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Video Game Structural Features Are Related to Internet Gaming Disorder and Motivations of Play: Design and Validation of the Video Game Structure Scale (VGSS)

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Abstract

Structural characteristics of video games influence the development of maladaptive behavioral patterns such as Internet gaming disorder (IGD). The aim of this study was to develop and validate a tool to evaluate users' perceptions of video game structural features. The sample was composed of 502 gamers with an average age of 23.35 years ($SD = 6.89$). In total, 67.3% used a personal computer, 20.7% a desktop console, 11.4% a mobile platform, and 0.6% a portable console. Multiple exploratory factor analyses were conducted to identify the optimal model. Initial evidence of reliability, construct, and external validity was found (TLI and CFI > .90, RMSEA < .06, SRMR < .08). Structural features were categorized into three primary factors: social, control, and reward. After a multiple linear regression, structural features and gaming motivations explain 19% of the variance in IGD. In conclusion, the scale demonstrates solid psychometric properties for assessing how Spanish-speaking players perceive the structural characteristics of video games and how these relate to the development of IGD.

Keywords Gaming disorder · Structural features · Problematic gaming behavior · Behavioral addiction · Video game addiction

With global video game players projected to reach 3.2 billion in 2024 (Turner, 2023), issues related to gaming such as Internet gaming disorder (IGD) are increasingly widespread. IGD refers to excessive or compulsive gaming behavior that leads to negative consequences in various aspects of life. Therefore, IGD was included in the DSM-5 (American Psychiatric Association, 2013) and in the ICD-11 (World Health Organization, 2019).

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Currently, its prevalence stands between 1.96 and 4.97% (Pontes et al., 2022a, 2022b). Despite its incorporation into diagnostic manuals, controversy persists about some of its diagnostic criteria (e.g., preoccupation and withdrawal symptoms). The first may pathologize normal behavior, while the second blurs the line between brief negative emotions and measurable withdrawal symptoms (Kuss et al., 2017). Also, its diagnosis continues to be surrounded by stigma (Pontes et al., 2022a, 2022b).

Although IGD research often categorizes games by genre (e.g., first-person shooter, massively multiplayer online role-playing, and multiplayer online battle arena) (Clarke et al., 2015), this approach has limitations (e.g., Carmona et al., 2023), leading some authors to suggest a focus on structural characteristics instead (Dale & Green, 2017; Griffiths & Nuyens, 2017; Hull et al., 2013; King et al., 2010; Saini & Hodgins, 2023). Structural features are elements of video game design that encourage or sustain gaming behavior, independent of players' individual traits (Wood et al., 2004). Some examples are the permanence of the game world, systems of advancement and reinforcement, and elements that support social interaction (Király et al., 2023). They are also linked to whether and how people become players, whether they keep playing over time, and how they play the game. Following this line, a recent scoping review conducted by Saini and Hodgins (2023) suggested that IGD is a behavior pattern whose development depends largely on the structural characteristics of the games played. Furthermore, structural features are associated with problematic or adaptative behaviors depending on gaming motives.

Gaming motivations refer to the underlying psychological factors that drive individuals to engage in video gaming, varying in nature and significantly influencing how players interact with games and their gaming behavior (Ryan et al., 2006). Motivations, such as escapism, social interaction, and competition, play a critical role in differentiating pathological from normal gaming behavior (Kircaburun et al., 2020; Marino et al., 2020; Melodia et al., 2022; Slack et al., 2022; Wang & Cheng, 2022). Additionally, it is known that some players are more vulnerable to certain game designs depending on their motivation of play. For example, those who play to escape their problems are more vulnerable to developing IGD (Slack et al., 2022). However, gamers who play to socialize are likely to develop pro-social behaviors and seek games focused on building relationships (Fu et al., 2017). Although it is true that building social relationships exclusively online can increase the risk of developing problematic behavior, socializing in video games can help to develop shared interests, improve leadership skills, and increase sports performance (Badrinarayanan et al., 2015; Mao, 2021; Vella et al., 2016).

The examination of the structural features of video games is still in its early stages. While IGD has been extensively studied in terms of video game genre, empirical studies on video game structural characteristics are scarce (Rehbein et al., 2021). Despite this, its study helps us to understand the effects that certain features have on player behavior in disparate games (Carbonell, 2017). Over time, several taxonomies have emerged to classify structural features (see Table 1), the most widely adopted being that of King et al. (2010). This taxonomy was designed to understand how players interact with video games and identify which design components can generate overuse or dependency. Over the years, and according to the work of King et al., (2010), some studies have identified a positive relationship between IGD and reward and punishment, social and narrative, and identity aspects (González-Cabrera et al., 2023; Laconi et al., 2017; Szolin et al., 2022). And manipulation and control aspects have been related to a decrease in overall happiness (Hull et al., 2013). In addition, escape motives have been positively related to social and reward and punishment aspects (Li et al., 2020; Melodia et al., 2022; Zendle & Cairns, 2018).

Table 1 Studies that propose taxonomies of existing structural characteristics

Study name	Authors
The structural characteristics of video games: A psycho-structural analysis	Wood et al. (2004)
Game classification and game design: Construction through critical analysis	Elverdam and Aarseth (2007)
Video game structural characteristics: A new psychological taxonomy	King et al. (2010)
A data-driven taxonomy of undergraduate student videogame enjoyment	Quick and Atkinson (2011)
User-centered approach in creating a metadata schema for video games and interactive media	Lee et al. (2013)
The game genre map: A revised game classification	Heintz and Law (2015)
Investigating gaming structural features associated with gaming disorder and proposing a revised taxonomical model: A scoping review	Saini and Hodgins (2023)
Design of a taxonomy for the psychological study of the structural characteristics of video games	Carmona et al. (2023)

Own elaboration

However, due to the rapid evolution of the video games industry, none of the taxonomies mentioned above contemplates current structural characteristics.

Given the rapid evolution of game design, Carmona et al (2023) proposed an expanded taxonomy based on King et al. (2010) to capture a broader range of structural characteristics. Although Saini and Hodgins (2023) developed an updated classification based on the same theoretical framework, it only contemplates those features associated with IGD or a proxy of IGD. So, a broader taxonomy is justified. Furthermore, Saini and Hodgins's (2023) taxonomy was carried out through a scoping review of the literature, not identifying new characteristics but exposing those already known. Carmona's et al. (2023) taxonomy divides structural characteristics into four aspects: (a) social, responsible for generating and regulating relationships between players; (b) manipulation and control, which govern the rules of gameplay and refer to all those aspects of the game that players can control; (c) narrative and identity, which refer to the ways in which the player assumes identity within the game and the way in which he or she relates to the narrative generated through his or her action; and (d) reward and punishment, responsible for rewarding and penalizing the player for performing certain behaviors in the game.

