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TITLE: PORTUGUESE VALIDATION OF THE INTERNET GAMING DISORDER SCALE – SHORT-FORM (IGDS9-SF)

RUNNING TITLE: PORTUGUESE VALIDATION OF THE IGDS9-SF

Abstract

In the latest (fifth) edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), Internet Gaming Disorder (IGD) was included as a tentative disorder worthy of future research. Since then, several psychometric instruments to assess IGD have emerged in the literature, including the 9-item Internet Gaming Disorder Scale–Short-Form (IGDS9-SF), the most brief tool available to date. Research on the effects of IGD in Portugal has been minimal and may be due the lack of psychometrically validated tool to assess this construct within this particular cultural background. Therefore, the aim of the present study was to develop and examine the psychometric properties the Portuguese IGDS9-SF. A total of 509 adolescents were recruited to the present study. Construct validity of the IGDS9-SF was assessed in two ways. Firstly, confirmatory factor analysis (CFA) was performed to investigate the factorial structure of the IGDS9-SF in the sample and the uni-dimensional structure of the IGDS9-SF fitted the data well. Secondly, nomological validation of the IGDS9-SF was carried out and the nomological network analyzed was replicated as expected, further supporting the construct validity of the IGDS9-SF. Criterion validity of the IGDS9-SF was also established using key criterion variables. Finally, the IGDS9-SF also showed satisfactory levels of reliability using several indicators of internal consistency. Based on the results found, the IGDS9-SF appears to be a valid and reliable instrument to assess IGD amongst Portuguese adolescents and further research on IGD in Portugal is warranted.

Introduction

Research into the effects of gaming on human health has grown substantially during the past decade. Although the positive effects of health gaming have been demonstrated by a large body of research,[1-4] numerous studies have systematically reported potentially harmful effects games can have on human health due to its potentially addictive properties[5-7] and overall detrimental effects[8-11] in several life domains for a minority of gamers. Such harmful effects related to addiction to gaming can include decreased levels of exercise and sports,[12] impaired decision-making,[13] poorer psychosomatic health,[14] greater incidence of psychiatric symptoms,[15] lower expected college engagement and grades in adolescent students,[5] compromised prefrontal cognitive control over emotional interference,[16] in addition to other psychiatric disorders and abnormal behaviors.[11, 17, 18]

In light of this, the latest (fifth) edition of the American Psychiatric Association's (APA) *Diagnostic and Statistical Manual of Mental Disorders*[19] included Internet Gaming Disorder (IGD) as a condition that needs further research before being fully recognized and accepted as an independent disorder in subsequent publications of the DSM.[20] The clinical diagnosis of IGD comprises a behavioral pattern encompassing persistent and recurrent engagement with online and offline games, leading to significant impairment or distress over a 12-month period as indicated by endorsing five (or more) of nine criteria. More specifically, the nine proposed criteria for IGD include: (1) preoccupation with games; (2) withdrawal symptoms when gaming is taken away; (3) tolerance, resulting in the need to spend increasing amounts of time engaged in games; (4) unsuccessful attempts to control participation in games; (5) loss of interest in previous hobbies and entertainment as a result of, and with the exception of, games; (6) continued excessive use of games despite knowledge of psychosocial problems; (7) deceiving

family members, therapists, or others regarding the amount of gaming; (8) use of games to escape or relieve negative moods; and (9) jeopardizing or losing a significant relationship, job, or education or career opportunity because of participation in games.[19]

The initial recognition of IGD as a tentative disorder from the APA coupled with the need for unifying the field of assessment of the IGD,[21] was followed by several psychometric validation studies that attempted to standardize the assessment of IGD with new instruments, mostly because extant measures prior to the publication of the DSM-5 had several methodological shortcomings and potential biases.[22-24] Moreover, after the publication of the first-ever standardized instrument to assess IGD (i.e., *Internet Gaming Disorder Test* [IGD-20 Test]),[25] several other scholars developed similar measures to assess IGD.[26, 27] However, these instruments were arguably lengthy in nature as they had a relatively large pool of items. Consequently the Internet Gaming Disorder Scale – Short-Form (IGDS9-SF)[28] was developed to cater for the apparent need of a shorter measure to assess IGD that was valid and reliable as well as being suitable for use in large-scale surveys. The IGDS9-SF was developed in an empirical study that included a heterogeneous sample of 1,397 English-speaking gamers from 58 different countries and was reported to have adequate psychometric properties (i.e., validity and reliability).[28]

