TITLE: MEASURING DSM-5 INTERNET GAMING DISORDER: DEVELOPMENT AND VALIDATION OF A SHORT PSYCHOMETRIC SCALE

SHORT TITLE: THE DEVELOPMENT OF THE IGDS-SF9

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1. The IGDS-SF9 was developed and its psychometric properties were examined.

2. The IGDS-SF9 showed satisfactory psychometric properties.

3. The IGDS-SF9 is suitable for measuring IGD.

4. APA’s Internet Gaming Disorder criteria can be operationalized via IGDS-S9.

5. The IGDS-SF9 was developed to promote a unified research approach in the IGD field.

Abstract

Despite the large growth on gaming behaviour research, little has been done to overcome the problem stemming from the heterogeneity of gaming addiction nomenclature and the use of non-standardised measurement tools. Following the recent inclusion of internet gaming disorder [IGD] as a condition worthy of future studies in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders [DSM-5], researchers have now an opportunity to reach consensus and unification in the field. The aim of this study was to develop a new nine-item short-form scale to assess internet gaming disorder (IGDS-SF9) and to further explore its psychometric properties. A sample of 1,060 gamers (85.1% males, mean age 27 years) recruited via online gaming forums participated. Exploratory factor analysis [EFA], confirmatory factor analysis [CFA], analyses of the criterion-related and concurrent validity, reliability, standard error of measurement [SEM], population cross-validity, and floor and ceiling effects were performed to assess the instrument's psychometric properties. The results from the EFA revealed a single-factor structure for IGD that was also confirmed by the CFA. The nine items of the IGDS-SF9 are valid, reliable, and proved to be highly suitable for measuring IGD. It is envisaged that the IGDS-SF9 will help facilitate unified research in the field.

Key-words: Gaming Addiction; Video Games; Internet Gaming Disorder; DSM-5; IGD9-SF; Behavioural Addictions;

1. Introduction

In Section 3 of the latest (fifth) edition of the *Diagnostic and Statistical Manual of Mental Disorders* [DSM-5], the American Psychiatric Association [APA] included Internet Gaming Disorder [IGD] as a condition worthy of future study (APA, 2013). The inclusion of IGD followed the (i) increasing amount of research published over the last decade and (ii) debates surrounding the legitimacy of IGD as an independent clinical disorder. As suggested by the APA (2013), the clinical diagnosis of IGD comprises a behavioural pattern encompassing persistent and recurrent use of the internet to engage in online games, leading to significant impairment or distress over a period of 12 months as indicated by endorsing five (or more) of nine criteria. More specifically, the nine proposed criteria for IGD include: (1) preoccupation with internet games; (2) withdrawal symptoms when internet gaming is taken away; (3) tolerance, resulting in the need to spend increasing amounts of time engaged in internet games; (4) unsuccessful attempts to control participation in internet games; (5) loss of interest in previous hobbies and entertainment as a result of, and with the exception of, internet games; (6) continued excessive use of internet games despite knowledge of psychosocial problems; (7) deceiving family members, therapists, or others regarding the amount of internet gaming; (8) use of internet games to escape or relieve negative moods; and (9) jeopardising or losing a significant relationship, job, or education or career opportunity because of participation in internet games. Moreover, IGD may lead to school/college failure, job loss, or marriage failure as the problematic gaming behaviour tends to displace usual and expected social, work and/or educational, relationship, and family activities (APA, 2013).