With all this, Carmona's et al. (2023) classification fitted better with a greater number of characteristics which allows the study of unknown relationships between features and (a) IGD development and (b) its influence on intrinsic variables of the player, also important in IGD appearance (Bäcklund et al., 2022; Lin et al., 2020; Zsila et al., 2023). Therefore, this study aims to develop and validate a tool that assesses how players perceive these structural features and their potential association with IGD.

The Present Study

Given the need for further research in this area, this study aims to validate the internal consistency and the validity of the Video Game Structure Scale (VGSS). For this, the psychometric properties of the VGSS, including its internal structure, reliability, and validity in relation to other variables, will be analyzed. Additionally, the relationships among IGD,

gaming motivations, and structural characteristics will be examined through correlations and linear regression. With this in mind, we formulate the following hypotheses:

H_1: VGSS will show evidence of construct validity, reliability, and external validity.
H_2: Reward aspects will correlate positively with IGD.
H_3: Narrative and identity aspects will correlate positively with IGD.
H_4: Manipulation and control aspects will correlate positively with IGD.
H_5: Social aspects will correlate positively with IGD.

Method

Participants

A sample of 502 Spanish-speaking video gamers was recruited through Discord servers to complete an online questionnaire between May 21 and August 9, 2022. Participants were eligible if they were 18 years or older, played video games at least one hour per week, and provided informed consent. A total of 101 participants who did not meet these criteria were excluded from the analysis. Descriptive statistics of the sample are included in Table 2.

Measures

Participants completed an ad hoc questionnaire consisting of four parts:

Sociodemographic and Gaming Data Gender, age, number of hours played per week, and the device they most used.

Video Game Structure Scale (VGSS) Based on the taxonomy of Carmona et al. (2023), the questionnaire measures participants' assessment of different video game structural characteristics. First, 69 items were designed based on the theoretical framework that could be

Table 2 Descriptive statistics of the sample

		Age		Game hours per week	
	Valid (%)	Mean	*SD*	Mean	*SD*
Total sample	502 (100%)	23.35	6.89	19.39	17.73
Gender					
Male	365 (72.2%)	23.30	6.75	20.07	18.12
Female	130 (25.9%)	23.63	7.42	17.72	16.73
Other	7 (1.4%)	20.29	1.70	14.71	13.83
Habitually used device					
Personal computer	338 (67.3%)	22.30	5.68	21.82	18.98
Desktop console	104 (20.7%)	25.39	7.28	14.44	13.19
Mobile platform	57 (11.4%)	25.67	10.43	14.19	14.60
Portable console	3 (0.6%)	26.67	9.61	16.00	5.29

SD standard deviation

answered with a five-point Likert scale. The Likert scale was chosen because it has been shown to be suitable for conducting a wide variety of statistical analyses, including factor analyses (Dawes, 2008). The statement of the instrument was the following: "Below, you will find some statements that refer to different aspects of video games. Answer from 1 (I don't value it) to 5 (I value it a lot) depending on how you value the presence of these aspects when you play video games." The 69 items were submitted to two judges for evaluation. Both judges, experts in video game development, evaluated the items with the objective of determining whether the content of the items matched that proposed by the theoretical taxonomy. After their approval, the questionnaire was shown to six regular video gamers (three men and three women), who confirmed that all the items were easy to understand. The questionnaire was then administered to a total sample of 502 regular video gamers and a factor analysis was carried out, resulting in a 20-item scale with a score range of 20 to 100 (see the Appendix). A higher score indicated a more positive evaluation of the structural characteristics present in the participant's preferred video games.

Spanish Version of the Internet Gaming Disorder Scale-Short Form (Beranuy et al., 2020) The IGDS9-SF assesses the severity of IGD and its detrimental effects, examining online and/or offline gaming activities that occur over a 12-month period with nine questions based on the DSM-5 IGD criteria that are rated on a five-point Likert scale: 1 (never), 2 (rarely), 3 (sometimes), 4 (often), and 5 (very often). Participants' total score ranges from 9 to 45 points. Higher scores typically indicate a higher level of IGD symptom severity and a greater incidence of problems related to gaming behaviors. The sample of the present study presented a reliability coefficient (ω) of 0.87 on that scale.

Reasons for Playing Video Games (González & Igartua, 2018) This scale is made up of a total of 16 Likert-type items with values between 1 (strongly disagree) and 5 (strongly agree). The items are grouped under a model of four dimensions or main motivational factors: (a) fantasy, (b) escape and entertainment, (c) competition and challenge, and (d) socio-activation emotional. In this study sample, omega reliability coefficient (ω) of 0.81 for the scale was found.

Procedure

The survey was applied through an online questionnaire using Typeform© (Typeform, 2024). Participants received a message in the general chat of their Discord explaining the purpose of the research and inviting them to request the questionnaire link. Participants completed the questionnaire using a mobile device or PC. It took 15–20 min on a mobile device and 25–35 min on a PC.

Statistical Analysis

To evaluate the construct validity, reliability, and external validity of the VGSS, we conducted exploratory and confirmatory factor analyses using JASP© 0.19.2 (JASP Team, 2024). To observe the factorial loads of the different items in each of the factors, an exploratory factor analysis (EFA) with promax oblique rotation was conducted, manually entering the number of factors. We calculated Cronbach's alpha (Cronbach, 1951) and McDonald's omega (McDonald, 1999) for each factor. A confirmatory factor analysis was also performed with the factors obtained and the suitability indices were

checked. Fit was considered acceptable if TLI and CFI exceeded 0.90, RMSEA was below 0.06, and SRMR was under 0.08 (Hu & Bentler, 1999; McDonald & Ho, 2002).

Once the factor structure was found, the descriptive statistics (mean, standard deviation, skewness, and kurtosis) and the discrimination index of the final 20 items were examined (Muñiz & Fonseca-Pedrero, 2019). The examination of convergent and discriminant validity was conducted through the assessment of composite reliability (CR), average variance extracted (AVE), and maximum shared variance (MSV). Convergent validity was supported if the AVE exceeded 0.50, while discriminant validity was established if AVE was lower than MSV (Cheung et al., 2023).

To evaluate the external validity of the construct (Mitchell, 2012), Spearman's correlations were calculated between the Video Game Structure Scale, the Spanish version of IGDS9-SF, and the scale of reasons to play video games. Since the Shapiro–Wilk test indicated that the variables did not follow a normal distribution ($p < 0.05$ for all variables), Spearman's correlation was used.

Finally, a multiple linear regression was conducted to assess if VGSS-assessed structural characteristics and gaming motivations predicted IGD. The variance explained by the model (R^2) was examined to determine predictive strength (e.g., Cohen, 1988).

