

Measurement instruments of Internet gaming disorder in adolescents and young people according to DSM-5 criteria: a systematic review

Instrumentos de medida del trastorno de juego en internet en adolescentes y jóvenes según criterios DSM-5: una revisión sistemática

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Abstract

The inclusion of Internet Gaming Disorder (IGD) in the DSM-5 has generated controversy over its diagnosis, and it therefore seems necessary to establish a clear cut-off point to identify when excessive gaming becomes problematic. Such identification is especially difficult in adolescents and young people, who frequently dedicate a great deal of time to online games. The goal of this systematic review was to analyze the instruments developed to assess IGD in adolescents and young people since its inclusion in the DSM-5. We identified 13 studies which included validations of seven assessment instruments for IGD in adolescents and young people. Each instrument and its validations in different languages are described. In comparison to previous reviews, a lower diversity of assessment instruments, a reduction in the number of items and a more uniform form of measurement was observed, maintaining high internal consistency and good criterion validity. However, problems related to sample selection, the lack of sensitivity and specificity studies, and the establishment of cut points and profiles of gamers remain. Advances in the analysis of the psychometric qualities of the instruments and their validation in different countries are needed, and cultural differences should be considered in order to allow the prevalence of this problem to be compared.

Key Words: Assessment, Measurement, Internet Gaming Disorder (IGD), youth and adolescents, DSM-5.

Resumen

La inclusión del Trastorno de Juego en Internet (TJI) en el DSM-5 ha generado polémica sobre su diagnóstico, no obstante parece necesario establecer un punto de corte claro para identificar cuando este juego excesivo se convierte en problemático. Esta identificación se hace especialmente difícil en adolescentes y jóvenes, entre los que suele ser frecuente la dedicación a este tipo de juegos. El objetivo de esta revisión sistemática fue analizar los instrumentos desarrollados para la evaluación del TJI en adolescentes y jóvenes desde su inclusión en el DSM-5. Se identificaron 13 estudios que incluían validaciones de 7 instrumentos de evaluación del TJI en adolescentes y jóvenes. Se describió cada instrumento y sus validaciones en distintos idiomas. En relación con revisiones previas, se observó una menor diversidad de instrumentos de evaluación, una reducción en el número de ítems y una forma de medida más uniforme, manteniéndose una alta consistencia interna y una buena validez de criterio. Sin embargo, siguen presentes los problemas referidos a la selección de muestras, la falta de estudios de sensibilidad y especificidad, y el establecimiento de puntos de corte y perfiles de jugadores. Se recomienda avanzar en el análisis de las cualidades psicométricas de los instrumentos, y su validación en distintos países para considerar las diferencias culturales y poder comparar la presencia de este problema.

Palabras clave: Evaluación, Medida, Trastorno de Juego en Internet (TJI), jóvenes y adolescentes, DSM-5.

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When Internet gaming involves young people and adolescents, it is associated with negative personal, family and/or social consequences, such as sleep problems (Lam, 2014), an impact on well-being (Scott & Porter-Armstrong, 2013), and greater frequency of mental problems and less self-control (Dinh, Yasuoka, Poudel, Otsuka & Jimba, 2013). The prevalence of Internet Gaming Disorder (IGD) was estimated by a recent meta-analysis to lie between 0.7% and 15.6% (Feng, Ramo, Chan & Bourgeois, 2017), while a recent study with a Spanish-speaking population highlighted problematic video game use at 10.9% and dependence at 1.9% (Pedrero et al., 2018).

Before the inclusion of IGD in the DSM-5 (APA, 2013), the criteria used to diagnose problems of Internet gaming addiction in empirical studies were based on the criteria for diagnosing pathological gaming, or on the criteria for substance dependence. For example, a systematic review of studies on Internet gaming disorder in children and adolescents between 2000 and 2011 (Kuss & Griffiths, 2012) found that the diagnosis in 18 studies was based on pathological gaming criteria, while three studies used substance dependence criteria, and mixed criteria were used in three others. Including IGD in the DSM-5 was an important step in terms of establishing normative criteria for what should be considered symptomatic of this disorder. The classification includes nine criteria: (1) concern about playing on the internet; (2) withdrawal symptoms; (3) tolerance; (4) failed attempts to control participation in online games; (5) loss of interest in previous hobbies and entertainment behavior as a result of, and with the exception of, online games; (6) excessive and continued use of online games despite knowing the psychosocial problems it causes; (7) deception of relatives, therapists, or other people about the amount of play on the Internet; (8) use of online games as a way of escaping or alleviating negative moods; and, (9) having risked or lost significant interpersonal relationships, work and educational or professional opportunities due to participation in gaming on the Internet. At least five of the nine criteria have to be met during a 12-month period, although levels of severity are not established depending on the number of criteria met.

DSM-5 inclusion sparked controversy both in terms of the acknowledgment of IGD as an addiction and its diagnosis (Kuss, Griffiths & Pontes, 2017a, 2017b; Starcevic, 2017; Van Rooij & Kardefelt-Winther, 2017). Despite the social alarm it has caused, playing video games is in most cases a normal leisure activity, which only becomes a health problem necessitating professional help in a small percentage of players. However, when addressing this issue it is important that the scientific community and professionals agree on criteria and cut-off points which make it possible to distinguish when a person plays in a non-problematic way and when it is damaging to their daily lives. Neverthe-

less, it becomes difficult to establish a clear and precise distinction between what is safe gaming, excessive gaming and problematic gaming. This distinction is especially difficult among adolescents and young people, who frequently dedicate themselves single-mindedly to online gaming (Carbonell, Torres-Rodríguez & Fuster, 2016); hence the interest in having suitable tools for diagnosis.