Research into the psychosocial effects of video games has increased with many studies being published (Kardefelt-Winther, 2014a, 2014b; Kowert, Domahidi, Festl, & Quandt, 2014; Kuss, Griffiths, & Binder, 2013; Kuss, van Rooij, Shorter, Griffiths, & van de Mheen, 2013; Lopez-Fernandez, Honrubia-Serrano, Baguley, & Griffiths, 2014; Lopez-Fernandez, Honrubia-Serrano, Gibson, & Griffiths, 2014; Odrowska & Massar, 2014; Snodgrass et al., 2014). More recently, several scholars (Griffiths, King, & Demetrovics, 2014; King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013; Petry & O'Brien, 2013; Petry et al., 2014) have noted the need for developing a new psychometric tool for IGD capable of integrating the new aspects of the concept. Research on gaming behaviour has increased greatly over the last few years (Griffiths, Kuss, & Daniel, 2012; Kuss & Griffiths, 2012). However, it is argued that the field has been hindered by the use inconsistent non-standardised criteria to assess gaming addiction (Griffiths et al., 2012). Traditionally, researchers have adopted a broad range of nomenclatures (e.g., problematic gaming, video game addiction, online gaming addiction, compulsive internet use) to address the same phenomenon (Demetrovics et al., 2012; Gentile, 2009; Griffiths, 1993; Griffiths & Hunt, 1998; Rehbein, Psych, Kleimann, Mediasci, & Mößle, 2010; Young, 1998). This has resulted in a lack of a widely accepted definition and difficulty in unifying the field. Therefore, the use of a nomenclature that researchers can agree upon (e.g., IGD) and standardised psychometric tool rooted in the IGD concept, may represent an important step in providing a consensual view of the phenomenon from a scientific standpoint, and help unify different approaches into a singular one amongst researchers (Griffiths et al., 2014).

In light of this, the aim of the present study is twofold. Firstly, the main goal is to examine whether the nine adapted IGD criteria from the DSM-5 (APA, 2013) can serve as a basis for developing a new standardised psychometric tool for measuring IGD (namely the nine-item short-form *Internet Gaming Disorder Scale* [IGDS-SF9]. Secondly, to explore its psychometric properties in-depth in order to ascertain if it can be a valid and reliable tool for assessing IGD in accordance with the nine criteria from the DSM-5 (APA, 2013).

2. Method

2.1. Participants and procedures

A total sample comprising 1,397 English-speaking gamers from 58 different countries were recruited to take part in the study by clicking the survey link provided in 52 English-speaking online gaming forums. To advertise the survey link, authorisation from the gaming forum's moderators was sought prior the creation of a thread containing the survey link and specifying its nature on each forum. Every thread was individually checked for a period of one month on a daily basis. All important queries addressed by the participants to the research team were given personalised feedback.

The online data collection methodology was chosen because of its benefits regarding ease of access to larger sample pools, opportunity to reach a heterogeneous group of gamers and not only those playing massively multiplayer online role-playing games [MMORPGs], cost-efficiency, and its usefulness and practical advantages for researching behavioural addictions in general (Griffiths, 2012; Wood & Griffiths, 2007), especially in the case of online gamers.

Furthermore, a total of 337 out of 1,397 (24%) questionnaires were excluded from the final analyses due to severe incompleteness or other response biases (e.g., answering '5' to all questions, specifying an unlikely value for age) resulting in an overall heterogeneous self-selected sample comprising 1,060 English-speaking gamers.

The sample was predominantly male (85.1%; n = 902) with ages ranging from 16 to 70 years (M_{age} = 27 years, SD = 9.02). All participants were assured of anonymity and confidentiality, and the study was granted approval by the research team's University Ethics Committee.

2.2. Measures

2.3. Socio-demographics. The survey included questions relating to gender, age, country of residence, first time of gameplay (online and/or offline), relationship status, use of psychoactive substances for more than three times a week (i.e., cigarettes and alcohol) in order to map onto excessive substance use behaviours, ownership of mobile device with internet access, and ownership of gaming console and/or other gaming devices were collected.

2.4. Internet Gaming Disorder Scale – Short-Form (IGDS9-SF). The IGDS9-SF is a short psychometric tool adapted from the nine core criteria that define IGD according to the DSM-5 (APA, 2013). The aim of this instrument is to assess the severity of IGD and its detrimental effects by examining both online and/or offline gaming activities occurring over a 12-month period. The nine questions comprising the IGDS9-SF are answered using a 5-point Likert scale: 1 ("Never"), 2 ("Rarely"), 3 ("Sometimes"), 4 ("Often"), and 5 ("Very Often"). The scores are obtained by summing the gamer' answers and total scores can range from 9 to 45, with higher scores being indicative of higher degrees of gaming disorder. It is also worth noting that the main purpose of this instrument is not to diagnose IGD but to assess its severity and accompanying detrimental effects to the gamer's life. However, for research purposes, it may be possible to classify disordered gamers and non-disordered gamers by considering only those gamers that obtain a minimum of 36 out of 45 in the test (i.e., those who answered 'often' and 'very often' to all nine questions). For clinical diagnosis purposes, the APA symptom checklist containing the nine IGD criteria in their 'yes/no' format should be given preference over the IGDS9-SF for diagnosing IGD since the former appears to have diagnostic validity (Ko et al., 2014).