Because the IGD diagnostic framework developed by the APA is recent, there is a need for cross-cultural studies employing the nine IGD criteria.[29, 30] This is a crucial step to be considered in IGD research in case the phenomenon is ever to be recognized as a *bona fide* addictive disorder. In fact, according to Petry and colleagues,[31] "*establishing the psychometric properties of instruments assessing these nine [IGD] criteria should begin using a cross-cultural perspective.*" (p. 6). In light of this rationale, the main aim of the present study was to examine the psychometric properties of the IGDS9-SF in a sample of Portuguese adolescents, and to provide more evidence from a distinct cultural

background in regard to the psychometric properties of the nine IGD criteria. To the best of the authors' knowledge, this is the first study ever to be conducted on the effects of addictive gaming in Portugal. Therefore, this study has the potential to facilitate research in this field in Portugal by providing researchers with a previously established psychometric tool to assess the phenomenon of IGD.

Methods

Participants and procedures

The target population of this study were all students (N = 700) enrolled in the sixth, seventh, eighth, and ninth grades of a major school located in the Algarve, south of Portugal during the academic year of 2014-2015. Authorization from the school's principal and parents was obtained, and participants completed an online survey with the assistance of computers within the school's library during the students' extra-curricular activities. The period of data collection spanned from May until June 2015. The school was chosen on the basis of availability, and the students of the school were selected by randomly sampling the pool of classes comprising the sixth, seventh, eighth and ninth grades (i.e., ages 10 to 18 years) to achieve optimal representativeness of the school's population. Data were collected from 509 students (72.7% of the entire population sampled). The final sample's mean age was 13 years (S.D. = 1.64) and there was a relatively equivalent gender split with 53.5% (n = 265) being male (see Table 1).

Measures

Sociodemographics and frequency of gameplay. Demographic data were collected on age, gender, and relationship status. Frequency of gameplay variables included a dichotomous question asking if participants had played videogames during the present

month, and two questions asking participants' about their average time spent gaming both daily and weekly.

Internet Gaming Disorder Scale – Short-Form (IGDS9-SF). The IGDS9-SF is a short psychometric tool reflecting the nine core criteria that define IGD.[19] The IGDS9-SF assesses 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 scale: 1 (''Never''), 2 (''Rarely''), 3 (''Sometimes''), 4 (''Often''), and 5 (''Very Often''). The scores are obtained by summing the responses and total scores can range from 9 to 45, with higher scores being indicative of a higher degree of gaming disorder. Although the authors have suggested a monothetic cut-off of 36 out of 45 points (i.e., those who answered 'often' and 'very often' to all nine questions) to classify disordered gamers,[19] there is currently no empirical nor clinical data supporting the cut-off of the IGDS9-SF. Hence, a more strict diagnostic approach of endorsement of five or more of the nine IGD criteria as assessed by the IGDS9-SF on the basis of answering 'very often' only should be considered.

Psychiatric symptoms. Symptomatology of depression, stress, and anxiety were assessed with the Depression Anxiety and Stress Scale–21 (DASS-21)[32] which comprises three 7-item subscales covering the three symptoms that are rated on a 4-point scale (i.e., 0 = "Did not apply to me at all" to 3 = "Applied to me very much, or most of the time"). The version of the DASS-21 used in the present study has been previously shown to possess good psychometric properties in the study's population.[33] The Cronbach's alpha for this instrument in the present study were .86 (depression), .88 (anxiety), and .89 (stress).