Ethics

All participants provided written informed consent. The study was approved by the Institutional Review Board of Ramon Llull University (File CER URL_2023_2024_004) and adhered to American Psychological Association and Helsinki Declaration ethical guidelines.

Results

Factor Analysis

The Kaiser–Meyer–Olkin index was 0.873, indicating the data's suitability for factor analysis. Of the initial 69 items, 20 met the criteria for factor loading above 0.4 and model fit, resulting in a three-factor structure ($\chi^2 = 470.213(133)$; $p < 0.001$) (see Table 3). The internal consistency for each factor was as follows: social aspects ($\alpha = 0.866$, $\omega = 0.867$), control aspects ($\alpha = 0.767$, $\omega = 0.769$), and reward aspects ($\alpha = 0.709$, $\omega = 0.716$), with an overall scale consistency of $\alpha = 0.855$ and $\omega = 0.857$, explaining 46.2% of the variance. Confirmatory factor analysis, using the maximum likelihood estimator, indicated a good model fit: $\chi^2 = 396,897(149)$, $p < 0.001$; CFI = 0.908; TLI = 0.909; and RMSEA = 0.058 (0.051–0.064), according to Hu and Bentler's (1999) cutoff criteria.

Descriptive statistics, including skewness, kurtosis, and discrimination indices, met acceptable standards (see Table 3). Evidence of convergent and discriminant validity was also supported based on CR, AVE, and MSV values (view Table 3 for details on these indexes). However, it is worth noting that the third factor had an AVE slightly lower than the recommended threshold of 0.40, with a value of 0.37. Although this is not a significant issue, it is mentioned here for clarity and correctness.

Table 3 Descriptive statistics, discrimination indices of the items, and reliability of the specific dimensions of the VGSS

Item	M	SD	Sk	K	D.I.s	FL	ω	α	AVE	MSV	CR
Social aspects	26.44	6.67	−0.94	0.49	–	–	.87	.87	.52	.25	.88
19. Cooperating with other players	3.85	1.29	−0.85	−0.15	.371	.780					
8. Feeling like I'm part of a team	3.70	1.29	−0.68	−0.60	.385	.756					
1. Using communication tools (e.g., text and voice chat) to socialize	3.53	1.41	−0.49	−1.10	.434	.735					
18. Having a friend management system that allows me, among other things, to invite friends to games and know when they are connected	4.11	1.19	−1.25	0.54	.433	.728					
10. Competing against other players	3.85	1.29	−0.87	−0.34	.464	.708					
15. Finding out the statistics of the team's performance at the end of the game	3.90	1.25	−1.05	0.09	.501	.670					
9. Belonging to a clan in which helping each other allows us to obtain greater rewards	3.47	1.36	−0.47	−0.99	.438	.663					
Control aspects	29.89	3.98	−0.93	1.07	–	–	.77	.77	.40	.13	.82
6. Having the freedom to decide what objectives I want to achieve	4.32	0.82	−1.24	1.69	.474	.720					
11. Being free to decide in what order I fulfill my objectives	4.30	0.87	−1.19	1.15	.491	.711					
5. Unlocking new skills as I progress	4.31	0.86	−1.38	2.16	.543	.664					
16. Choosing from a variety of challenges	4.07	0.95	−0.90	0.45	.581	.634					
7. Choosing my style of play, through different roles, skills, or characters	4.45	0.77	−1.58	2.86	.623	.601					
3. Storing my items in an inventory and then use them	4.03	1.05	−0.98	0.36	.541	.570					
17. Learning to control the outcome of the game better (e.g., be able to get better rewards, die less, etc.), as I progress	4.43	0.80	−1.49	2.30	.679	.517					
Reward aspects	17.03	5.10	0.03	−0.34	–	–	.72	.71	.37	.30	.77
12. Having to wait a certain amount of time for a reward to be unlocked	2.56	1.33	0.29	−1.06	.471	.719					
13. Getting random rewards	3.23	1.30	−0.20	−0.96	.548	.640					
20. That investing real money gives me a clear advantage over other players	1.64	1.18	1.18	2.06	.600	.630					
14. That there are rewards that you can only get during certain periods of time or at certain times of the day	3.10	1.47	−0.12	−1.33	.500	.625					
4. To be rewarded more than other players for playing for longer	3.04	1.36	−0.08	−1.14	.685	.520					
2. Being able to buy items and upgrades in a store, either because other players sell them or because they are offered by the game itself	3.45	1.33	−0.51	−0.86	.645	.475					

M mean, *SD* standard deviation, *Sk* skewness, *K* kurtosis, *D.I.s* discrimination index per dimension, *FL* factor loading, *α* Cronbach, *ω* McDonald, *AVE* average variance extracted, *MSV* maximum shared variance, *CR* composite reliability

Concurrent Validity

Correlations were also found between the structural characteristics and the gaming sociodemographic data. Positive correlations were found between weekly hours of play and social aspects ($r = 0.163$, $p < 0.001$) and reward aspects ($r = 0.106$, $p = 0.018$). Negative correlations were observed between age and social aspects ($r = -0.210$, $p < 0.001$), control aspects ($r = -0.088$, $p = 0.049$), and reward aspects ($r = -0.167$, $p < 0.001$).

At the level of external validity, we observe that the different constructs behave as expected theoretically (see Table 4). The four dimensions of motivations of play and IGD correlated significantly with the three factors of the scale. Only control aspects did not correlate with IGD.

Finally, a multiple linear regression was carried out (see Table 5). IGD was the dependent variable and structural characteristics assessment, and motivations of play were the independent variables. Results showed that 19% of IGD can be explained by structural characteristics assessment and motivations of play.

Discussion

The study aimed to develop and validate an instrument for assessing users' evaluations of the structural characteristics of video games, a key aspect of gaming in the context of IGD development (Griffiths & Nuyens, 2017). To our knowledge, it is the only scale that measures players' assessments of these features in current video games. The results obtained provide initial evidence of construct validity, reliability, and external validity of the Video Game Structure Scale, thus corroborating hypothesis 1 of the study.

After a factor analysis, a total of twenty items were retained and grouped into three factors: social, control and reward. The first relevant finding is that two theoretically identified factors in Carmona's et al. (2023) taxonomy (narrative and identity aspects and manipulation and control aspects) merged into one factor named control aspects. Items in this factor measure player's assessment of those elements that allow influence over the game's development and outcome through mastery of the game mechanics. These items, originally part of the narrative and identity aspects, are now categorized under control aspects. This may reflect players' valuation of control over the game events, rather than focusing solely on the narrative aspect. In addition, the manipulation component in the theoretical taxonomy was removed from the control aspects because the scale does not include manipulative characteristics (e.g., modification of the virtual world). The second relevant finding is that the reward and punishment aspects were consolidated into reward aspects. This change occurred because the questionnaire does not include characteristics related to punishment (e.g., category downgrade) and only reward-related items remained after the factor analysis. This could be because modern video games feature more reward elements than punishment, and it is known that positive reinforcement leads to longer game sessions and higher spending (Mathews et al., 2019; Zendle et al., 2020a, 2020b). Therefore, the greater presence of rewards may shape players' perceptions, emphasizing reward-related traits over punishment-related ones.

