particularly by utilizing a robust tool like the POGQ. With its construction in six factors, the use of the Arabic version of the POGQ by therapists could focus on a specific problematic dimension and gain a better understanding of the player's personal gaming experience and reasons for using online video games. The Arabic validation of the POGQ thus enables a more precise detection of problematic use of online video games and the implementation of appropriate treatments to address this issue [82].

It is important to note that like other studies, this one also has limitations. First and foremost, our research design is a cross-sectional, correlational analysis, preventing any inferences about causation. Additionally, respondents participated through online means, raising potential concerns about the authenticity of their identities. Furthermore, the study was conducted exclusively with Moroccan players, necessitating caution in generalizing the results to other cultures. We hope that future studies will replicate these findings in diverse Arab cultures. Another significant consideration is the reliance on self-reported data, highlighting the need for future investigations to validate the identified problematic dimensions through clinical or observational studies. Importantly, our study did not include analyses of convergent, discriminant, or incremental validity. For clinical applications, it is essential that future research incorporates additional analyses, such as assessments of responsivity, sensitivity to change, and the determination of minimally important clinical differences. Exploring these aspects will contribute to a more comprehensive understanding and application of the Arabic version of the POGQ.

Conclusions

Overall, this work represents the first validation of the Arabic version of the POGQ instrument. We investigated its psychometric properties within a sample of 456 Moroccan university students, employing CFA to investigate its underlying factor structure. The results confirmed its reliability and validity. The Arabic version of POGQ was affirmed to have a six-factor structure, resembling the original POGQ version. These six factors encompassed Withdrawal, Social isolation, Overuse, Immersion, Preoccupation and Interpersonal conflict. Additionally, the Arabic POGQ version demonstrated a strong level of test-retest reliability.

The POGQ scale enables the evaluation of diverse aspects pertaining to online gaming. By utilizing the Arabic version of the POGQ, it becomes feasible to acquire valuable insights into the patterns of gaming addiction and the related interpersonal problems, social isolation, and the degree of withdrawal associated with gaming addiction. The adoption of the POGQ is expected to advance research efforts aimed at addressing and preventing online gaming dependency within the Arabic world.

Abbreviations

AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval
CR	Composite Reliability
df	Degrees of Freedom
DSM	Diagnostic and Statistical Manual of Mental Disorders

EFA   Exploratory Factor Analysis
GAS   Game Addiction Scale
GFI   Goodness of Fit Index
GSI   Global Severity Index
IC   Interpersonal Conflict
ICC   Interclass Correlation Coefficient
IGD   Internet Gaming Disorder
IM   Immersion
KMO   Kaiser?Meyer?Olkin test
MMORPGs   Massively Multiplayer Online Role Playing Games
NFI   Normed Fit Index
OV   Overuse
PAF   Principal Axis Factoring
PIUQ   Problematic Internet Use Questionnaire
POGQ   Problematic Online Gaming Questionnaire
PR   Preoccupation
RMSEA   Root-Mean Square Error of Approximation
SI   Social isolation
SRMR   Standardized Root-Mean Square Residual
TLI   Tucker Lewis Fit Index
WI   Withdrawal

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

Declarations

Ethics Approval and consent to participate
Ethical approval was obtained from the hospital-university ethics committee of Sidi Mohamed Ben Abdellah University (N°16/22). All the participants were notified about the aim of the study and had provided electronic informed consent before starting the investigation. All methods were carried out in accordance with the relevant guidelines and regulations by in the declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