King, Haagsma, Delfabbro, Gradisar and Griffiths (2013) conducted a systematic review of psychometric instruments used to evaluate IGD between 2000 and 2012, prior to DSM-5 inclusion. Table 1 shows a summary of the 18 instruments their research covered. The major strengths of the instruments were: (a) their ease of application, (b) relative brevity, (c) ease of scoring and administering; (d) high internal consistency (between .70 and .96, although this was not reported for seven of the 18 instruments), and (e) good convergent validity (unreported for four instrument) with related measures, such as social competence, education, impulsivity, sensation seeking, aggressiveness, depression, anxiety, attention problems, sleep difficulties, life satisfaction, etc. In terms of criterion validity, defined as a positive correlation between the severity and/or number of symptoms and the time spent playing video games, seven of the instruments yielded significant correlations, while 11 did not measure it. The authors note that, of these 18 instruments, only the *Problem Video Game Playing Scale* (PVP) (Salguero & Morán, 2002) would be able to assess IGD by covering the 9 DSM-5 criteria. Additionally, the *Game Addiction Scale* (GAS) (Lemmens, Valkenburg & Peter, 2009), would allow eight of the nine criteria to be assessed.

Meanwhile, the reviews by Kuss and Griffiths (2012) and King et al. (2013) noted the characteristics of the samples used and the lack of sensitivity of the measures as the major problems with the measurement instruments prior to DSM-5.

Regarding sample characteristics, Kuss and Griffiths (2012) indicated that the samples are specific to a certain age or nationality (which does not allow generalization to other populations), mixed (which cannot be generalized to specific groups), and/or convenience samples (basically involving people who are particularly motivated to participate); the authors therefore recommend cross-cultural studies which allow the comparison of results in different socio-cultural contexts. Similarly, King et al. (2013) noted that samples are usually recruited on the Internet (only a third were recruited through schools), with the biases that this implies. They recommend using random selection methods to recruit participants from the general population and the development of manuals with standardized norms for each instrument.

With regard to the qualities of sensitivity and specificity, meeting both requirements is a complex proposition. On the one hand, it is preferable that screening instruments, aimed at detecting possible cases, be highly sensitive so that

Table 1. *Internet gaming disorder assessment instruments prior to DSM-5 criteria*

Instrument	Country of origin	Language	N	Items	Format (options)	Factors
Adaptation DSM-IV-TR pathological game	USA	E	9995	10/11	Yes/No	2
Adaptation DSM-IV-TR dependence substances	USA	E	516	7	Yes/No	2
Addiction Engagement Questionnaire	UK	E	482	24	Likert (7)	2
Compulsive Internet Use Scale (CIUS)	UK	E, G	3744	14	Likert (5)	5
Engagement Addiction Questionnaire	UK	E	404	19	Likert (6)	2
Exercise Addiction Inventory (adaptado)	UK	E	119	6	Likert (5)	-
Game Addiction Scales (GAS)	UK	E, G, N	3413	7/21	Likert (5)	7
Korean Internet Addiction Test (KIAS)	South Korea	K	627	40	Likert (4)	7
Online Game Addiction Scale- Adolescents in Taiwan (OAST)	Taiwan	T	666	29	Likert (4)	4
Online Game Addiction Index (OGAI)	China	C, E	195	12	n.i.	3
Problem Videogame Playing (PVP) Scale	Spain	E, F, C	4988	9	Yes/No	7
Problematic Internet Use Scale (ISS-20)	Austria	G	468	20	Likert (6)	5
Problematic Internet Use Scale (POGU)	South Korea	E, K	1422	20	n.i.	5
Problematic Online Gaming Questionnaire (POGQ)	Hungary	E	3415	18	Likert (5)	6
Video Game Addiction Test (VAT)	Netherlands	E, G	2894	14	n.i.	5
Video Game Dependency Test (KFN-CSA-II)	Germany	G	15168	14	Likert (4)	5
Young Internet Addiction Scale (YIAS)	USA	E, C, F, IT, TU	2025	8	Yes/No	5
Young Internet Addiction Test (YIAT)	USA	G, E, F, C	7874	20	Likert (5)	6

Note. AR = Arabic; C = Chinese; E = English; F = French; G = German; IT = Italian; K = Korean; N = Norwegian; T = Taiwanese; TU = Turkish. n.i. = no information
Adapted from King et al. (2013).

all cases with a disorder may be identified, even at the risk of increasing false positives. On the other, highly specific instruments are preferable in order to confirm a possible diagnosis and reduce the rate of false positives. King et al. (2013) recommend prioritizing sensitivity in epidemiological studies and specificity when identifying clinical cases for treatment. Kuss and Griffiths (2012) pointed out that with the assessment instruments analyzed in their review, it is difficult to judge whether they are sufficiently sensitive to determine the level of gaming addiction of children and adolescents, or whether they are able to identify adolescents who are not addicted to online gaming.

Finally, King et al. (2013) observed that most of the instruments (11 of 18) used Likert-type scales instead of dichotomous response options in order to increase sensitivity, and that there were problems of standardization in their application related to the lack of reference manuals or precision at cut points. Thus, different cut points were used with some instruments in different studies, with five of them not even applying cut points or not providing information in this regard.

