

Validation of a Scale to evaluate Pathological Digital Game Dependence

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BACKGROUND INFORMATION: Digital game or video game disorders have been recently (June 2018) included in ICD-11 (International Classification of Diseases) by the World Health Organization (WHO). The disorder can occur with or without an internet connection. **OBJECTIVE:** Validation of a scale to evaluate the dependence of pathological digital game (PDGD).

METHOD: Validation of the PDGD was performed in 5 phases: (1) initial scale construction with 20 questions, (2) expert assessment, (3) application to 200 volunteers, (4) statistical analysis and production of results using statistical programs, (5) elaboration of the final validated scale.

RESULTS: We used the R statistical program Version 3.4.2 and the “dplyr” package to present the descriptive statistics, the hypotheses tests of differences of means and the factorial analysis. The last step was to calculate Cronbach’s alpha, in order to measure the internal consistency of the questionnaire. The value found was 0.955, which is very good.

CONCLUSIONS: This research allowed us to construct a final version of the PDGD suitable for the clinical contexts and usable in research on the dependence of digital games. This scale may contribute to future studies, conscious use of technologies, reduction of physical and emotional damage and improvement of the quality of life.

KEYWORDS: Digital game; video-game; game disorder, gaming behavior.

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INTRODUCTION

In June 2018, the World Health Organization (WHO) introduced “disorders for digital games or video games”¹ into the International Statistical Classification of Diseases (ICD-11). The disorder refers to the pathological use of digital games or video games, which can occur with or without internet connection.

Pathological Gaming was already part of the previous WHO International Classification (ICD-10)² in the Personality Disorders and Adult Behavior section, which did not refer to digital games.³ The inclusion of digital games in this recently published ICD-11 creates the immediate need for a scale to meet an already existing and escalating demand. No such scale exists.

This pioneer instrument will be instrumental in providing professional care and guidance to people (mainly young people) who have become pathologically dependent of video games.

We are living a new reality, with young people being excluded, isolated from society, from families and being marginalized for secluding themselves for many hours of exclusive devotion to digital games.³ In this manner people dependent on digital games follow a similar path of stigmatization and social marginalization of other addicts (e.g. drugs and alcohol). This isolation, as well as the usual neglect with physical care (nutrition and hygiene) are some of the issues that become common in these players. In addition, there are additional problems, including difficulties with sleep, obesity, distraction,

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emotional losses⁴ (depression, anxiety) and physical damage⁵ (spinal injuries, arthritis, vision) that may be associated with abusive use of digital games.

The theme has turned into a serious global problem and one which grows continually. Although video games can strengthen some skills such as attention, concentration, and reaction time,⁶ they do not contribute to learning, maintaining focus, and understanding what one is reading.

We have thus decided to create and validate a scale to evaluate the dependence of pathological digital gaming. To the best of our knowledge this is the first specific instrument in the identification of this type of disorder and in the orientation of its treatment.

■ MATERIALS AND METHODS

To produce and validate any such scale, content must be aligned with the its subject and objectives. Hair et al⁷ point out that no scale should be administered before being evaluated in terms of accuracy and coherence. Experts in the field must develop a scale to be tested on volunteers and the results must be statistically analyzed for validity. The number of specialists who should participate in scale validation is a debatable point, which is left at the discretion and accessibility of the researcher: more specialists generate more disagreement, whereas a smaller number (e.g., less than 3) comes with a risk of 100% agreement.

The production, validation and testing of PDGD was carried out in 5 phases.

1. Construction of an initial questionnaire; six specialists trained in the area of digital dependence were given the task and produced 20 questions.
2. The questions were evaluated by a second group of six similarly trained specialists, who analyzed the questionnaire, focusing on presentation, clarity, relevance and understanding. Thus, a preliminary validation was provided.
3. Application of the scale to 200 volunteers, divided into two groups: a MAIN Group included 100 participants with apparent abuse of digital games; a CONTROL Group of 100 participants with no apparent abuse use of digital games. For separation into the Main or Control groups, volunteers were previously submitted to the Internet Addiction Test (IAT) scale.⁸ Volunteers with IAT scores ≥ 50 and admitting to playing digital games for at least 2 hours/day were assigned to the Main group; the Control Group included IAT scores < 50 who denied playing digital games daily or frequently.