2.5. Weekly Gameplay. This variable examined the gamer's weekly time spent playing on computers, consoles, and/or other gaming platforms (e.g., handheld devices) and distinguished between those that played less than seven hours, between 8 and 14 hours, between 15 and 20 hours, between 21 and 30 hours, between 31 and 40 hours, and more than 40 hours per week respectively. This variable helps to inform APA's definition of IGD since disordered gamers typically devote at least 30 hours per week gaming (APA, 2013). Consequently, a significant positive correlation between this variable and the IGDS9-SF measure would be suggestive of the scale's criterion-related validity, and is a common procedure of studies of this nature (Lemmens, Valkenburg, & Peter, 2009).

2.6. Internet Gaming Disorder Test (IGD-20 Test). The IGD-20 Test (Pontes, Király, Demetrovics & Griffiths, 2014) comprises 20 items rated on a 5-point Likert scale: 1 ("Strongly disagree"), 2 ("Disagree"), 3 ("Neither agree or disagree"), 4 ("Agree"), and 5 ("Strongly agree") that reflects the nine criteria of IGD as in the DSM-5 (APA, 2013) and is also embedded in the theoretical framework of the components model of addiction (i.e., salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse) proposed by Griffiths (2005). Moreover, the aim of the IGD-20 is to assess the severity of IGD by examining both online and/or offline gaming activities occurring over a 12-month period. In the present study, the Cronbach's alpha for the IGD-20 Test was .88. Similar to the weekly gameplay variable, this measure was used to examine the IGDS-SF9 concurrent validity should a significant positive correlation be observed between the two measures.

2.3. Statistical Analysis

Statistical analysis comprised of (i) descriptive statistics of the main sample's characteristics and (ii) a psychometric study of the IGDS-SF9. These latter analyses encompassed an exploratory factor analysis (EFA), confirmatory factor analysis (CFA), assessment of the criterion-related validity, concurrent validity, population cross-validity, reliability, standard measurement error (SEM), and floor and ceiling effects. To carry out the analyses, MPLUS 7 (Muthén & Muthén, 2012) was used for the CFA and IBM SPSS Statistics Version 20 for the remaining analyses. All statistical tests adopted a significance level of .05.

3. Results

3.1. Descriptive Statistics

Table 1 summarises all relevant socio-demographic information collected in the current sample. Results of the analysis showed that half of the sample were in a relationship (45.7%, n = 484). Additionally, most gamers reported they first played video games at a very early age, that is, before the age of six years (45.8%, n = 485) and between the age of 7 and 12 years (44.3%, n = 470). Almost one-third of the total sample (26.7%, n = 283) reported playing games for more than 30 hours per week. In addition, only a small percentage of the sample reported smoking cigarettes (17.7%, n = 188) and drinking alcohol (12.4%, n = 131) for more than three times a week. Furthermore, most gamers reported owning a mobile device with internet access

(86.4%, n = 916) and a game console or other dedicated gaming device (70.1%, n = 743).

[Please insert Table 1. about here]

3.2. Exploratory Factor Analysis (EFA)

Before investigating the IGDS-SF9 factor structure (i.e., EFA and CFA), the whole sample was randomly split into two samples. Therefore, an EFA using the Principal Axis Factoring extraction method with Promax (oblique) rotation on the nine items of the IGDS-SF9 was performed in Sample 1 (n = 532) to examine its factorial structure and construct validity. The number of components to be extracted was determined through an examination of the scree plot (Cattell, 1966) in combination with the conventional Kaiser criterion (all factors with eigenvalues greater than one) (Kaiser, 1960). Furthermore, the acceptable threshold of items with factor loadings above .50 and/or parallel loadings below .20 were used as the criteria to retain items (Ferguson & Cox, 1993).