Given this state of affairs, the aim of the present systematic review is to analyze the instruments that have been developed for the assessment of IGD in adolescents and young people since this disorder was included in the DSM-5. In particular, the characteristics of the instruments, the samples used in their validation and their psychometric

qualities will be analyzed, bearing in mind the changes detected since the publication of the DSM-5 IGD criteria.

Method

A bibliographic search was carried out from January 2012 to May 2018 in *PsycINFO*, *Academic Search Premier*, *PubMed* and *Web of Science* databases, using the following Boolean logic terms and operators: (video gam* OR online gam* OR internet gam* OR computer gam* OR internet OR internet use) AND (addict* OR problem* OR pathological OR excessive or compulsive OR disorder* OR depend*) AND (measurement* OR psychometric* OR assessment), in an attempt to reproduce the systematic review by Kuss and Griffiths (2012). Searches were made in the keyword field or meSH terms.

The inclusion criteria were: (a) that the main subject of the article was the measurement instrument, (b) that IGD was assessed, (c) that minors were included as participants, (d) that it was an original article or clinical study and (e) that was published in English or Spanish. The exclusion criteria were: (a) that the main topic of the article was the analysis of explanatory models or associated or IGD risk factors, (b) that the instrument assessed Internet addiction in general without a specific section on IGD, (c) that only participants older than 18 years were included, (d) that it was a systematic review, meta-analysis or case study.

The articles were reviewed by two independent reviewers. The bibliographic search was complemented with the manual consultation of the reference lists of the selected articles.

Results

The search parameters used yielded a total of 361 results, which included the following results from each database: *PsycINFO* (85 results), *Academic Search Premier* (83 results), *PubMed* (71 results) and *Web of Science* (122 results).

Figure 1 shows the flow diagram for article selection. The database search strategy located 361 articles. After eliminating 190 duplicate entries, the remaining 171 were subjected to the inclusion and exclusion criteria by reading titles and abstracts, with 159 being eliminated for not meeting the criteria and 12 being selected for exhaustive analysis through a complete reading. After consulting the bibliographies of these articles, seven further articles were submitted to the selection criteria. Finally, 13 articles meeting the criteria were included in the review.

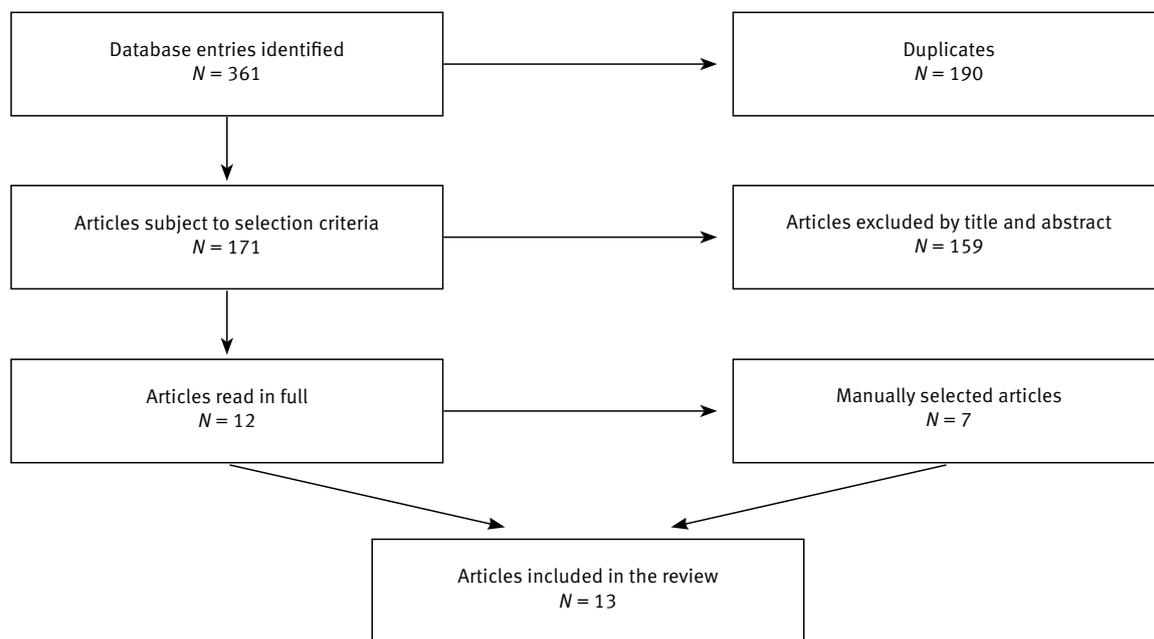


Figure 1. Flow diagram of the process of identification and selection of articles.

Table 2 summarizes the measurement instruments found in the review of articles and shows country of origin, languages in which they can be found, number of items, response options and underlying factors. Table 3 summarizes the studies included in the review, indicating the reference instrument, studies reviewed, number of participants, age range of the sample and psychometric properties of the instrument, including, when analyzed, cut-off points, number of player types, sensitivity, specificity, and correlation with time spent playing. In total, seven instruments were found (see Tables 2 and 3) which had been validated with adolescents and/or young people, and these will be described below.