References
1. Kemp S. Digital in 2018. 2018.
2. Kuss DJ, Griffiths MD, Karila L, Billieux J. Internet addiction: a systematic review of epidemiological research for the last decade. Curr Pharm Des. 2014;20(25):4026–52.
3. Kuss DJ, Griffiths MD. Social Networking Sites and Addiction: ten lessons learned. Int J Environ Res Public Health Mars. 2017;14(3):311.
4. Savci M, Aysan F. Interpersonal Competence, Loneliness, Fear of Negative Evaluation, and Reward and Punishment as predictors of social media addiction and their accuracy in classifying adolescent social media users and non-users. Curr Approach Psychiatry. 17 mai 2018;11(2):223–38.
5. Griffiths MD. Internet addiction: an issue for clinical psychology? Clin Psychol Forum. 1996;97:32–6.
6. Young KS. Caught in the net: how to recognize the signs of Internet addiction–and a winning strategy for recovery. John Wiley & Sons; 1998. p. 274.
7. Kwon M, Lee JY, Won WY, Park JW, Min JA, Hahn C, et al. Development and validation of a smartphone addiction scale (SAS). PLoS ONE. 2013;8(2):e56936.
8. Lei L, Yang Y. The development and validation of adolescent pathological internet use scale. Acta Physiol Sinica 1 janv. 2007;39:688–96.
9. Meerkerk GJ, Van Den Eijnden RJJM, Vermulst AA, Garretsen HFL. The compulsive internet use scale (CIUS): some psychometric properties. Cyberpsychol Behav févr. 2009;12(1):1–6.
10. Panda A, Jain NK. Compulsive smartphone usage and users' ill-being among young indians: does personality matter? Telematics and Informatics 1 août. 2018;35(5):1355–72.
11. Saidon J, Musa R, Harun MHM, Adam AA. The conceptual Framework of Pathological Smartphone Use (PSU). Procedia Econ Finance. 2016;37:426–31.
12. Shapira NA, Lessig MC, Goldsmith TD, Szabo ST, Lazoritz M, Gold MS, et al. Problematic internet use: proposed classification and diagnostic criteria. Depress Anxiety. 2003;17(4):207–16.
13. Takao M, Takahashi S, Kitamura M. Addictive personality and problematic mobile phone use. Cyberpsychol Behav oct. 2009;12(5):501–7.
14. Rose S, Dhandayudam A. Towards an understanding of internet-based problem shopping behaviour: the concept of online shopping addiction and its proposed predictors. J Behav Addict juin. 2014;3(2):83–9.
15. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington, DC: American Psychiatric Association; 2013.
16. World Health Organization. Print versions for the ICD-11 beta draft (mortality and morbidity statistics). 2016.
17. Owens EW, Behun RJ, Manning JC, Reid RC. The impact of internet pornography on adolescents: a review of the research. Sex Addict Compulsivity: J Treat Prev. 2012;19:99–122.
18. World Health Organization. ICD-11 for Mortality and Morbidity Statistics. 2019.
19. World Health Organization. Behavioural disorders associated with excessive use of the Internet, computers, smartphones and similar electronic devices. 2016.
20. Saunders JB, Hao W, Long J, King DL, Mann K, Fauth-Bühler M, et al. Gaming disorder: its delineation as an important condition for diagnosis, management, and prevention. J Behav Addict 1 sept. 2017;6(3):271–9.
21. Petry NM, Rehbein F, Ko CH, O'Brien CP. Internet gaming disorder in the DSM-5. Curr Psychiatry Rep sept. 2015;17(9):72.
22. Castro-Calvo J, King DL, Stein DJ, Brand M, Carmi L, Chamberlain SR, et al. Expert appraisal of criteria for assessing gaming disorder: an international Delphi study. Addict sept. 2021;116(9):2463–75.
23. González-Bueso V, Santamaría JJ, Fernández D, Merino L, Montero E, Jiménez-Murcia S, et al. Internet gaming disorder in adolescents: personality, psychopathology and evaluation of a psychological intervention combined with parent psychoeducation. Front Psychol. 2018;9:787.
24. Bargeron AH, Hormes JM. Psychosocial correlates of internet gaming disorder: psychopathology, life satisfaction, and impulsivity. Comput Hum Behav. 2017;68:388–94.
25. King DL, Delfabbro PH. The cognitive psychopathology of internet gaming disorder in adolescence. J Abnorm Child Psychol nov. 2016;44(8):1635–45.
26. Gervasi AM, La Marca L, Costanzo A, Pace U, Guglielmucci F, Schimmenti A. Personality and internet gaming disorder: a systematic review of recent literature. Curr Addict Rep 1 sept. 2017;4(3):293–307.
27. Cheng C, Cheung MWL, Wang H. yi. Multinational comparison of internet gaming disorder and psychosocial problems versus well-being: Meta-analysis of 20 countries. Computers in Human Behavior. 2018;88:153–67.
28. Sarda E, Bègue L, Bry C, Gentile D. Internet gaming disorder and Well-Being: a scale validation. Cyberpsychol Behav Soc Netw Nov. 2016;19(11):674–9.
29. Kim YJ, Lim JA, Lee JY, Oh S, Kim SN, Kim DJ, et al. Impulsivity and compulsivity in internet gaming disorder: a comparison with obsessive-compulsive disorder and Alcohol Use Disorder. J Behav Addict 1 déc. 2017;6(4):545–53.