4. Statistical analyzes were performed through the R statistical program, version 3.4.2.⁹ for the orthogonal model. The method used was Principal Components based on Spearman's correlation matrix. For data analysis we used the "dplyr",¹⁰ "psy",¹¹ "paran"¹² packages into R.
5. Preparation of the validated final version.

The 200 volunteers participating in the research were asked to insert values opposite each question, as follows: Never/Rarely (0 points); Often (1 point), Always (2 points). The final sum of the results obtained ranked responders as follows: Up to eight points without disturbances - 9 to 18 points (mild dependence) - 19 to 28 points (moderate dependence) - 29 to 38 points (severe dependence). Orientations referring to each range of points was offered.

Sample. Volunteers included in PDGD were (i) patients seen at our facility with complaints and symptoms of digital game dependence. (ii) accompanying persons (iii) students, employees and any others who agreed to participate, who were randomly recruited through posters at the institution, verbal communication from person to person and on social networks.

Inclusion Criteria. Participants should be aged 17 to 65 years and fulfilling conditions for inclusion in either of the two groups.

Exclusion Criteria. illiterate candidates and persons with some kind of mental impairment that would prevent them from using digital games.

■ RESULTS

Descriptive Statistics. Table 1 shows the results of the descriptive statistics of the sample, divided into Main and Control groups. For each characteristic we present the absolute number and the proportion within its group. Demographic data were collected for statistical purposes and not considered in the expert evaluation

Scores for the original 20-question scale. The mean \pm standard deviation score for the Control group was 2.55 ± 3.92 , while the corresponding value for the Main group was 7.05 ± 10.3 . The t-test of means between the two groups produced a p-value < 0.001 (t-statistic = 3.940). This indicates a significantly higher level of damage in the Main group vs. the Control group and ratifies, prima facie, the characteristics of the groups, namely dependence in the main group vs. little or no dependence in the control group.

Factor analysis. The first test performed was the Bartlett sphericity test to determine if the variables are correlated with each other. In this test, the null hypothesis is that the correlation matrix, based on Spearman's correlation matrix is equal to the identity matrix. For the data set, we found a statistic equal to 3046.163 and a p-value < 0.001 , implying that the covariance matrix is not equal to identity.

The next criterion used to check the adequacy of a factor analysis was the Kaiser-Meyer-Olkin (KMO) criterion. Its value was equal to 0.921; values above 0.8 are considered appropriate.⁷ Table 2 displays the Measurement of Sampling Adequacy (MSA) indices for each of the variables.

Both the Bartlett test and the KMO criterion allowed us to proceed to the factor analysis for the questionnaire.

The factor analysis to determine the number of relevant factors included 3 criteria: Factor Load, Screeplot

and Parallel Analysis. Table 3 shows the factor loads, estimated by the method of the principal components:

Factor loads whose cumulative proportion exceed 0.9 should be used.⁷ However, for the data set, we would have to use 11 factors, which in practice would not solve the problem of data reduction. We moved to the Screeplot criterion of the correlation matrix, where we must eliminate the factors related to Eigenvalues > 1. Figure 1 presents this criterion:

Table 1. Descriptive sample statistics.

| | | Gender | | | | | |
|---------|--|-------------|------------|------------|------------|------------|----------|
| | | Male | | Female | | | |
| Control | | 28 (31.1%) | | 62 (68.9%) | | | |
| Main | | 34 (36.2%) | | 60 (63.8%) | | | |
| | | Age (years) | | | | | |
| | | 15-25 | 26-36 | 37-47 | 48-58 | 59-69 | |
| Control | | 29 (32.2%) | 23 (25.6%) | 11 (12.2%) | 11 (12.2%) | 16 (17.8%) | |
| Main | | 44 (46.8%) | 23 (24.5%) | 20 (21.3%) | 5 (5.3%) | 2 (2.1%) | |
| | | Education | | | | | |
| | | Middle | Higher | Graduate | Master | Doctoral | NI |
| Control | | 21 (23.3%) | 26 (28.9%) | 37 (41.1%) | 2 (2.2%) | 3 (3.3%) | 1 (1.1%) |
| Main | | 53 (56.4%) | 26 (27.7%) | 9 (9.6%) | 5 (5.3%) | 0 (0%) | 1 (1.1%) |