Internet Gaming Disorder Test (IGD-20)

The *IGD-20* consists of 20 items which are answered on a 5-point Likert scale: (1) totally disagree, (2) disagree, (3)

neither agree nor disagree, (4) agree, and (5) totally agree. It was developed by Pontes, Király, Demetrovics and Griffiths (2014) as a valid and accurate instrument to evaluate IGD, incorporating DSM-5 diagnostic criteria and at the same time reflecting the six dimensions of the Griffiths addiction model (2005). These six dimensions are: salience, mood modification, tolerance, withdrawal, conflict, and relapse. The study measures online and offline gaming activity during the previous 12 months.

To validate the original instrument, Pontes et al. (2014) used a sample of 1003 participants over the age of 16, with an average age of 26.5 years (SD = 8.2), recruited through a survey advertised on gaming forums. The presence of six dimensions was confirmed; it was reliable, with good internal consistency; it displayed criterion validity, significantly correlating with time spent playing per week and DSM-5 diagnostic criteria ($r = .82$; $p < .001$). Five types of players

Table 2. Internet gaming disorder assessment instruments included in the review

Instrument	Country of origin	Language	Items	Format (options)	Factors
IGD-20	UK	E	20	Likert (5)	6
		SP, AR	20	Likert (5)	1
IGDS9-SF	UK	E, SL, PO, IT, PE, TU, P	9	Likert (5)	1
POGQ	Hungary	E	18	Likert (5)	6
POGQ-SF	Hungary	E	12	Likert (5)	6
VAT	Netherlands	G, PO	14	Likert (5)	1
C-VAT 2.0	Netherlands	G	14	Yes/No	n.a.
IGD Scale	Netherlands	G	27	Yes/No	1
			9	Likert (5)	1
				Yes/No	1
			9	Likert (5)	

Note. AR = Arabic; E = English; G = German; IT = Italian; SL = Slovene; SP = Spanish; P = Polish; PE = Persian; PO = Portuguese; TU = Turkish. n.a. = not assessed.

Table 3. Characteristics and psychometric properties of the assessment instruments

Instrument	Reviewed studies	N	Age evaluated	Cut-off points	Types	Sensitivity	Specificity	Internal consistency	Corr. time
IGD-20	Pontes et al. (2014)	1003	16-58	71	5	96%	100%	.88	.77***
	Fuster et al. (2016)	1074	12-58	75	5	71%	99%	.87	.42**
	Hawi y Samaha (2017)	375	14-19	n.a.	n.a.	n.a.	n.a.	.915	.48***
IGDS9-SF	Pontes y Griffiths (2015)	1060	16-60	36	n.a.	n.a.	n.a.	.87	n.a.
	Pontes y Griffiths (2016)	509	10-18	5 of 9 criteria	n.a.	n.a.	n.a.	.87	.36***
	Pontes et al. (2016)	1071	12-16	5 of 9 criteria	n.a.	n.a.	n.a.	.93	.52***
	Monacis et al. (2017)	687	16	21	n.a.	86.1%	86%	.99	n.a.
	Wu et al. (2017)	2389	12-19	n.a.	n.a.	n.a.	n.a.	.90	n.i.
	Evren et al. (2018)	1250	15-48	5 of 9 criteria	n.a.	n.a.	n.a.	.89	n.a.
	Schivinski et al. (2018)	3377	12-49	5 of 9 criteria	n.a.	n.a.	n.a.	.82	.36***
POGQ	Smohai et al. (2017)	1964	13	n.a.	n.a.	n.a.	n.a.	.92	n.a.
POGQ-SF	Papai et al. (2013)	2774	15-16	32	3	96%	97%	.807	c ² , ***
VAT	Van Rooij et al. (2012a)	2894	13-16	n.a.	n.a.	n.a.	n.a.	.93	n.a.
C-VAT 2.0	Van Rooij et al. (2017)	32	13-14	5 of 9 criteria	n.a.	91%	n.a.	n.e.	n.a.
IGD	Lemmens et al. (2015)	2444	13-40	5 of 9 criteria	3	66-87% ⁽¹⁾	72-98% ⁽¹⁾	.94-.93 .97-.83	n.a.

Note. Corr. = Correlation; * = p < .05; ** = p < .01; *** p < .001; n.a. = not assessed; n.i. = no information; (1) = minimum and maximum values of item sensitivity/specificity.

were discerned: (1) occasional players, (2) regular gamers, (3) low risk gamers, (4) high risk gamers, and (5) gamers with disorder. Taking the group of gamers with IGD as a gold standard, the cut-off point was established at 71, with a sensitivity of 96% and a specificity of 100%. The original instrument has been validated in Spanish and Arabic.

The Spanish validation of the IGD-20 (Fuster, Carbonell, Pontes & Griffiths, 2016) was carried out with a sample of 1074 participants aged between 12 and 58 from different Spanish-speaking countries in Europe and Latin America, recruited through a link on different gaming forums. The internal consistency of the instrument was .87. As in the

original study, six factors were identified, and good criterion validity was in evidence, with significant correlations with hours per week spent playing ($r = .42$, $p < .010$) and participant age ($r = -.12$, $p < .01$). As in the original validation, five player types or subgroups were identified: (1) occasional gamers, (2) regular gamers, (3) low risk gamers, (4) high risk gamers, and (5) addicted gamers. Using the players with IGD as the gold standard, the cut-off point was established at 75, with a specificity of 99% and a sensitivity of 71%.

The Arab validation (Hawi & Samaha, 2017) included a sample of 317 students aged 14 to 19 from eight random-

ly selected private schools in Lebanon. The instrument yielded an internal consistency of .915 and good criterion validity, showing a significant correlation with time spent playing video games daily and on weekends. Factor analysis confirmed the existence of only one factor.