30. Ryu H, Lee JY, Choi A, Park S, Kim DJ, Choi JS. The relationship between Impulsivity and Internet Gaming disorder in young adults: Mediating effects of Interpersonal relationships and Depression. Int J Environ Res Public Health mars. 2018;15(3):458.

31. Hawi NS, Samaha M, Griffiths MD. Internet gaming disorder in Lebanon: relationships with age, sleep habits, and academic achievement. J Behav Addict 1 mars. 2018;7(1):70–8.

32. Sahin M, Gümüş Y, Tofur S. Game addiction and academic achievement. Educational Psychol 27 oct. 2014;36:1533–43.

33. Savci M, Aysan F. Technological addictions and social connectedness: predictor effect of internet addiction, social media addiction, digital game addiction and smartphone addiction on social connectedness. Düşünen Adam: Journal of Psychiatry and Neurological Sciences. 2017;30(3):202–16.

34. Lam LT. Internet gaming addiction, problematic use of the internet, and sleep problems: a systematic review. Curr Psychiatry Rep Avr. 2014;16(4):444.

35. Kim NR, Hwang SSH, Choi JS, Kim DJ, Demetrovics Z, Király O, et al. Characteristics and Psychiatric symptoms of internet gaming disorder among adults using self-reported DSM-5 criteria. Psychiatry Investig janv. 2016;13(1):58–66.

36. Brunborg GS, Mentzoni RA, Frøyland LR. Is video gaming, or video game addiction, associated with depression, academic achievement, heavy episodic drinking, or conduct problems? J Behav Addict mars. 2014;3(1):27–32.

37. Liau A, Choo H, Li D, Gentile D, Sim T, Khoo A. Pathological video-gaming among youth: a prospective study examining dynamic protective factors. Addict Res Theory 19 déc 2014;23.

38. Männikkö N, Billieux J, Kääriäinen M. Problematic digital gaming behavior and its relation to the psychological, social and physical health of Finnish adolescents and young adults. J Behav Addict. 4(4):281–8.

39. Schou Andreassen C, Billieux J, Griffiths MD, Kuss DJ, Demetrovics Z, Mazzoni E, et al. The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: a large-scale cross-sectional study. Psychol Addict Behav mars. 2016;30(2):252–62.

40. Wei HT, Chen MH, Huang PC, Bai YM. The association between online gaming, social phobia, and depression: an internet survey. BMC Psychiatry 28 Juill. 2012;12:92.

41. Van rooij AJ, Kuss DJ, Griffiths MD, Shorter GW, Van de Schonmakers MT. mheen D. The (co-)occurrence of problematic video gaming, substance use, and psychosocial problems in adolescents. J Behav Addict. sept 2014;3(3):157–65.