This dissonance between the theoretical framework and the empirical validation of the scale may be because most taxonomies designed to date, including the one used in this study, are based on King's et al. (2010) classification. Therefore, this theoretical structure

Table 4 Table of Spearman correlations of external validity

Variable	SA	CA	RA	VGSS	SEA-M	F-M	EE-M	CC-M	IGD
1. Social aspects	-	.351***	.440***	.835***	.540***	.143***	.251***	.414***	.180***
2. Control aspects		-	.300***	.613***	.259***	.347***	.185***	.124**	− .012
3. Reward aspects			-	.761***	.365***	.184***	.256***	.436***	.212***
4. Total scale				-	.531***	.257***	.313***	.455***	.173***

SA social aspects, *CA* control aspects, *RA* reward aspects, *VGSS* Video Game Structure Scale, *SEA-M* socio-emotional activation motives, *F-M* fantasy motives, *SE-M* escapism and entertainment motives, *CC-M* competition and challenge motives, *IGD* Internet Gaming Disorder

*p < .05; ** p < .01; ***p < .001

Table 5 Multiple linear regressions to predict internet gaming disorder

Dependent variable	Beta (*p*)	R^2
Internet gaming disorder		.19
Social aspects	− .055 (.267)	
Control aspects	− .158 (.001)	
Reward aspects	.139 (.004)	
Motivations of play	.409 (< .001)	

$R^2 = \%$ variance explained of the dependent variable

designed more than a decade ago, and never empirically tested, may no longer adequately explain the reality of video game design. Furthermore, player preferences in structural characteristics have changed over the years. Wood et al. (2004) identified character development, multiplayer features, and game customization as some of the highest rated characteristics. Westwood and Griffiths (2010) recognized realistic graphics and sounds as the main player preferences. Similarly, King et al. (2011) identified a complex story, fast load-time, realistic graphics, ability to gain experience points, and customization options as important features. These changes in structural features and preferences over the years reflect the influence of business model changes and advancements in video game design (Shi et al., 2019). Therefore, the empirical data obtained in this study provides a deeper understanding of current video game design and helps identify which features are most valued nowadays.

Regarding the evaluation of structural characteristics obtained in the present study, control aspects are the most highly valued by players. It is important to note that these aspects play a crucial role in esports gameplay mechanics, and the growing popularity of esports is likely to have contributed to their increased appreciation (Cranmer et al., 2021). Additionally, Laffan et al. (2016) found that these features are the most recognized by gamers. Although current control aspects differ from those of some years ago, it is possible that users can still easily identify them in today's video games. Social aspects are the second most valued. Despite Melodia et al. (2022) suggesting that social interaction is one of the main reasons for playing online, their lower value in this study may be because not all gamers are interested in playing with others; some prioritize completing the game or developing skills (Cheah et al., 2022; Jimenez et al., 2019; Kahn et al., 2015). However, every gamer (whether they want to play with others or not) needs to positively assess the control aspects because they are essential for the development of the game activity and learning

game mechanics (Linehan et al., 2014). Therefore, users who do not value these aspects over others will find it difficult to engage in gaming. The reward aspects are the least valued despite being linked to longer playing times, sense of achievement, social influence, and social status in the virtual world (Arbeau et al., 2020; Bleize & Antheunis, 2019; King et al., 2010). It is important to note that most of the characteristics in this factor can create a perception of injustice in players, as most reward systems do not reward better players but distribute rewards randomly, benefiting those who invest real money. Paid and random rewards, such as loot boxes, which are in-game items or rewards that can be purchased or unlocked through gameplay but offer random content, have been heavily criticized for the injustice they cause to players with fewer financial resources (Zendle et al., 2020a, 2020b). Thus, it is observed that the reward aspects are the opposite of control aspects. While players value control aspects highly for their ability to control the game's outcome, they value reward aspects negatively due to their random and paid components.

Regarding the correlations between the subscales of the VGSS, the strongest association in structural characteristics assessment is found between reward and social aspects. This may be because social aspects are tools that facilitate collaboration and competition to speed up the process of obtaining rewards. Furthermore, displaying these rewards in front of other players helps to gain social status within the virtual world (Fu et al., 2017). This search for social recognition through obtaining rewards can be very attractive to players but can also lead to problematic behavior, as the player may end up prioritizing the virtual world over the real one (Deleuze et al., 2019; Wang & Sun, 2011). The second strongest relationship is found between reward and control aspects. This might be because control aspects allow players to influence the development of the game and its result, while reward aspects aim to encourage the learning of game mechanics to improve decision-making and influence the game's result (Tan et al., 2019). Depending on the video game and platform, this association could lead to problematic behaviors, such as IGD or gambling issues (Saini & Hodgins, 2023). For example, in games like *FIFA* or *Clash Royale*, random rewards obtained by mastering game mechanics play a major role in unlocking new items to rank up. Therefore, players who want to master the game are exposed to deceptive mechanics designed to maintain gaming behavior and encourage real-money expenditure. Finally, the association between control and social aspects can be explained by the fact that social interaction enhances the recognition of achievements obtained through mastering game mechanics (Dindar, 2018). This, like the previous association, could lead to problematic behaviors depending on the game and platform (Saini & Hodgins, 2023).

Concerning the relationship between structural characteristics and gaming motives, all dimensions are correlated with each other. Firstly, control aspects have the strongest correlation with fantasy motives. This suggests that curiosity about exploring the virtual world increases the likelihood of mastering the game mechanics (González & Igartua, 2018; Kircaburun et al., 2020). Likewise, its relationship with socio-emotional activation motives suggests that mastering game mechanics is related to the search for social recognition through achievement (Dindar, 2018). The association with escapism and entertainment motives suggests, as mentioned earlier, that those who do not value these aspects will hardly enjoy gaming. Its correlation with competition and challenge motives is related to the pursuit of victory in esports (Cranmer et al., 2021). Secondly, social aspects are most strongly correlated with socio-emotional activation motives, suggesting that those who seek to socialize in the game value being given tools to do so (Carmona et al., 2023). Similarly, competition and challenge motives are related to these aspects because competitiveness has an inherent social component (Erickson & Sammons-Lohse, 2021). Its relationship with fantasy motives may be because gamers like to explore the virtual world

with others (López-Fernández et al., 2022). Its association with escapism and entertainment motives is probably because these have been found as one of the main reasons to play online (Melodia et al., 2022). Finally, reward aspects' main relation is with competition and challenge motives, probably because players who want to win value those aspects that give them a clear advantage over others (Kahn et al., 2015; Saini & Hodgins, 2023). Additionally, its relationship with socio-emotional activation motives suggests that some players seek social recognition by having better rewards than others (Fu et al., 2017). Its association with escapism and entertainment motives suggests that those who play to escape or entertain themselves value reward aspects as a way to forget anxiety-related suffering (Jouhki & Oksanen, 2022). Since these aspects resemble those present in gambling activities, it is expected that this motivation influences them similarly (Saini & Hodgins, 2023). Finally, its association with fantasy motives indicates that those gamers who want to explore the virtual world need to be rewarded to continue their exploration.