Internet Gaming Disorder Scale – Short Form (IGDS9-SF)

The *IGDS9-SF* is a brief instrument developed by Pontes and Griffiths (2015) consisting of nine items covering the nine DSM-5 diagnostic criteria. Its objective is to assess the severity of IGD and its harmful effects by evaluating online and offline gaming activities during the previous 12 months. Each item has a 5-point Likert scale: (1) never, (2) rarely, (3) sometimes, (4) often, and (5) very often, producing a score range of 9–45. Although the main objective of the instrument is not to diagnose IGD but to evaluate its severity and harmful effects on the player's life, a cut-off point is established at 36 points to differentiate between players with and without disorder, with the former corresponding to those participants who answer “often” or “very often” on all items. As in the case of the *IGD-20*, the validation of the original instrument (Pontes & Griffiths, 2015) was carried out with 1060 English-speaking players aged between 16 and 60 (average age = 27 years, SD = 9.02). The instrument yielded an internal consistency of .87, a single factor, and good criterion validity with significant correlations with the *IGD-20*, and time spent playing per week. This instrument has been validated in Portuguese, Slovenian, Italian, Persian, Turkish and Polish.

The Portuguese validation (Pontes & Griffiths, 2016) was carried out with a sample of 509 adolescents and young people from 10 to 18 years of age (average age 13 years, SD = 1.64) from a high school in the Algarve, selected by random sampling in the classes from 6th to 9th grade. The cut-off point to consider a player as having a disorder was reached when answering more than five items with “very often”. The analyses confirmed the existence of a single factor, with an internal consistency of .87, and good criterion validity, with significant correlations with daily and weekly gaming time, as well as good nomological validity, which is a predictor of depression ($R^2 = .17, p < .001$), anxiety ($R^2 = .15, p = .001$), and stress ($R^2 = 0.21, p < .001$).

The Slovenian validation (Pontes, Macur & Griffiths, 2016) was carried out with a sample of 1071 of 8th grade adolescents, with an age range of 12 to 16 (average age 13.44 years, SD = .59), through stratified random sampling in the 12 regions of Slovenia. As in the Portuguese validation, a cut-off point was reached when any five of the nine criteria were met, i.e., on answering “very often”. The analyses confirmed the existence of a single factor. In addition, the instrument yielded excellent internal consistency and good criterion validity, showing significant correlations with time spent gaming daily and on weekends; as well as

good concurrent validity with participants' self-assessment regarding life satisfaction ($r = -.11, p < .001$) and mental health ($r = -.12, p < .001$).

The Italian validation (Monacis, De Palo, Griffiths & Sinatra, 2017) was carried out with a sample of 687 participants aged over 16 (with an average age of 21.62 years, SD = 3.9) from secondary schools, universities and gaming forums. The schools and universities were chosen on the grounds of convenience and in those available, classes to be assessed were selected at random. Different age groups were distinguished within the sample: adolescents ($n = 254$), aged between 16 and 19; and young adults ($n = 433$), older than 19 years of age. The analyses confirmed a unifactorial structure, as well as excellent internal consistency. Likewise, the *IGDS9* showed good convergent validity with the *Internet Addiction Test (IAT)* ($r = .83, p < .001$) and the short version of the *Gaming Addiction Scale (GAS-SF)* adapted to Italian ($r = .81, p < .001$), as well as good criterion validity, showing significant correlation with the *Bergen Social Networking Addiction Scale (BSNAS)* ($r = .76, p < .001$), which was chosen because it used the same six addiction criteria as the *IGDS9-SF*. The cut-off point was set at 21 according to the *GAS* gold standard of 21+, to distinguish between players with and without disorder, yielding a sensitivity of 86.1% and a specificity of 86%.

The Persian validation (Wu, Lin, Årestedt, Griffiths, Broström & Pakpour, 2017) was carried out with a sample of 2389 students from 12 to 19 years of age (average age 15.6, SD = 1.2) from 15 randomly selected schools in the city of Qazvin (Iran), of which most ($n = 2010$) repeated the assessment after two weeks. The analyses confirmed the instrument's unifactorial structure, which yielded excellent internal consistency and adequate test-retest reliability of .87. Criterion validity was also in evidence as significant correlations with weekly online gaming time ($\beta = .66, p < .001$) and with the measures of depression ($\beta = .14, p < .001$), anxiety ($\beta = .15, p < .001$) and stress ($\beta = .10, p < .001$) were shown.

The Turkish validation (Evren, Dalbudak, Topcu, Kutlu, Evren & Pontes, 2018) involved a sample of 1250 participants aged 15 to 48 (aged on average 21.8 years, SD = 3.42) from the university of Ankara, the database of an Istanbul sporting events company, and Turkish players on gaming forums. The unifactorial structure of the instrument was confirmed, yielding good internal consistency, adequate criterion validity with a significant correlation with average online gaming time in the previous year, and convergent validity with significant correlations with *Young's Internet Addiction Test - Short Form (YIAT-SF)* ($r = .46, p < .001$), and the *Internet Gaming Disorder Scale (IGDS; Lemmens et al., 2015)* ($r = .77, p < .001$).