NI: not informed

Table 2. Measured Sampling Adequacy (MAS).

| PDGD.1 | PDGD.2 | PDGD.3 | PDGD.4 | PDGD.5 |
|---------|---------|---------|---------|---------|
| 0.929 | 0.917 | 0.967 | 0.874 | 0.923 |
| PDGD.6 | PDGD.7 | PDGD.8 | PDGD.9 | PDGD.10 |
| 0.933 | 0.953 | 0.882 | 0.878 | 0.939 |
| PDGD.11 | PDGD.12 | PDGD.13 | PDGD.14 | PDGD.15 |
| 0.949 | 0.943 | 0.896 | 0.925 | 0.908 |
| PDGD.16 | PDGD.17 | PDGD.18 | PDGD.19 | PDGD.20 |
| 0.937 | 0.934 | 0.884 | 0.869 | 0.945 |

Table 3. Factor loads of Principal Components.

| | PC1 | PC2 | PC3 | PC4 | PC5 |
|-----------------------|-------|-------|-------|-------|-------|
| Standard deviation | 3.346 | 1.172 | 1.018 | 0.927 | 0.883 |
| Variance proportion | 0.560 | 0.069 | 0.052 | 0.043 | 0.039 |
| Cumulative proportion | 0.560 | 0.628 | 0.680 | 0.723 | 0.762 |
| | PC6 | PC7 | PC8 | PC9 | PC10 |
| Standard deviation | 0.841 | 0.786 | 0.740 | 0.640 | 0.630 |
| Variance proportion | 0.035 | 0.031 | 0.027 | 0.020 | 0.020 |
| Cumulative proportion | 0.798 | 0.828 | 0.856 | 0.876 | 0.896 |
| | PC11 | PC12 | PC13 | PC14 | PC15 |
| Standard deviation | 0.597 | 0.542 | 0.504 | 0.489 | 0.478 |
| Variance proportion | 0.018 | 0.015 | 0.013 | 0.012 | 0.011 |
| Cumulative proportion | 0.914 | 0.929 | 0.941 | 0.953 | 0.965 |
| | PC16 | PC17 | PC18 | PC19 | PC20 |
| Standard deviation | 0.441 | 0.393 | 0.376 | 0.359 | 0.298 |
| Variance proportion | 0.010 | 0.008 | 0.007 | 0.006 | 0.004 |
| Cumulative proportion | 0.974 | 0.982 | 0.989 | 0.996 | 1.000 |

PC= Principal Components

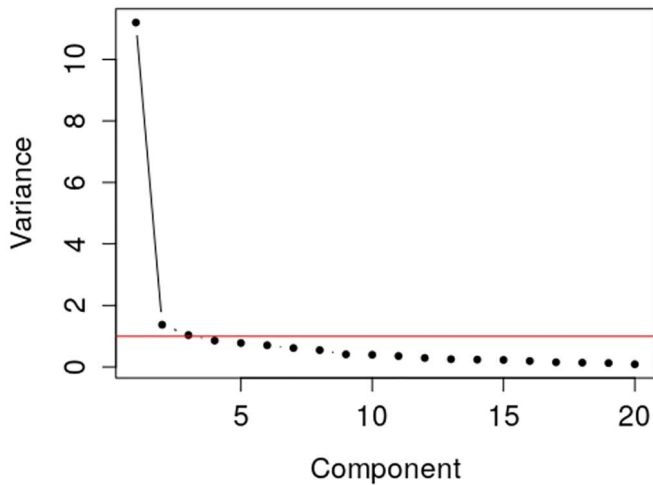


Figure 1. Screeplot. The components with variances greater than 1 (above the red line) are the relevant components.

By this criterion, we must use 3 factors, and in this case, the commonalities of the variables are presented in table 4. Because Question #13 (How often do you perceive pains in the body due to staying during long periods of playing?) had a commonality less than 0.5 it was excluded.