In addition, as suggested in previous studies (King & Delfabbro, 2018), and confirming hypothesis 2 of the study, the results show that the reward aspects of video games have a direct impact on IGD symptoms. This could be because of the presence of (gambling-like) random rewards, their partial variable ratio schedule, and their alterations in a player's reward processing system (González-Cabrera et al., 2023; Hwang et al., 2020; Raiha et al., 2020; Zendle & Cairns, 2018). These features are prevalent today due to a significant transformation in the gaming industry's business model. Most titles integrate reward aspects based on micropayment monetization schemes that seek to maintain gaming behavior to obtain economic return. This design, which prioritizes the retention of gaming habits while fostering gradual financial expenditure, contributes to the emergence of IGD and problematic gambling (Saini & Hodgins, 2023; Spicer et al., 2022), especially in those players who have a high level of spontaneous thinking (Chiorri et al., 2023). Also, hypotheses 3 and 4 could not be confirmed because of the fusion of both factors and their negative relationship with IGD. This suggests that control aspects acted as a protective factor against IGD. It is possible that this relationship exists because these aspects of design are closely linked to learning the game mechanics and improving decision making (Tan et al., 2019). Hypothesis 5 of the study was partially met because social aspects are associated with IGD in the correlation but not in the linear regression. The fact that social aspects did not influence IGD may be because the sample of this study consists of players from different platforms who value structural features differently. It is possible that this heterogeneity, along with the covariance between the different factors of the scale, may have influenced these results. Finally, as in previous studies, it was found that motivations of play have a direct effect on IGD (Kircaburun et al., 2020; Marino et al., 2020; Melodia et al., 2022; Wang & Cheng, 2022).

Theoretical Implications

This study's findings challenge certain aspects of existing models, such as King's et al. (2010) framework, by emphasizing the importance of control aspects over narrative or manipulative elements, reflecting contemporary trends in game design. The fusion of narrative and control aspects in the factor analysis may reflect a shift in player preferences, where control over game outcomes has become more valued than narrative-driven elements. Additionally, the absence of punishment elements in the reward factor reflects industry practices that focus on positive reinforcement to sustain engagement.

Practical Implications

The findings of this study can inform policies aimed at reducing the addictive potential of video games. Given the association between reward aspects and IGD, game designers should consider revising reward systems to reduce reliance on randomized or paid rewards, which can promote addictive behavior. At the same time, they should prioritize control-related elements, such as goal selection and skill-building, which foster healthier engagement. Additionally, the VGSS could serve as a valuable tool for clinicians to assess players' perceptions of game features, identifying those at higher risk for IGD and guiding appropriate interventions.

Limitations

Having said that, the results presented in the study must be interpreted considering a series of limitations. First, as the video game industry continues to evolve, the structural characteristics evaluated in this study may shift. Future versions of the VGSS should account for these changes. Second, the sample's demographic composition, including a higher proportion of PC gamers, may have influenced the findings. Future research should involve more diverse gaming platforms and participant demographics. Third, this study used convenience sampling and a cross-sectional design. Fourth, the tests performed in this study do not provide enough evidence to assess a causal relationship between variables. Future studies should assess the scale's applicability across different genders and cultural contexts to ensure its broader validity.

Conclusion

In essence, this study presents a new instrument (Video Game Structure Scale; VGSS) to assess how Spanish-speaking players value structural characteristics of current video games, with satisfactory psychometric properties. Therefore, the assessment of structural characteristics can be measured objectively to study how video game design influences Internet gaming disorder appearance and thus recognize emerging problem gamers based on their gaming preferences. Furthermore, future research may benefit from identifying causal links between players' assessment of design and their intrinsic variables (e.g., emotional regulation and impulse control). Additionally, it may help to identify which design features are most associated with the appearance of IGD depending on the gaming platform.

Appendix

Table 6 Video game structure scale

Factor	Item	Likert Scale				
S	Using communication tools (e.g., text and voice chat) to socialize [Usar herramientas de comunicación (p. ej., chat de texto y de voz) para socializar.]	1	2	3	4	5
R	Being able to buy items and upgrades in a store, either because other players sell them or because they are offered by the game itself [Comprar objetos y mejoras en una tienda, ya sea porque lo venden otros jugadores o porque los ofrece el mismo juego.]	1	2	3	4	5
C	Storing my items in an inventory and then use them [Almacenar mis objetos en un inventario para luego usarlos.]	1	2	3	4	5
R	To be rewarded more than other players for playing for longer [Que se me recompense más que a otros jugadores por jugar durante más tiempo.]	1	2	3	4	5
C	Unlocking new skills as I progress [Desbloquear nuevas habilidades a medida que avanzo.]	1	2	3	4	5
C	Having the freedom to decide what objectives I want to achieve [Tener libertad para decidir en qué orden cumplo mis objetivos.]	1	2	3	4	5
C	Choosing my style of play, through different roles, skills, or characters [Elegir mi estilo de juego, ya sea mediante roles, habilidades o personajes distintos.]	1	2	3	4	5
S	Feeling like I'm part of a team [Sentir que formo parte de un equipo.]	1	2	3	4	5
S	Belonging to a clan in which helping each other allows us to obtain greater rewards [Pertenecer a un clan en el que la ayuda mutua nos permita obtener mayores recompensas.]	1	2	3	4	5
S	Competing against other players [Competir contra otros jugadores.]	1	2	3	4	5
C	Being free to decide in what order I fulfill my objectives [Tener libertad para decidir qué objetivos quiero realizar.]	1	2	3	4	5

Table 6 (continued)