42. Walther B, Morgenstern M, Hanewinkel R. Co-occurrence of addictive behaviours: personality factors related to substance use, gambling and computer gaming. Eur Addict Res. 2012;18(4):167–74.

43. Kuss DJ, Griffiths MD. Internet gaming addiction: a systematic review of empirical research. Int J Ment Health Addiction 1 avr. 2012;10(2):278–96.

44. Mihara S, Higuchi S. Cross-sectional and longitudinal epidemiological studies of internet gaming disorder: a systematic review of the literature. Psychiatry Clin Neurosci Juill. 2017;71(7):425–44.

45. Darvesh N, Radhakrishnan A, Lachance CC, Nincic V, Sharpe JP, Ghassemi M, et al. Exploring the prevalence of gaming disorder and internet gaming disorder: a rapid scoping review. Syst Rev 2 avr. 2020;9(1):68.

46. Fam JY. Prevalence of internet gaming disorder in adolescents: a meta-analysis across three decades. Scand J Psychol oct. 2018;59(5):524–31.

47. Van Rooij AJ, Schoenmakers TM, Vermulst AA, Van den Eijnden RJJM, Van de Mheen D. Online video game addiction: identification of addicted adolescent gamers. Addict janv. 2011;106(1):205–12.

48. Chiang CLL, Zhang MWB, Ho RCM. Prevalence of internet gaming disorder in medical students: a Meta-analysis. Front Psychiatry. 2021;12:760911.

49. Sosso FAE, Kuss DJ, Vandelanotte C, Jasso-Medrano JL, Husain ME, Curcio G et al. Insomnia, sleepiness, anxiety and depression among different types of gamers in African countries. Sci Rep. 6 févr 2020;10:1937.

50. van Rooij AJ, Schoenmakers TM, van den Eijnden RJJM, Vermulst AA, van de Mheen D. Video game addiction test: validity and psychometric characteristics. Cyberpsychol Behav Soc Netw Sept. 2012;15(9):507–11.

51. Demetrovics Z, Griffiths MD. Behavioral addictions: past, present and future. J Behav Addict mars. 2012;1(1):1–2.

52. Griffiths M. A 'components' model of addiction within a biopsychosocial framework. J Subst Use 1 janv. 2005;10(4):191–7.

53. Charlton JP, Danforth IDW. Distinguishing addiction and high engagement in the context of online game playing. Comput Hum Behav. 2007;23(3):1531–48.

54. Kim MG, Kim J. Cross-validation of reliability, convergent and discriminant validity for the problematic online game use scale. Computers in Human Behavior 1 mai. 2010;26(3):389–98.

55. Inoue K, Yokomitsu K, Irie T, Matsuyama M, Tanaka M. The validation and reliability of a Japanese version of the problematic online Gaming Questionnaire (POGQ-J). Addict Sci Clin Pract. nov 2021;20(1):69.

56. Männikkö N, Ruotsalainen H, Demetrovics Z, Lopez-Fernandez O, Myllymäki L, Miettunen J, et al. Problematic Gaming Behavior among Finnish Junior High School students: relation to socio-demographics and gaming behavior characteristics. Behav Med. 2018;44(4):324–34.

57. Ballabio M, Griffiths MD, Urbán R, Quartiroli A, Demetrovics Z, Király O. Do gaming motives mediate between psychiatric symptoms and problematic gaming? An empirical survey study. Addict Res Theory 3 sept. 2017;25(5):397–408.

58. Bőthe B, Tóth-Király I, Orosz G. Clarifying the Links among Online Gaming, Internet Use, drinking motives, and Online Pornography Use. Games Health J avr. 2015;4(2):107–12.

59. Pápay O, Urbán R, Griffiths MD, Nagygyörgy K, Farkas J, Kökönyei G, et al. Psychometric properties of the problematic online Gaming Questionnaire Short-Form and Prevalence of Problematic Online Gaming in a National Sample of adolescents. Cyberpsychol Behav Soc Netw Mai. 2013;16(5):340–8.