Data management, analytic strategy, and statistical analysis

Data management involved (i) cleaning the dataset by inspection of cases with missing values above the conventional threshold of 10% in all relevant instruments; (ii) checking for univariate normality of all items of the IGDS9-SF using standard guidelines (i.e., Skewness > 3 and Kurtosis > 9);[34] (iii) screening for univariate outliers that scored ± 3.29 standard deviations from the IGDS9-SF z-scores;[35] and (iv) screening for multivariate outliers using Mahalanobis distances and the critical value for each case based on the chi-square distribution values. This procedure resulted in the exclusion of 14 cases, thus yielding a final dataset of 495 valid cases that were eligible for subsequent analyses. Statistical analyses comprised (i) descriptive analysis of the main sample's characteristics; (ii) assessment of the construct validity of the IGDS9-SF by means of a confirmatory factor analysis (CFA); (iii) nomological validation of the IGDS9-SF to strengthen the case of construct validity by performing a full bootstrapped structural equation modeling (SEM) with 95% Bias-corrected and accelerated (BCa) confidence interval (CI) for the coefficient estimates of a theoretical model reflecting a nomological network[36] that replicates the pattern of association known for each construct in the model with IGD; (iv) criterion validity of the IGDS9-SF by examining the bootstrapped Pearson's correlation coefficients with 95% BCa CI between IGD and the frequency of gameplay variables alongside their coefficients of determination (R^2); (v) analysis of the scale's reliability using the Cronbach's alpha, composite reliability, and factor determinacy coefficients of internal consistency. All statistical analyses were performed using Mplus 7.2 and IBM SPSS Statistics 20.

Results

Descriptive statistics

In terms of the sociodemographic characteristics and frequency of gameplay of the final sample, very few reported being in a relationship 20% (n = 99) and time spent gaming daily (Mean = 2.48 hours; SD = 3.45) and weekly (Mean = 10.21 hours; SD = 17.86) were modest.

Please insert Table 1 about here.

Construct validity

A CFA was performed on the nine items of the IGDS9-SF using maximum likelihood estimation method with robust standard errors (MLR) in order to test the one-factor solution of the IGD construct as previously established.[28] Conventional fit indices and thresholds were used to examine the goodness of fit of the model under analysis: χ^2/df [1;4], Root Mean Square Error of Approximation (RMSEA) [0.05;0.08], RMSEA 90% confidence interval (CI) with its lower limit close to 0 and the upper limit below .08, Probability level value of the test of close fit (Cfit) > .05, Standardized Root Mean Square Residual (SRMR) [0.05;0.08], Comparative Fit Index (CFI) and Tucker-Lewis Fit Index (TLI) [.90;.95].[37-40] The results of this analysis produced the following results: $\chi 2$ (27) = 46.96, $\chi 2$/df = 1.7; RMSEA = 0.039 [90% CI: 0.019–0.057], Cfit = .84; SRMR = 0.035, CFI = .974; TLI = .965. Additionally, the results of the CFA provided acceptable standardized item loadings (i.e., $\lambda_{ij} \geq .50$, $p < .0001$) (see Figure 1). Overall, these results clearly demonstrate that the one-factor solution model presents an excellent fit to the data.

Please insert Figure 1 about here.

Nomological Validity

Assessing construct validity of IGD also involves identifying a network of key constructs associated with it, and to explicate the pattern of interrelationships that exist

among them.[41] This procedure has been discussed by Cronbach and Meehl[36] who argued that it is necessary to understand the nature of a construct via the statistical or deterministic laws underlying the network of key constructs, often referred as nomological network. The nomological network is usually considered an aspect of construct validity of a given phenomenon, and can be established by replication of the structural and causal relationships between IGD and psychiatric symptoms such as depression, anxiety, and stress that have been known to be associated the phenomenon of addictive gaming. For this reason, a full bootstrapped SEM was performed on the data to investigate the nomological validity of the IGD construct. The structural model included IGD as the predictor of depression, anxiety, and stress because several empirical studies have long acknowledged these associations.[6, 42-44] The results produced an adequate fit to the data ($\chi^2 = 665.9$, df = 399; CFI = .934, TLI = .928; RMSEA = 0.037 [90% CI: 0.032–0.042]; Cfit = 1.0; SRMR = 0.051). In terms of the variance explained (R^2) for each outcome in the model, IGD explained 17.4% of the variance in depression ($R^2 = 0.174$, $p < .0001$), 14.5% of the variance in anxiety ($R^2 = 0.145$, $p = .001$), and 21.4% of the variance in stress ($R^2 = 0.214$, $p < .0001$).