Factor	Item	Likert Scale				
R	Having to wait a certain amount of time for a reward to be unlocked [Tener que esperar un determinado tiempo hasta que se me desbloquee una recompensa.]	1	2	3	4	5
R	Getting random rewards [Obtener recompensas aleatorias.]	1	2	3	4	5
R	That there are rewards that you can only get during certain periods of time or at certain times of the day [Que haya recompensas que solo pueda obtener durante ciertos periodos de tiempo o en determinados momentos del día.]	1	2	3	4	5
S	Finding out the statistics of the team's performance at the end of the game [Conocer las estadísticas del rendimiento del equipo al acabar la partida.]	1	2	3	4	5
C	Choosing from a variety of challenges [Elegir entre variedad de retos.]	1	2	3	4	5
C	Learning to control the outcome of the game better (e.g., be able to get better rewards, die less, etc.), as I progress [Que a medida que progrese, aprenda a controlar mejor el resultado del juego (p. ej. ser capaz de obtener mejores recompensas, morir menos, etc.).]	1	2	3	4	5
S	Having a friend management system that allows me, among other things, to invite friends to games and know when they are connected [Tener un sistema de gestión de amigos que me permita, entre otras cosas, invitarlos a partidas y saber cuándo están conectados.]	1	2	3	4	5
S	Cooperating with other players [Cooperar con otros jugadores.]	1	2	3	4	5
R	Investing real money gives me a clear advantage over other players [Que invertir dinero real me dé una clara ventaja respecto al resto de jugadores.]	1	2	3	4	5

S social aspects, *C* control aspects, *R* reward aspects

Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics Declarations All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Ethical Approval The study was approved by the Institutional Review Board of the Ramon Llull University with the file CER URL_2023_2024_004.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare no competing interests.

References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* (5th ed.). American Psychiatric Association.

Arbeau, K., Thorpe, C., Stinson, M., Budlong, B., & Wolff, J. (2020). The meaning of the experience of being an online video game player. *Computers in Human Behavior Reports, 2*, 100013. https://doi.org/10.1016/j.chbr.2020.100013

Bäcklund, C., Elbe, P., Gavelin, H. M., Sörman, D. E., & Ljungberg, J. K. (2022). Gaming motivations and gaming disorder symptoms: A systematic review and meta-analysis. *Journal of Behavioral Addictions, 11*(3), 667–688. https://doi.org/10.1556/2006.2022.00053

Badrinarayanan, V., Sierra, J., & Martin, K. (2015). A dual identification framework of online multiplayer video games: The case of massively multiplayer online role playing games (MMORPGs). *Journal of Business Research, 68*(5), 1045–1052. https://doi.org/10.1016/j.jbusres.2014.10.006

Beranuy, M., Machimbarrena, J., Vega, A., Carbonell, X., Griffiths, M., Pontes, H., & González, J. (2020). Spanish validation of the internet gaming disorder scale–short form (IGDS9-SF): Prevalence and relationship with online gambling and quality of life. *International Journal of Environmental Research and Public Health, 17*(5), 1562. https://doi.org/10.3390/ijerph17051562

Bleize, D., & Antheunis, M. (2019). Factors influencing purchase intent in virtual worlds: A review of the literature. *Journal of Marketing Communications, 25*(4), 403–420. https://doi.org/10.1080/13527266.2016.1278028

Carbonell, X. (2017). From Pong to Pokemon Go, catching the essence of the Internet Gaming Disorder diagnosis. *Journal of Behavioral Addictions, 6*(2), 124–127. https://doi.org/10.1556/2006.6.2017.010

Carmona, A., Carbonell, X., & Fuster, H. (2023). Diseño de una taxonomía para el estudio psicológico de las características estructurales de los videojuegos [Design of a taxonomy for the psychological study

of the structural characteristics of video games]. *Aloma Revista De Psicologia, Ciències De l'Educació I De l'Esport, 41*(2), 37–48. https://doi.org/10.51698/aloma.2023.41.2.37-48

Cheah, I., Shimul, A. S., & Phau, I. (2022). Motivations of playing digital games: A review and research agenda. *Psychology & Marketing, 39*(5), 937–950. https://doi.org/10.1002/mar.21631

Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2023). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*. https://doi.org/10.1007/s10490-023-09871-y

Chiorri, C., Soraci, P., & Ferrari, A. (2023). The role of mindfulness, mind wandering, attentional control, and maladaptive personality traits in problematic gaming behavior. *Mindfulness, 14*(3), 648–670. https://doi.org/10.1007/s12671-022-02066-4

Clarke, R., Lee, J., & Clark, N. (2015). Why video game genres fail: A classificatory analysis. *Games and Culture, 12*(5), 445–465. https://doi.org/10.1177/1555412015591900

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Cranmer, E. E., Han, D.-I.D., van Gisbergen, M., & Jung, T. (2021). Esports matrix: Structuring the esports research agenda. *Computers in Human Behavior, 117*, 106671. https://doi.org/10.1016/j.chb.2020.106671

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334. https://doi.org/10.1007/BF02310555

Dale, G., & Green, S. (2017). The changing face of video games and video gamers: Future directions in the scientific study of video game play and cognitive performance. *Journal of Cognitive Enhancement, 1*(3), 280–294. https://doi.org/10.1007/s41465-017-0015-6

Dawes, J. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *International Journal of Market Research, 50*(1), 61–104. https://doi.org/10.1177/147078530805000106

Deleuze, J., Maurage, P., Schimmenti, A., Nuyens, F., Melzer, A., & Billieux, J. (2019). Escaping reality through videogames is linked to an implicit preference for virtual over real-life stimuli. *Journal of Affective Disorders, 245*, 1024–1031. https://doi.org/10.1016/j.jad.2018.11.078

Dindar, M. (2018). Do people play MMORPGs for extrinsic or intrinsic rewards? *Telematics and Informatics, 35*(7), 1877–1886. https://doi.org/10.1016/j.tele.2018.06.001

Elverdam, C., & Aarseth, E. (2007). Game classification and game design: Construction through critical analysis. *Games and Culture, 2*(1), 3–22. https://doi.org/10.1177/1555412006286892

Erickson, L. V., & Sammons-Lohse, D. (2021). Learning through video games: The impacts of competition and cooperation. *E-Learning and Digital Media, 18*(1), 1–17. https://doi.org/10.1177/2042753020949983

Fu, X., Chen, X., Shi, Y., Bose, I., & Cai, S. (2017). User segmentation for retention management in online social games. *Decision Support Systems, 101*, 51–68. https://doi.org/10.1016/j.dss.2017.05.015

González, A., & Igartua, J. (2018). ¿Por qué los adolescentes juegan videojuegos? Propuesta de una escala de motivos para jugar videojuegos a partir de la teoría de usos y gratificaciones [Why do teenagers play video games? Proposal of a scale of motives for playing video games based on the theory of uses and gratifications]. *Cuadernos. Info, 42*, 135–146. https://doi.org/10.7764/cdi.42.1314