The appropriateness for conducting the EFA was confirmed by the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO = .915) and Bartlett's Test of Sphericity (χ^2 [36, 532] = 1929, $p < .0001$) results (Hair, Black, Babin, & Anderson, 2010; Malhotra, 1999). The analysis revealed a single factor explaining 45.4% of the total variance of the construct and was extracted after four iterations (see Table 2).

Because Kaiser criterion technique for determining the number of factors to be retained can be problematic (Costello & O, 2005; Velicer & Jackson, 1990; Zwick & Velicer, 1982, 1986), Horn's Parallel Analysis (Horn, 1965) was performed as this compares the observed eigenvalues extracted from the correlation matrix to be analysed with those obtained from uncorrelated normal variables. This method is based on the Monte Carlo simulation process, since ‘expected’ eigenvalues are obtained by simulating normal random samples that parallel the observed data in terms of sample size and number of variables (Ledesma & Valero-Mora, 2007). By adopting the rule that a factor was considered significant if the associated eigenvalue was bigger than the mean of those obtained from the random uncorrelated data, the single factor solution was further corroborated by this analysis.

[Please insert Table 2. about here]

3.3. Confirmatory Factor Analysis (CFA)

In order to confirm the single factor solution found of the IGDS-SF9 obtained in the EFA, a CFA with maximum likelihood with robust standard errors estimation method (MLR) was performed on Sample 2 (n = 528) using the nine IGDS-SF9 items in order to confirm a high-order single factor solution and further corroborate the factor structure found previously. This estimation method was preferred over the more traditional maximum-likelihood method because it deals better with non-normality issues. The latent construct was IGD – which was not directly observed – as it was considered the endogenous variable, whereas the nine items from the IGDS-SF9 were considered the exogenous variables used to measure gamers’ IGD level.

For the CFA goodness of fit, a *p* value of chi-square smaller than .05 for test of close fit was considered. Additionally, other fit indices included Comparative Fit Index (CFI), Tucker–Lewis Fit Index (TLI), Root Mean Square Residual (SRMR). For both CFI and TLI, values greater than .90 were considered acceptable whereas values above .95 were considered optimal. Moreover, a RMSEA value smaller than .08 expresses an acceptable fit, whereas an optimal fit is expressed by a value close to .06 (Byrne, 2013; Hu & Bentler, 1999). In light of the aforementioned assumptions, the analysis of the first-order model provided an optimal model fit for the IGDS-SF9. More specifically, χ^2 [27, 528] = 68.02, $p < .00001$; CFI = .964; TLI = .952; RMSEA = .054 (90% CI: [.038-.070]), *p*close = .331; SRMR = .034. As shown in Figure 1 and Table 3, all factor loadings were statistically significant and within the conventional acceptable threshold of > .50.

[Please insert Figure 1. about here]

[Please insert Table 3. about here]

3.4. Validity, Reliability and Standard Error of Measurement (SEM)

As noted above, another goal of this study was to further investigate the validity of the IGDS-SF9. To examine the criterion-related validity of the IGDS-SF9, the respondents' scores on the IGDS-SF9 were correlated with weekly gameplay and the total score obtained in the IGD-20 Test. As Table 4 shows, the IGDS-SF9 showed moderate to strong correlations with weekly gameplay and the IGD-20 Test in the expected directions. Moreover, the highest correlations observed between the IGDS-SF9 and the IGD-20 Test (r (473) = .842, $p < .0001$) and weekly gameplay (r (532) = .325, $p < .0001$) were both in Sample 1. Furthermore, the correlations were highly comparable and consistent across the samples.

[Please insert Table 4. about here]

Population cross-validity can be assessed by investigating if the results obtained in one sample of a population can also be replicated in another sample drawn from the same population (e.g., Raju, Bilgic, Edwards, & Fleer, 1997, 1999). In the present study, population cross-validation was examined by splitting the total sample into two random independent samples and assessing whether the single factor solution found for the IGDS-SF9 in Sample 1 would be replicated in Sample 2. As shown in Table 3, the IGDS-SF9 internal consistency as measured by the Cronbach's alpha was very high across the samples. More specifically, for Sample 1 (n = 532) the Cronbach's alpha was .88, whereas for Sample 2 (n = 528) was .87, and .87 for the overall sample (N = 1,060). Additionally, the IGDS-SF9 would not have its reliability increased by removing any of the nine items in any of the three samples.