Please insert Figure 2 about here.

Criterion validity

Criterion validity was ascertained by demonstration of association between reliable and recognized indicators of IGD with the IGDS9-SF's scores. To achieve this goal, bootstrapped Pearson's correlation coefficient with 10,000 bootstrap samples and 95% BCa CI between both daily ($r = .36$, $R^2 = .13$, $p < .0001$, 95% BCa CI [.27 - .46]) and weekly ($r = .42$, $R^2 = .18$, $p < .0001$, 95% BCa CI [.34 - .50]) time spent gaming and IGD, which provided further support for the IGDS9-SF's criterion validity

Reliability analysis

The reliability of the IGDS9-SF as assessed by the Cronbach's alpha was relatively high (α = .87) and could not be improved upon deletion of any item. The composite reliability of the IGDS9-SF was .87, which is well beyond the accepted threshold of .70.[45, 46] Finally, factor determinacy for the IGDS9-SF was .93, which is above the desired threshold of .80.[47] These results clearly demonstrate that the Portuguese IGDS9-SF presents adequate internal consistency levels as evaluated by several different indicators.

Discussion

Using a sample Portuguese adolescents, the present study sought to conduct a psychometric validation of the IGDS9-SF in an attempt to create a valid and reliable instrument to stimulate research on IGD within the Portuguese cultural context. For this purpose, the IGDS9-SF was assessed in terms of validity and reliability from several levels. In regards to the IGDS9-SF validity, construct and criterion validity were investigated alongside the instrument's internal consistency.

Construct validation was conducted by means of CFA and nomological validation of the IGDS9-SF. The results from the CFA provided additional support for the uni-dimensionality IGDS9-SF as the goodness of fit was excellent and model fitted the data adequately. Furthermore, factor loadings of the nine items of the IGDS9-SF were all statistically significant and relatively high, lending support to the construct validity of the IGDS9-SF. To further assess the instrument's construct validity, nomological validity of the IGDS9-SF and its associated constructs was examined via a nomological network that included IGD as the predictor of depression, anxiety, and stress. The results of the

nomological validation provided extra evidence supporting the construct validity of the IGDS9-SF as the empirical replication these hypothesized relationships between the constructs was achieved in the structural equation model analysis.

In addition to these results, the IGDS9-SF was found to be associated with relevant criterion variables, which included the time spent gaming both daily and weekly. The observed associations between IGDS9-SF and frequency of gameplay lend support to previous findings[5, 7, 48, 49] and illustrate the IGDS9-SF possesses a good degree of criterion validity. Finally, in terms of the reliability of the IGDS9-SF, the results supported its adequacy concerning its internal consistency as assessed by several indicators such as the Cronbach's alpha, composite reliability, and factor determinacy.

Although the findings encountered concerning the psychometric properties of the IGDS9-SF were overall strong, there are some potential limitations worth noting. Firstly, the data were all self-reported and, as such, are prone to various known biases (e.g., social desirability, memory recall biases, etc.). Secondly, because all participants were self-selected, generalization of the present findings to the general population cannot be directly made. Thirdly, because the sample of this study comprised only Portuguese adolescents, the present findings may therefore not be generalizable to adolescents from other cultural backgrounds or adult samples.

Notwithstanding this, the present study will hopefully pave the way for new research on IGD both in Portugal and internationally. Thus, future studies could benefit from replicating the findings of this study in larger nationally representative sample in order to advance reliable estimates of prevalence rates of IGD. However, this should only be done after extensive support for the suggested cut-off point of the IGDS9-SF has been provided.

Conclusion

The findings of the present study demonstrate that IGD can be validly and reliably measured in Portuguese adolescents by the IGDS9-SF. The IGDS9-SF is the first instrument developed to assess IGD in the context of the Portuguese cultural background and for this reason more research on IGD will hopefully emerge. Given the seriousness and harmful consequences resulting from IGD in a minority of gamers, more research on IGD should carried out to gather evidence as to the clinical legitimacy of this phenomenon.

Authors Disclosure Statement

No competing financial interests exist.

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