González-Cabrera, J., Basterra-González, A., Ortega-Barón, J., Caba-Machado, V., Díaz-López, A., Pontes, H. M., & Machimbarrena, J. M. (2023). Loot box purchases and their relationship with internet gaming disorder and online gambling disorder in adolescents: A prospective study. *Computers in Human Behavior, 143*, 107685. https://doi.org/10.1016/j.chb.2023.107685

Griffiths, M., & Nuyens, F. (2017). An overview of structural characteristics in problematic video game playing. *Current Addiction Reports, 4*(3), 272–283. https://doi.org/10.1007/s40429-017-0162-y

Heintz, S., & Law, E. (2015). The game genre map: A revised game classification. *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play*, *October*, 175–184. https://doi.org/10.1145/2793107.2793123

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hull, D., Williams, G., & Griffiths, M. (2013). Video game characteristics, happiness and flow as predictors of addiction among video game players: A pilot study. *Journal of Behavioral Addictions, 2*(3), 145–152. https://doi.org/10.1556/jba.2.2013.005

Hwang, H., Hong, J., Kim, S. M., & Han, D. H. (2020). The correlation between family relationships and brain activity within the reward circuit in adolescents with Internet gaming disorder. *Scientific Reports, 10*(1), 9951. https://doi.org/10.1038/s41598-020-66535-3

JASP Team. (2024). *JASP (Version 0.19.2)* [Computer software]. https://jasp-stats.org

Jimenez, N., San-Martin, S., Camarero, C., & Cabezudo, R. S. J. (2019). What kind of video gamer are you? *Journal of Consumer Marketing, 36*(1), 218–227. https://doi.org/10.1108/JCM-06-2017-2249

Jouhki, H., & Oksanen, A. (2022). To get high or to get out? Examining the link between addictive behaviors and escapism. *Substance Use and Misuse, 57*(2), 202–211. https://doi.org/10.1080/10826084.2021.2002897

Kahn, A. S., Shen, C., Lu, L., Ratan, R. A., Coary, S., Hou, J., Meng, J., Osborn, J., & Williams, D. (2015). The Trojan player typology: A cross-genre, cross-cultural, behaviorally validated scale of video game play motivations. *Computers in Human Behavior, 49*, 354–361. https://doi.org/10.1016/j.chb.2015.03.018

King, D., & Delfabbro, P. (2018). Predatory monetization schemes in video games (e.g. 'loot boxes') and internet gaming disorder. *Addiction, 113*(11), 1967–1969. https://doi.org/10.1111/add.14286

King, D., Delfabbro, P., & Griffiths, M. (2010). Video game structural characteristics: A new psychological taxonomy. *International Journal of Mental Health and Addiction, 8*(1), 90–106. https://doi.org/10.1007/s11469-009-9206-4

King, D., Delfabbro, P., & Griffiths, M. (2011). The role of structural characteristics in problematic video game play: An empirical study. *International Journal of Mental Health and Addiction, 9*(3), 320–333. https://doi.org/10.1007/s11469-010-9289-y

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

Kircaburun, K., Demetrovics, Z., Griffiths, M. D., Király, O., Kun, B., & Tosuntaş, ŞB. (2020). Trait emotional intelligence and Internet gaming disorder among gamers: The mediating role of online gaming motives and moderating role of age groups. *International Journal of Mental Health and Addiction, 18*(5), 1446–1457. https://doi.org/10.1007/s11469-019-00179-x

Kuss, D. J., Griffiths, M. D., & Pontes, H. M. (2017). Chaos and confusion in DSM-5 diagnosis of Internet gaming disorder: Issues, concerns, and recommendations for clarity in the field. *Journal of Behavioral Addictions, 6*(2), 103–109. https://doi.org/10.1556/2006.5.2016.062

Laconi, S., Pirès, S., & Chabrol, H. (2017). Internet gaming disorder, motives, game genres and psychopathology. *Computers in Human Behavior, 75*, 652–659. https://doi.org/10.1016/j.chb.2017.06.012

Laffan, D., Greaney, J., Barton, H., & Kaye, L. (2016). The relationships between the structural video game characteristics, video game engagement and happiness among individuals who play video games. *Computers in Human Behavior, 65*, 544–549. https://doi.org/10.1016/j.chb.2016.09.004

Lee, J., Cho, H., Fox, V., & Perti, A. (2013). User-centered approach in creating a metadata schema for video games and interactive media. *Proceedings of the 13th ACM/IEEE-CS Joint Conference on Digital Libraries - JCDL 13*, 229–238.https://doi.org/10.1145/2467696.2467702

Li, X., Huang, L., Li, B., Wang, H., & Han, C. (2020). Time for a true display of skill: Top players in League of Legends have better executive control. *Acta Psychologica, 204*, 103007. https://doi.org/10.1016/j.actpsy.2020.103007

Lin, P.-Y., Lin, H.-C., Lin, P.-C., Yen, J.-Y., & Ko, C.-H. (2020). The association between emotional regulation and Internet gaming disorder. *Psychiatry Research, 289*, 113060. https://doi.org/10.1016/j.psychres.2020.113060

Linehan, C., Bellord, G., Kirman, B., Morford, Z. H., & Roche, B. (2014). Learning curves: Analysing pace and challenge in four successful puzzle games. *CHI PLAY 2014 - Proceedings of the 2014 Annual Symposium on Computer-Human Interaction in Play*, 181–190. https://doi.org/10.1145/2658537.2658695

López-Fernández, F. J., Mezquita, L., Griffiths, M. D., Ortet, G., & Ibáñez, M. I. (2022). The development and validation of the Videogaming Motives Questionnaire (VMQ). *PLoS ONE, 17*(12), e0280007. https://doi.org/10.1371/journal.pone.0280007

Mao, E. (2021). The structural characteristics of esports gaming and their behavioral implications for high engagement: A competition perspective and a cross-cultural examination. *Addictive Behaviors, 123*, 107056. https://doi.org/10.1016/j.addbeh.2021.107056

Marino, C., Canale, N., Vieno, A., Caselli, G., Scacchi, L., & Spada, M. M. (2020). Social anxiety and Internet gaming disorder: The role of motives and metacognitions. *Journal of Behavioral Addictions, 9*(3), 617–628. https://doi.org/10.1556/2006.2020.00044

Mathews, C., Morrell, H., & Molle, J. (2019). Video game addiction, ADHD symptomatology, and video game reinforcement. *American Journal of Drug and Alcohol Abuse, 45*(1), 67–76. https://doi.org/10.1080/00952990.2018.1472269

McDonald, R. P. (1999). *Test theory: A unified treatment*. Lawrence Erlbaum Associates.