In addition, the SEM was calculated because it reflects the degree to which the observed scores obtained on the IGDS-SF9 fluctuate as a result of the errors of measurement (Morrow, Jackson, Disch, & Mood, 2011). The SEM was computed by the standard deviation of the measure multiplied by the square root of one minus its reliability coefficient (Morrow et al., 2011). SEM ≤ SD/2 was taken as the criterion of acceptable precision (Wuang, Su, & Huang, 2012; Wyrwich, Nienaber, Tierney, & Wolinsky, 1999). The lower the reliability, the greater the SEM, and the less precise the measure. As expected, the SEM values for the IGDS-SF9 scores across the overall sample, Sample 1, and Sample 2 all attained the criterion (SEM ≤ SD/2), suggesting an acceptable measurement precision of the measure (see Table 5).

[Please insert Table 5. about here]

3.5. Analysis of the Distribution: Floor and Ceiling Effects

The score distributions of the IGDS-SF9 items were examined across the samples for floor and ceiling effects. The ceiling effect represents a limitation of an instrument whereby the scale cannot determine increased performance beyond a certain level. Similarly, the floor effect represents the opposite extreme (Wuang et al., 2012). In order to examine the presence of these effects, the percentage of gamer reporting the lowest scores (i.e., 9) and the highest possible scores (i.e., 45) for the IGDS-SF9 were calculated. The recommendations of Terwee et al. (2007) were used to ascertain whether a floor or ceiling effect was present. Essentially, in any sample of 50 or more gamer, having 15% or more of the gamer scoring at the highest or lowest score indicates a floor or ceiling effect.

As shown in Table 6, the IGDS-SF9 was found to have negligible floor or ceiling effects across the overall sample, Sample 1, and Sample 2. In regard to the overall sample, only 50 (4.7%) gamers responded "never" to all nine questions on the IGDS-SF9 while another five gamers (.5%) responded "very often" to all nine questions of the test. Similarly, for gamers in Sample 1, only 30 (5.6%) endorsed the lowest category for the IGDS-SF9 whereas four gamers (.8%) endorsed the highest category of the scale. Finally, regarding gamers in Sample 2, only 20 (3.8%) reported "never" to all questions while only one gamer (.2%) reported "very often". More gamers reported the lowest score than the highest score. In sum, none of the samples analysed reached the threshold for significant floor or ceiling effect.

[Please insert Table 6. about here]

4. Discussion and Conclusion

The purpose of this study was to develop a brief screening tool to assess gaming addiction based on the latest diagnostic DSM-5 criteria for IGD (APA, 2013). To achieve this goal, two steps were taken. Firstly, a short psychometric tool comprising nine items based on the DSM-5 diagnostic criteria of IGD was developed by experts in the field. Secondly, the newly developed tool was subject to in-depth psychometric examination in order to ascertain whether it reflected the concept of IGD. The results demonstrated a single-factor solution for IGD using the nine items of the IGDS-SF9. This structure emerged in the EFA and was later confirmed by the CFA results that provided fit indices that confirmed the viability of the proposed single-factor solution as the model optimally fitted the data.

The literature on IGD is scarce. This is because it is only recently that IGD has been proposed (i) by official medical bodies (e.g., APA), and (ii) as a condition worthy of future studies before being included in future editions of the DSM. Nevertheless, to the authors' knowledge, three studies investigated IGD under this new conceptualisation (Cho et al., 2014; Ko et al., 2014; Pontes et al., 2014). In one study (Pontes et al., 2014), IGD was conceptualised in terms of gaming addiction, resulting in the development of a new psychometric tool for assessing IGD with 20 items, while the other two studies either examined IGD's diagnostic validity in the clinical setting (Ko et al., 2014) or attempted to test the viability of the concept for assessing generalised internet addiction (Cho et al., 2014). Consequently, the present study represents a new contribution to the behavioural addiction literature by providing a new and brief valid psychometric tool for assessing IGD. Therefore, future research in the field should investigate if the single-factor solution holds for other samples in different contexts and populations. If the present conceptualisation of IGD can be replicated in future studies, it will potentially help reduce the several inconsistencies found in the literature related to gaming addiction prior to the conceptualisation of IGD.