The Polish validation (Schivinski, Brzozowska-Woś, Buchanan, Griffiths & Pontes, 2018) was carried out with a sample of 3377 participants aged 12 to 49 (with an average age of 20), of which 21% were between 12 and 16 years

of age, and 69.2% between 17 and 25. They came from different gaming forums, and to be included in the study they had to have played at least once in the previous year. The analyses confirmed the instrument had a unifactorial structure, which displayed adequate internal consistency, criterion validity, with significant correlations with average time spent gaming on weekdays ($\beta = .08, p = .001$) and weekends ($\beta = .36, p = .001$) and with the average duration of video game sessions ($\beta = .09, p = .001$).

Problematic Online Gaming Questionnaire (POGQ)

Demetrovics et al. (2012) developed an instrument with 26 items answered on a 5-point Likert scale, from never to always/almost always. Based on a review of the literature and interviews with players, it aims to detect problems related to online gaming. It was tested in a sample exclusively of adults, recruited through the 18 video game websites in Hungary. Of the original 26 items, 18 were retained and organized in six dimensions: preoccupation, overuse, immersion, social isolation, interpersonal conflicts, and withdrawal symptoms. The cut-off point was set at 65, with a sensitivity of 96% and a specificity of 100%. Four types of gamers were identified: below average use, gamers with low risk of problematic use, gamers with medium risk of problematic use, and gamers with high risk of problematic use.

Since this instrument had only been tested with adult online players, Smohai et al. (2017) applied it to online and offline players, with a sample of 1964 adolescents, 13-year-old high school students from 47 schools in 33 cities in Hungary who had played at least once in the previous month. Cronbach's alpha consistency coefficients for the different dimensions ranged from .75 (for the preoccupation dimension) to .86 (for withdrawal), with internal consistency for the total scale at .92. However, data on the validity of the instrument are not available.

Problematic Online Gaming Questionnaire – Short Form (POGQ-SF)

Papay et al. (2013) developed an abbreviated form of the *POGQ* by selecting the two items with the highest load of each factor. Thus, the *POGQ-SF* is composed of 12 items covering the six *POGQ* dimensions. Responses to each item are provided on a 5-point Likert scale of 1, never; 2, rarely; 3, occasionally; 4, often; and 5, always.

The instrument was applied to a sample of 2774 grade 9 and 10 general and vocational secondary school students aged 15 to 16 years. The average age of the participants was 16.4 years ($SD = .87$). Those who had played online video games at least once in the previous month were selected. The six dimensions were confirmed and three types of gamers were identified: below average users, low risk of problematic use, and high risk of problematic use. Taking membership of the high-risk category as the gold standard, the cut-off point was established at 32, with a sensitivity of 96% and a specificity of 97%. The instru-

ment showed good internal consistency, as well as validity since high-risk gamers showed a greater chance of playing more than five hours a day ($\chi^2 = 133.6, p < .001$), had higher scores in depression as measured with the Depression Scale (*CES-D*) ($\chi^2 = 54.5, p < .001$) and lower self-esteem as measured through the Rosenberg Self-Esteem Scale (*RSES*) ($\chi^2 = 33.9, p < .001$).

Video Game Addiction Test (VAT)

The *VAT* is a direct adaptation of the items on the *Compulsive Internet Use Scale* (*CIUS*), focusing specifically on video game playing. It consists of 14 items with the following components: loss of control, conflict, preoccupation/salience, coping/mood modification and withdrawal symptoms. Responses to each item are given on a 5-point Likert scale of 0, never; 1, rarely; 2, sometimes; 3, often; and 4, very often. The term gaming is used in a general sense in the items to refer to online gaming. Although this study predates the appearance of the DSM-5, it is included because the questionnaire used in subsequent studies or as a starting point for the development of other instruments (*C-VAT 2.0*) originated here.

Van Rooij, Schoenmakers, Van den Eijnden, Vermulst and Van de Mheen (2012a) applied the instrument to a sample of 2894 students from 10 secondary schools in the Netherlands, aged between 13 and 16, with an average age of 14.3 ($SD = 1.0$). The instrument yielded a one-dimensional factorial structure, excellent internal consistency, and construct validity, with significant relationships to the *GAS* ($r = .74, p < .001$) and the *CIUS* ($r = .61, p < .001$), and a weaker but nevertheless significant relationships to depressed mood ($r = .29, p < .001$), negative self-esteem ($r = .22, p < .001$), loneliness ($r = .29, p < .001$), social anxiety ($r = .22, p < .001$) and weekly online video game playing time ($r = .37, p < .001$).

This questionnaire has been validated in Brazil and adapted to the Portuguese language (Lemos, Cardoso & Sougey, 2016); however, it was not included in the present review because it only includes university students, i.e., participants of legal age.

Clinical Video Game Addiction Test (C-VAT 2.0)

The *C-VAT 2.0* is an assessment instrument to be administered by a clinician and was developed to identify and diagnose gaming addiction among the clinical population. It is an adaptation of the *C-VAT* (Van Rooij, Van Duin, Frielink, Defuentes-Merillas & Schoenmakers, 2012b) to the DSM-5 criteria and consists of three questions about video game playing habits, 11 questions with a dichotomous response format (Yes/No) about IGD symptoms in the previous year (nine of which cover the nine DSM-5 criteria for IGD, plus two more related to craving and health problems), and a short table of recommendations for identifying comorbid problems.

Van Rooij, Schoenmakers and Van de Mheen (2017) validated the instrument using a sample of 32 patients aged 13 to 23 in treatment for video gaming disorder. The cut-off score used to establish a diagnosis is 5 of 9, as proposed by DSM-5, with a sensitivity of 91%. Of the 32 patients, 27 had video game disorder as their main diagnosis, while for the other 5 cases it was a secondary disorder. They also had other comorbid disorders, which included depression, anxiety problems, hyperactivity and developmental disorder.