60. Cattell RB. The Scientific Use of Factor Analysis in behavioral and Life sciences. Boston, MA: Springer US; 1978.

61. Hogarty KY, Hines CV, Kromrey JD, Ferron JM, Mumford KR. The quality of Factor Solutions in exploratory factor analysis: the influence of sample size, communality, and overdetermination. Educational and Psychological Measurement 1 avr. 2005;65(2):202–26.

62. Everitt BS. Multivariate analysis: the need for data, and other problems. Br J Psychiatry mars. 1975;126(3):237–40.

63. Henson RK, Roberts JK. Use of Exploratory Factor Analysis in published research: common errors and some comment on Improved Practice. Educational and Psychological Measurement 1 juin. 2006;66(3):393–416.

64. Nunnally JCJ, Bernstein I. Book Review: psychometric theory: Second Edition. New York: McGraw-Hill; 1995.

65. Tabachnick BG, Fidell LS. Using Multivariate Statistics. 6th edition. Boston: Pearson; 2012. 983 p.

66. Costello AB, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Practical Assess Res Evaluation. 2005;10(1):7.

67. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. Seventh edition. Pearson new international edition. Harlow, Essex; 2014.

68. MacCallum RC, Widaman KF, Zhang S, Hong S. Sample size in factor analysis. Psychol Methods. 1999;4(1):84–99.

69. Preacher KJ, MacCallum RC. Exploratory Factor Analysis in Behavior Genetics Research: factor recovery with small sample sizes. Behav Genet 1 mars. 2002;32(2):153–61.

70. Worthington RL, Whittaker TA. Scale Development Research: a content analysis and recommendations for best practices. Couns Psychol 1 nov. 2006;34(6):806–38.

71. Mokkink LB, Prinsen CA, Patrick DL, Alonso J, Bouter LM, de Vet HC, et al. COSMIN study design checklist for patient-reported outcome measurement instruments. Gut. 2019;70(1):139–47.

72. Hair JF, Babin BJ, Anderson RE. Multivariate Data Analysis. Cengage; 2019. p. 813.

73. Gabe KT, Jaime PC. Development and testing of a scale to evaluate diet according to the recommendations of the Dietary guidelines for the Brazilian Population. Public Health Nutr avr. 2019;22(5):785–96.

74. Hair JF. Multivariate Data Analysis. Prentice Hall; 2010. p. 828.

75. Koo TK, Li MY. A Guideline of selecting and reporting Intraclass correlation coefficients for Reliability Research. J Chiropr Med juin. 2016;15(2):155–63.

76. Taherdoost H, Sahibuddin S, Jalaliyoon N. Exploratory Factor Analysis; concepts and theory. Rochester, NY; 2022.

77. Finch WH. Using fit statistic differences to determine the optimal number of factors to retain in an exploratory factor analysis. Educ Psychol Meas Avr. 2020;80(2):217–41.

78. Cokluk O, Kayri M. The effects of methods of imputation for missing values on the validity and reliability of scales. Educational Sciences: Theory and Practice. 2011;11(1):303–9.

79. Dong G, Potenza MN. A cognitive-behavioral model of internet gaming disorder: theoretical underpinnings and clinical implications. J Psychiatr Res nov. 2014;58:7–11.

80. Winkler A, Dörsing B, Rief W, Shen Y, Glombiewski JA. Treatment of internet addiction: a meta-analysis. Clin Psychol Rev mars. 2013;33(2):317–29.

81. Young KS, Brand M. Merging theoretical models and therapy approaches in the context of internet gaming disorder: a personal perspective. Front Psychol. oct 2017;20:8:1853.
82. Zajac K, Ginley MK, Chang R. Treatments of internet gaming disorder: a systematic review of the evidence. Expert Rev Neurother janv. 2020;20(1):85–93.

Publisher's Note

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