The third criterion used to find the number of factors was the Parallel Analysis. By this criterion, the number of factors found was equal to 1, which does not allow for an adequate estimation of the Factor loads.

Therefore, after the three analyzes, we selected the Screeplot result, which points to commonalities for 3 factors and to the withdrawal of only one item from the questionnaire.

The last step of the study was to calculate Cronbach’s alpha,⁷ in order to measure the internal consistency of the questionnaire. The value found was 0.955, which is very good, ensuring the internal consistency of the instrument.⁷

DISCUSSION

Although the pathological use of games predates the Digital Age, its steep increase came with the birth and growth of computer technologies and of the Internet.

Globalization and the continuous increase in the number of digital players has turned digital gaming into a social fact.^{14,15,16} A final validated scale was constructed, with the purpose of being used in clinical practice which fully met what was proposed, namely the evaluation of dependence to the pathological digital game.

Therefore, it has become essential to assess its breadth and impact on people’s lives. It is necessary to have a scale validated in a structured manner that can provide elements directed to a specific evaluation that meets the needs of health professionals who must develop strategies for the treatment and care for digital players.

King et al.¹³ reported that there is a commitment in personal, social, academic and professional life in people with abusive use and/or dependent on digital gaming in their daily lives.

The inclusion of volunteers in the Main and Control groups through the unspecific Internet Addiction Test was useful, because it led to a successful differentiation between the groups through the original 20-question scale: the Main Group scored 7.05, nearly triple and significantly different from the Control Group, at 2.55. This established the main group’s dependent vs. the control group’s non-dependent profiles.

The Factor analysis was performed as a consequence of (i) the satisfactory results of the Bartlett sphericity test which presented low p-value <0.001, indicating a correlation between the variables; (ii) the adequacy of the Kaiser-Meyer-Olkin (KMO) criterion analysis, which was higher than 0.9 in 14 items, higher than 0.8 in 6 items.

In terms of the factor loads, 3 criteria were chosen: the Factor Loads criterion found 11 factors, an high number for 20 questions. The Screeplot criterion indicated 3 factors and the withdrawal of only one question from the scale, namely “How often do you notice body aches because of staying for long periods of time?” The criterion of Parallel Analysis pointed to only 1 factor. We chose the Screeplot Criterion with 3 factors and the withdrawal of the single question, leading to a scale with 19 questions. It is also important to highlight the excellent Cronbach Alpha⁷ result, with a value of 0.955, which ratifies the internal consistency of the scale, corroborating the previous evaluations, within the objective of this project.

Table 4. Commonalities for 3 Factors.

| PDGD.1 | PDGD.2 | PDGD.3 | PDGD.4 | PDGD.5 |
|---------|---------|---------|---------|---------|
| 0.778 | 0.684 | 0.688 | 0.527 | 0.678 |
| PDGD.6 | PDGD.7 | PDGD.8 | PDGD.9 | PDGD.10 |
| 0.650 | 0.718 | 0.740 | 0.661 | 0.739 |
| PDGD.11 | PDGD.12 | PDGD.13 | PDGD.14 | PDGD.15 |
| 0.621 | 0.652 | 0.425 | 0.652 | 0.764 |
| PDGD.16 | PDGD.17 | PDGD.18 | PDGD.19 | PDGD.20 |
| 0.664 | 0.622 | 0.779 | 0.780 | 0.784 |

Regarding the limitations of the study, there were no previous similar instruments to aid us as a model. This finding did not compromise the results, but required greater care in the elaboration, validation and application of the scale. We understand that further studies on the effects of digital games on individuals may enhance eventual future instruments.

■ CONCLUSION

The results obtained provided a validated final version for the scale to evaluate the dependence of pathologic digital gaming with 19 questions appropriate to clinical and research contexts in terms of clarity, accuracy and reliability. Statistical results showed that the final version of the scale presented questions in mutual alignment, qualifying it as a positive instrument to measure dependence to pathological digital gaming. The version displayed in the appendix can be confidently used as a pathological digital game dependence scale whenever necessary, in clinical scenarios, as well as to perform specific research on this subject.