McDonald, R. P., & Ho, M.-H.R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7*(1), 64–82. https://doi.org/10.1037/1082-989X.7.1.64

Melodia, F., Canale, N., & Griffiths, M. (2022). The role of avoidance coping and escape motives in problematic online gaming: A systematic literature review. *International Journal of Mental Health and Addiction, 20*(2), 996–1022. https://doi.org/10.1007/s11469-020-00422-w

Mitchell, G. (2012). Revisiting truth or triviality: The external validity of research in the psychological laboratory. *Perspectives on Psychological Science, 7*(2), 109–117. https://doi.org/10.1177/1745691611432343

Muñiz, J., & Fonseca-Pedrero, E. (2019). Diez pasos para la construcción de un test [Ten steps for test development]. *Psicothema, 31*(1), 7–16. https://doi.org/10.7334/psicothema2018.291

Pontes, H. M., Montag, C., Elhai, J. D., Monteiro, A. v., Evren, C., Throuvala, M. A., Macur, M., McDowall, A., Rumpf, H., Carbonell, X., Kuss, D., Lopez-Fernandez, O., & Griffiths, M. D. (2022). Stigma and gaming disorder: should we take a 'glass half full' or 'glass half empty' perspective? *Addiction*. https://doi.org/10.1111/ADD.15831

Pontes, H. M., Schivinski, B., Kannen, C., & Montag, C. (2022). The interplay between time spent gaming and disordered gaming: A large-scale world-wide study. *Social Science and Medicine, 296*, 114721. https://doi.org/10.1016/j.socscimed.2022.114721

Quick, J., & Atkinson, R. (2011). A data-driven taxonomy of undergraduate student videogame enjoyment. *Proceedings of the 7th International Conference on Games+ Learning+ Society Conference*, 185–190. https://doi.org/10.1184/R1/6686783.v1

Raiha, S., Yang, G., Wang, L., Dai, W., Wu, H., Meng, G., Zhong, B., & Liu, X. (2020). Altered reward processing system in Internet gaming disorder. *Frontiers in Psychiatry., 11*, 599141. https://doi.org/10.3389/fpsyt.2020.599141

Rehbein, F., King, D., Staudt, A., Hayer, T., & Rumpf, H. (2021). Contribution of game genre and structural game characteristics to the risk of problem gaming and gaming disorder: A systematic review. *Current Addiction Reports, 8*(2), 263–281. https://doi.org/10.1007/s40429-021-00367-7

Ryan, R. M., Rigby, C. S., & Przybylski, A. K. (2006). Motivation and gaming: The engagement of playing video games. *Personality and Social Psychology Review, 9*(4), 367–384. https://doi.org/10.1207/s15327957pspr0904_2

Saini, N., & Hodgins, D. C. (2023). Investigating gaming structural features associated with gaming disorder and proposing a revised taxonomical model: A scoping review. *Journal of Behavioral Addictions, 12*(2), 352–374. https://doi.org/10.1556/2006.2023.00019

Shi, J., Renwick, R., Turner, N., & Kirsh, B. (2019). Understanding the lives of problem gamers: The meaning, purpose, and influences of video gaming. *Computers in Human Behavior, 97*, 291–303. https://doi.org/10.1016/j.chb.2019.03.023

Slack, J. D., Delfabbro, P., & King, D. L. (2022). Toward a delineation of the differences between high engagement and problem gaming. *Addictive Behaviors Reports, 16*, 100462. https://doi.org/10.1016/j.abrep.2022.100462

Spicer, S. G., Nicklin, L. L., Uther, M., Lloyd, J., Lloyd, H., & Close, J. (2022). Loot boxes, problem gambling and problem video gaming: A systematic review and meta-synthesis. *New Media & Society, 24*(4), 1001–1022. https://doi.org/10.1177/14614448211027175

Szolin, K., Kuss, D., Nuyens, F., & Griffiths, M. (2022). Gaming disorder: A systematic review exploring the user-avatar relationship in videogames. *Computers in Human Behavior, 128*, 107124. https://doi.org/10.1016/j.chb.2021.107124

Tan, R., Zhou, J., Du, H., Shang, S., & Dai, L. (2019). An modeling processing method for video games based on deep reinforcement learning. *Proceedings of 2019 IEEE 8th Joint International Information Technology and Artificial Intelligence Conference, ITAIC 2019*, 939–942. https://doi.org/10.1109/ITAIC.2019.8785463

Turner, A. (2023). *How many people play videogames in the world?* Bankmycell. https://www.bankmycell.com/blog/how-many-people-play-video-games

Typeform, S.L. (2024). *Typeform* [Computer software]. https://www.typeform.com

Vella, K., Johnson, D., & Mitchell, J. (2016). Playing support: Social connectedness amongst male video game players. *Proceedings of the Annual Symposium on Computer-Human Interaction in Play Companion*, 343–350. https://doi.org/10.1145/2968120.2987734

Wang, H., & Sun, C. (2011). Game reward systems: Gaming experiences and social meanings. *Proceedings of DiGRA 2011 Conference*, 1–15.

Wang, H. Y., & Cheng, C. (2022). The associations between gaming motivation and Internet gaming disorder: Systematic review and meta-analysis. *JMIR Mental Health, 9*(2), e23700. https://doi.org/10.2196/23700

Westwood, D., & Griffiths, M. (2010). The role of structural characteristics in video-game play motivation: A Q-methodology study. *Cyberpsychology, Behavior and Social Networking, 13*(5), 581–585. https://doi.org/10.1089/cyber.2009.0361

Wood, R., Griffiths, M., Chappell, D., & Davies, M. (2004). The structural characteristics of video games: A psycho-structural analysis. *Cyberpsychology and Behavior, 7*(1), 1–10. https://doi.org/10.1089/109493104322820057

World Health Organization. (2019). *International Classification of Diseases: ICD-11 for mortality and morbidity statistics*.

Zendle, D., & Cairns, P. (2018). Video game loot boxes are linked to problem gambling: Results of a large-scale survey. *PLoS ONE, 13*(11), 1–12. https://doi.org/10.1371/journal.pone.0214167

Zendle, D., Cairns, P., Barnett, H., & McCall, C. (2020a). Paying for loot boxes is linked to problem gambling, regardless of specific features like cash-out and pay-to-win. *Computers in Human Behavior, 102*, 181–191. https://doi.org/10.1016/j.chb.2019.07.003

Zendle, D., Meyer, R., & Ballou, N. (2020b). The changing face of desktop video game monetization: An exploration of exposure to loot boxes, pay to win, and cosmetic microtransactions in the most-played Steam games of 2010–2019. *PLoS ONE, 15*(5), e0232780. https://doi.org/10.1371/journal.pone.0232780

Zsila, Á., Aruguete, M. S., Shabahang, R., & Orosz, G. (2023). Are gaming skills set in stone? Exploring the associations between mindset, passion, and gaming disorder. *Personality and Individual Differences, 202*, 111996. https://doi.org/10.1016/j.paid.2022.111996

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