In addition, future studies should examine if the suggested cut-off of 36 (out of 45) proposed for distinguishing disordered and non-disordered gamers using the IGDS-SF9 has clinical and empirical validity. To investigate whether the cut-off has clinical validity, a comparison with a clinically diagnosed sample could be made to actual IGDS-SF9 test scores. On the other hand, empirical validity could also be conducted by more sophisticated statistical analyses such as latent profile analysis using the empirical cut-off of 36 points as a gold standard for determining the profile of gamers and also conducting a subsequent sensitivity and specificity analyses.

In terms of the test's validity and reliability, the IGDS-SF9 appeared to be a valid and reliable measure for assessing IGD as suggested by the DSM-5 (APA, 2013). The statistically significant positive associations found between the IGDS-SF9, weekly gameplay, and IGD-20 Test, lend empirical evidence for the test's validity. Furthermore, the results stemming from the EFA and CFA also support the population cross-validity of the IGDS-SF9 as it was demonstrated that the single-factor solution found in the EFA (i.e., Sample 1) was also replicated and confirmed in the CFA (i.e., Sample 2). Moreover, the instrument was highly reliable across the samples since the Cronbach's alphas were very high and not possible to be increased by deleting any of the nine items of the scale. Additionally, the present study provided further psychometric data regarding the variability of the errors of measurement based on the SEM. The SEMs obtained for the overall sample, Sample 1 and Sample 2 were 2.45, 2.40 and 2.43 respectively. In sum, this suggests that the IGDS-SF9 measure is reliable and accurate in detecting changes in IGD levels.

It should also be noted that very few gamer had scores at the floor or ceiling levels of the IGDS-SF9. Typically floor and ceiling effects are considered problematic when more than 15% of the sample has either the lowest or highest score possible (Terwee et al., 2007). The IGDS-SF9 did not show either floor and/or ceiling of this magnitude in the present study. Overall, the IGDS-SF9 had more gamers at the floor level scores (i.e., 3.8% to 5.6%) than at the ceiling level (i.e., .2% to .8%).

The present study is not without limitations. Firstly, the use of convenience samples despite being common practice across various domains of the psychological literature, is not without its problems. In the present study, a convenience sample of gamers was used, and therefore was not necessarily representative of all gamers. Hence, these findings should be cautiously interpreted in terms of its generalizability. Future studies should aim to replicate the present findings using representative samples. Secondly, despite being a difficult issue to overcome, the use of self-report questionnaires is accompanied by possible associated biases (e.g., social desirability biases, short-term recall biases, etc.).

Overall, the findings of the present study lend empirical support for the concept of IGD as suggested by the DSM-5 (APA, 2013) while also supporting the viability of further study of this phenomenon. Moreover, the current findings suggested that the IGDS-SF9 can cater for the generalised need for a brief standardised and psychometrically sound tool for assessing gaming addiction accordingly to the new framework of gaming addiction presented in the DSM-5 (APA, 2013). Consequently, it is envisaged that this new tool will help facilitate research in the field by providing a concise, valid and reliable instrument for measuring IGD.

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Table 1. Socio-Demographic Characteristics of the Sample.

N	1060
Gender (male, n, %)	902 (85.1)
Age, years; Mean (SD)	27.3 (9.02)
Top 5 Countries (n, %)	
United Kingdom	281 (26.5)
United States	240 (22.6)
Sweden	73 (6.9)
Netherlands	52 (4.9)
Germany	36 (3.4)
Other countries	378 (35.7)
First time of Gameplay (n, %)	
Before the age of 6	485 (45.8)
Between 7 and 12 years old	470 (44.3)
Between 13 and 17 years old	67 (6.3)
After 18 years old	30 (2.8)
Don’t really remember	8 (.8)
Weekly Gameplay (n, %)	
Less than 7 hours	101 (9.5)
Between 8 and 14 hours	230 (21.7)
Between 15 and 20 hours	223 (21)
Between 21 and 30 hours	223 (21)
Between 31 and 40 hours	133 (12.5)
More than 40 hours	150 (14.2)
Relationship Status (n, %)	
In a relationship	484 (45.7)
Use of Substance > 3 times a week (yes, n, %)	
Cigarettes	188 (17.7)
Alcohol	131 (12.4)
Owning a mobile device with Internet access (n, %)	916 (86.4)
Owning a game console or other dedicated gaming device (n, %)	743 (70.1)