We recommend that the study be replicated in a larger sample and representative of the target population.

■ AUTHOR CONTRIBUTION:

ALS King - planned, reviewed the literature, applied the scales and worked on the database.

MK Padua - applied the scales.

E Guedes - applied the scales.

LL Gonçalves - analyzed statistically.

FL Guimarães - applied the scales and worked in the database.

H K Santos - analyzed statistically.

D Rodrigues - analyzed statistically.

AE Nardi - guided the research.

All authors participated in the writing of this article

■ CONFLICT OF INTEREST

Authors declare no conflict of interest regarding this project.

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Annex 1 - Validated final version**Scale to assess on Pathological Digital Game Dependence (PDGD).**

Date: ___/___/___ Age: _____

Volunteer Name: _____

Gender: F () M ()

Employed: Yes () No ()

Work: Yes () No ()

Level of Education: () Middle () higher () Graduate () Master () Doctoral

Signature of Volunteer: _____

Email: _____

Phone . _____

Interviewer: _____

The test is a scale with 19 questions that measure the mild, moderate and severe dependence of the Digital Pathological Game (computer, cell phone, tablet, among other technologies) (CTCTO).

Please enter the number corresponding to the answer next to the question. Being:

a- Never/ Rarely (0)

b- Frequently (1)

c- Always (2)

Questions

1 - How often during your day do you use some CTCTO technology to play?

2- How often cannot you remain without looking for some CTCTO technology to play?

3- How often do you set aside your chores to use some CTCTO technology to play?

4- How often do you use some CTCTO technology to play when you are away from home?

5- How often do you feel lonely when you realize you have no CTCTO technology available to play?

6- How often do you get the feeling of being on the go while playing using some CTCTO technology?

7- How often do you feel nervous or anxious when you realize that you do not have any CTCTO technology available to play?

8- How often do you feel fear or panic when you realize that you do not have any CTCTO technology available to play?

9- How often do you feel sad or depressed when you realize that you do not have any CTCTO technology available to play?

10- How often do you realize that you are having some injury in your external work or your work from home because you play excessively using some CTCTO technology?

11- How often do you feel devalued or unimportant when you realize that you spend many hours playing using some CTCTO technology?

12- How often do you feel like a loser by playing for long periods using some CTCTO technology?

13- How often do you stop exercising to play using some CTCTO technology?

14- How often do you harm your sleep to play using some CTCTO technology?

15- How often do you stop going out with family or friends to play using some CTCTO technology?

16- How often do you stop feeding properly so you do not interrupt the game when you are using some CTCTO technology?

17- How often do you realize that you are having some personal injury in your life by playing overboard using some CTCTO technology?

18- How often do you realize that you are having some detriment in your social life by game excessively using some CTCTO technology?

19- How often do you realize that you are having some detriment in family life by playing excessively using some CTCTO technology?

Results

Once you have answered all the questions, add up the numbers you selected for each answer to get a final score. The higher the score, the greater the level of addiction of the game and the problems related to digital pathological gaming.

Below are the points values obtained in your score:

Up to 8 points: You play for leisure and fun without signs of abuse or dependence and with full control over their use.

9 to 18 points: Mild - You show signs of a possible dependence on the game at light level. You start having occasional problems due to the start of abusive use of the game in certain situations. It may come in the future to have impacts on your life by getting to use the game more often than necessary. Be aware that abusive use of the game does not harm your quality of life in all aspects personal, social, family, professional and academic.

19 to 28 points: Moderate - You show signs of a possible dependence on the game at a moderate level. You start having frequent problems due to abusive use of the game in certain situations. You should be aware of possible personal, social, family, professional and academic losses that may occur as a result of playing more heavily than is recommended. You must learn to deal with the game more consciously.

29 to 38 points: Grave - At this time the use of the game is causing significant problems in your life at a serious level. It should evaluate the impacts, physical and emotional consequences and losses in the personal, social, family, professional and academic areas. Pathological gaming compromises significantly the quality of life of the subject. We recommend seeking guidance through professional help in specialized centers.