Internet Gaming Disorder Scale (IGDS)

Lemmens, Valkenburg and Gentile (2015) developed a 27-item German-language instrument in which each DSM criterion is measured with three items, each of which representing different central aspects of the criterion by using synonyms or making slight changes in the wording. There are two versions, one answered dichotomously (yes/no), and another with a 6-point Likert-type scale: (0) never, (1) 1-4 times in the previous year, (2) 5-11 times in the previous year, (3) 1-3 times in the previous month, (4) 1 or more times a week, (5) every day or almost every day.

The scale was validated with a sample of 1912 German-speaking adolescents and adults ($n = 989$ for the dichotomous version and $n = 923$ for the Likert-type version) of the Netherlands aged 13 to 40 with an average age of 24.8 (SD = 8.1) and 24.4 (SD = 7.6) years, respectively. Three age groups were established: adolescents ($n = 922$) aged 13 to 20, average age 17.6 (SD = 2.2); young adults ($n = 568$) aged 21 to 30, average age 25.1 (SD = 2.8); and medium-age adults ($n = 425$) from 31 to 40, average age 35.9 (SD = 2.8).

The instrument yielded high internal consistency in both versions. With the aim of building an abbreviated version, the item with the highest load of each criterion was selected which also showed high internal consistency, of .97 for the Likert-type version, and .83 for the dichotomous version. Both scales (27 and 9 items respectively) displayed adequate criterion validity, showing a small-to-moderate significant correlation with time spent playing video games, loneliness, self-esteem and prosocial behavior; and a highly significant correlation with aggressive behavior. However, the dichotomous version showed greater criterion validity than the Likert version because in contrast to the dichotomous version, the latter did not yield significant correlations with life satisfaction. The dichotomous nine-item version was used to diagnose IGD, adopting the 5-of-9 criteria as a cut-off point, as recommended in the DSM-5. Three gamer types were identified: normal gamers, at-risk gamers, and gamers with disorder. Class analysis results led the authors to suggest that it would be appropriate to raise the criteria to be met to 6 in order to avoid overdiagnosis. Sensitivity and specificity for each of the diagnostic criteria were examined using the 5-or-more criterion the DSM-5 and the 6-or-more criterion after class analysis, taking the

players with disorder as reference point. Although both yielded high specificity and adequate sensitivity, the 6-or-more criteria diagnosis displayed greater sensitivity.

Discussion

The main objective of this systematic review was to carry out an analysis of the instruments developed to measure online gaming problems in adolescents and young people since the publication of DSM-5 criteria for IGD. The changes detected in the characteristics of the instruments, samples used for their validation, and psychometric properties are analyzed below.

Instrument characteristics

The diversity of instruments is currently smaller, reduced from 18 instruments in the review by King et al. (2013) to seven. Differences have also been observed in terms of content; whereas previously, instruments in many cases assessed Internet addiction in general, they currently focus on the assessment of IGD.

Prior to the publication of the DSM-5 criteria, the instruments used were of a more general nature, measuring Internet addiction, and tending to originate in the United States. At present, however, the development of new instruments already focused on problematic video game use is concentrated in the United Kingdom, Hungary and the Netherlands. It should be pointed out that only instruments developed in the United Kingdom have been validated in other countries, with the *IGDS9-SF* being the most widely used instrument, and with a greater number of translations and validations in different languages. Also noteworthy is the fact that the instruments developed in the Netherlands were developed in German and some of the articles are not in English.

In general, as was the case previously, with the exception of *C-VAT 2.0*, these are self-report measures. However, their length has changed, from greater heterogeneity in terms of length, ranging from seven to 40 items, to shorter instruments of between nine and 27 items in which the number of items used has been reduced to practically half. In some cases, a short version of the original instrument was created, as in the case of the *POGQ*, reduced from 18 to 12 items in the abbreviated format, and the *IGD Scale*, down to 9 items from 27.

The type of response format is currently also more homogeneous. Whereas previously the two types of formats were used practically equally, now Likert-type scales tend to be favored, with the scale points (previously oscillating between four and seven) also becoming unified: items are now usually answered on 5-point Likert-type scales. Only the *IGD Scale*, in one of its formats, is answered dichotomously. The *C-VAT 2.0* also has a dichotomous response

format, but in this case it is to be completed by the clinician.

Sample characteristics

Few studies include young people and adolescents, with a good number of the instruments being developed with an adult population, despite the fact that internet gaming is a fairly frequent activity among the younger population. This shortage is even greater when considering studies which exclusively use adolescents and young people (Hawi & Samaha, 2017; Papay et al., 2013; Pontes & Griffiths, 2016; Pontes et al., 2016; Smohai et al., 2017; Van Rooij et al., 2012a; Wu et al., 2017). On occasion, heterogeneous age ranges are used for instrument validation without distinguishing age groups (Evren et al., 2018; Fuster et al., 2016; Van Rooij et al., 2017), although in some cases at least the number of participants corresponding to particular age groups is mentioned or some type of distinction is made (Monacis et al., 2017; Schivinski et al., 2018).