Table 2. Summary of the results from the EFA on the IGD9-SF nine items obtained from Sample 1 (n = 532).

Item[a]	*Factor Loadings*	*Communalities*	
	Factor 1[b, c, d]	**Initial**	**Extraction**
1	.544	.303	.296
2	.773	.560	.597
3	.687	.437	.472
4	.747	.516	.558
5	.640	.399	.409
6	.736	.496	.542
7	.669	.437	.448
8	.536	.276	.287
9	.688	.467	.473

a: Item description were omitted from the table for the sake of clarity. For a full description of the items please see Table 3.

b: Eigenvalue = 4.608.

c: Percentage of the Total Variance Explained = 45.4%.

d: Only one factor was possible to be extracted from the EFA after 4 iterations.

Table 3. Summary of CFA results obtained from the nine items of the IGD9-SF[a] on Sample 2 (n = 528).

	Factor Loadings[b]	R-Square
1. Do you feel preoccupied with your gaming behaviour? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your daily life?)	.634	.401
2. Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity?	.719	.517
3. Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure?	.695	.483
4. Do you systematically fail when trying to control or cease your gaming activity?	.702	.493
5. Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game?	.670	.449
6. Have you continued your gaming activity despite knowing it was causing problems between you and other people?	.683	.466
7. Have you deceived any of your family members, therapists or others because the amount of your gaming activity?	.635	.403
8. Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?	.506	.256
9. Have you jeopardised or lost an important relationship, job or an educational or career opportunity because of your gaming activity?	.630	.397
Factor Determinacies		.94
Cronbach's Alpha[c]		.87
Mean		18
SD		6.63

a: **Instructions**: *These questions will ask you about your gaming activity during the past year (i.e., last 12 months). By gaming activity we understand any gaming-related activity that has been played either from a computer/laptop or from a gaming console or any other kind of device (e.g., mobile phone, tablet, etc.) both online and/or offline.*

b: All factor loadings were statistically significant (i.e., $p < 0.0001$).

c: Cronbach's Alpha of the nine items of the IGD9-SF for Sample 2. For the purpose of clarity: Sample 1 (n = 532) (α = .88), Sample 2 (n = 528) (α = .87), and Overall sample (N = 1,060) (α = .87).

Table 4. Correlations Between the IGD9-SF and the Concepts used for Establishing Their Criterion-related Validity and Concurrent Validity.

	Overall Sample N =1,060	Sample 1 n = 532	Sample 2 n = 528
Weekly Gameplay	.319*	.325*	.312*
IGD-20 Test	.816*	.842*	.783*

* *p* < .0001.

Table 5. Analysis of the Standard Error of Measurement (SEM) of the IGD9-SF measure across the Overall Sample, Sample 1 and Sample 2.

	Overall Sample N =1,060	Sample 1 n = 532	Sample 2 n = 528
SEM	2.45	2.40	2.43
SD/2	3.40*	3.39*	3.31*

Notes: Overall Sample SD = 6.800; Sample 1 SD = 6.795; Sample 2 SD = 6.626;

* SEM ≤ SD/2.

Table 6. Summary of the Distribution Analysis: Floor and Ceiling Effects of the IGD9-SF across the Overall Sample (N = 1,060), Sample 1 (n = 532) and Sample 2 (n = 528).

Floor Effect (n, %)			Ceiling Effect (n, %)		
Overall Sample	Sample 1	Sample 2	Overall Sample	Sample 1	Sample 2
50 (4.7%)	30 (5.6%)	20 (3.8%)	5 (.5%)	4 (.8%)	1 (.2%)