As mentioned by Kuss and Griffiths (2012), and King et al. (2013), problems related to sample selection continue: the use of convenience samples, such as links in gaming forums (Evren et al., 2018; Fuster et al., 2016; Schivinski et al., 2018), or the use of schools which are available and accessible to researchers (Monacis et al., 2017; Pontes & Griffiths, 2016). Random samples are scarce, and in some cases there are samples taken in a single city (Hawi & Samaha, 2017; Wu et al., 2017). Nationwide stratified randomized studies are usually included in larger research projects and focused on a single school grade (Papay et al., 2013; Pontes et al., 2016; Smohai et al., 2017; Van Rooij et al., 2012a). More studies with a clinical population are also still necessary; the only study of this nature is by Van Rooij et al. (2017), with a small convenience sample ($n = 32$).

Psychometric properties

In terms of its dimensionality, three of the instruments assess a single factor (*IGDS9-SF*, *VAT*, *IGD Scale*) while three others measure six factors (*IGD-20*, *POGQ* and *POGQ-SF*), usually corresponding to the addiction model.

The internal consistency shown by the instruments is excellent, even better than the previous instruments, ranging from .82 to .99, and in seven of the 13 studies it is equal to or greater than .90. Criterion validity is similarly good, usually taking as a reference hours of gaming per week, with some instruments distinguishing between game time on weekdays and at weekends. Some studies also analyze its convergence with other measures such as: instruments prior to the publication of the DSM-5 criteria which have demonstrated their effectiveness in measuring IGD or Internet addiction (Evren et al., 2018; Pontes et al., 2016; Van Rooij et al., 2012a); depression, anxiety, and stress (Pontes & Griffiths, 2016; Wu et al., 2017); depression and self-esteem (Papay et al., 2013; Van Rooij et al., 2012a); loneli-

ness and social anxiety (Van Rooij et al., 2012); aggressive behavior (Lemmens et al., 2015); and satisfaction with life and mental health (Pontes et al., 2016).

However, only three studies offer information regarding the specificity and diagnostic accuracy of the instrument evaluated, and four regarding sensitivity. The lowest score for sensitivity is for the *IGD-20* in its validation with Spanish-speaking adolescents and young people (71%), although it should be noted that this is due to the cut-off point being raised by the authors to 75, rather than being kept at the 71 of the original instrument (in which case the sensitivity would be 96%, as in the original instrument), in order to favor greater specificity and better diagnostic accuracy (99%). The *POGQ-SF* is the instrument obtaining the highest levels of both sensitivity (96%) in specificity (97%), with excellent diagnostic precision (97%). It may be the case that those instruments which value more factors or dimensions have greater sensitivity and diagnostic precision.

Only three studies offer cut-off points with reference to empirical studies (*IGD-20*, *IGDS9-SF* and *POGQ-SF*); in six cases the cut points are those recommended by the DSM-5, and in five they are not specified. As previously mentioned, in the case of the *IGD-20*, the cut points are different in the Spanish and English-speaking samples, with a slightly higher cut point in the Spanish validation highlighting the importance of taking into account cultural variation.

In addition to analyzing cut-off points, it is also important to assess gamer profiles. However, only three studies offer information on the type of gamer, with one establishing five gamer profiles (*IGD-20*) and two studies describing three types of gamers (*POGQ-SF* and *IGD Scale*).

Conclusions

The inclusion of IGD in the DSM-5, in the section of conditions for further study, is a first step towards an attempt to establish unified criteria in the assessment of this problem. Reflecting this, changes have been detected in terms of reduced heterogeneity and shorter measurement instruments, adapted for the most part to the DSM-5 criteria. The 5-point Likert scale is the most frequently used response format, probably due to its greater sensitivity, with scores of 4 and 5 being used to establish the presence of the DSM-5 diagnostic criterion. Conversely, the only instrument found for clinical use employs the dichotomous form and the clinical judgment of the therapist.

The instruments which seem to enjoy the broadest acceptance internationally are those developed in the United Kingdom. The *IGDS9-SF* is the most widely used, with the greatest number of translations to different languages and validations, although a more complete study of its psychometric qualities is lacking. Moreover, different player types are not identified in most of its validations, and it is neces-

sary to empirically establish cut-off points outside the 5 of 9 recommended by the DSM-5 to analyze their specificity, sensitivity and diagnostic accuracy. On the other hand, the advantage of the *IGD-20* is its ability to analyze different gamer profiles, although translations and validations are not available for other countries. Although Spanish-language validation is fairly complete, it suffers from being one of the longest instruments and in some cases there may be problems in understanding certain items, specifically those whose phrasing involves negation (ex. "I never play video games to feel better").

This systematic review is not without weaknesses. Firstly, only those instruments published in English and Spanish were included, so that some publications in German or in Asian countries could have been overlooked. On the other hand, the scarcity of publications utilizing samples of young people and adolescents has led to the need to include some studies in which responses are not distinguished by the age of the participants.

For the future development of IGD assessment instruments, a complete study of the psychometric qualities of the instruments should be considered, including their sensitivity, specificity, diagnostic accuracy and cut-off points in order to establish different gamer types and their risk levels. For detection of the problem in large populations and the application of prevention programs in schools, it would be advisable to use a brief, highly sensitive self-report instrument and, after detection, a test with high specificity able to reduce false positives and confirm a diagnosis involving clinical judgment. To improve communication and collaboration between researchers and professionals at an international level, making the instruments and their authors accessible through web pages seems an appropriate strategy, as is the case of the instruments developed in the United Kingdom.

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Conflicts of interest

The authors declare that there is no conflict of interest in any aspect of this study.

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