



## RESEARCH ARTICLE

# Evaluation of the psychometric properties of the Turkish version of the Gaming Disorder Test among children and youth and assessment of contribution of gaming-specific cognitions to gaming disorder

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### ABSTRACT

**Objective:** The aim of this study was to develop and examine the psychometric properties of a Turkish version of the 4-item Gaming Disorder Test (GDT), a brief, standardized instrument used to assess GD based on the World Health Organization diagnostic framework.

**Method:** A total of 606 young participants, aged 11-18 years, were recruited for this study through an online survey. The scale's validity was examined using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Cronbach's alpha coefficient calculation and test-retest analysis were used to determine the scale's internal and time-dependent reliability. Multiple regression analysis was also performed to determine the predictive power of cognitions in GD.

**Results:** EFA and CFA analyses yielded a unidimensional factor structure with adequate psychometric properties for the Turkish version of the scale, which was consistent with the original. The Cronbach's alpha coefficient value of 0.84 indicated that the scale was reliable and time-dependent invariance of the scale was proven using test-retest analysis. Maladaptive cognitions related to overvaluing gaming rewards, maladaptive and inflexible rules about gaming, and gaming for social identity were found to be associated with GD.

**Conclusion:** The Turkish version of the 4-item GDT has sound psychometric properties and may be used as a valid and reliable tool to assess the symptoms and prevalence of GD among adolescents in Turkey.

**Keywords:** Behavioral addiction, cultural adaptation, Gaming Disorder Test, reliability, validity

## INTRODUCTION

Excessive involvement in playing video games has become a growing problem in recent years among young people around the globe. This pattern of behavior

has been associated with significant impairments in daily functioning (1). While gaming-related behavioral/emotional disturbances were recognized years ago and have attracted interest from clinical and research communities for over a decade, there has been an

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ongoing debate on the definition and conceptualization of gaming disorder (GD) (2-6). Internet gaming disorder (IGD) was first classified in the Emerging Measures and Models section of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) as an area warranting more research attention (7). The DSM-5 proposed 9 diagnostic criteria for IGD (preoccupation or obsession, loss of control/inability to stop gaming, withdrawal symptoms, tolerance, loss of interest in previously enjoyed activities, continued use despite problems, use of gaming to relieve negative feelings, deceit about the activity, and risk, that is, endangering or losing relationship or career opportunities due to excessive gaming), with the requirement that gaming caused significant impairment and that  $\geq 5$  of the 9 criteria had been experienced within the previous 12 months (7). In the International Classification of Diseases, 11th Revision (ICD-11), GD was included as a distinct entity in the section devoted to addictive disorders (1). The ICD-11 definition of GD included more emphasis on behavioral addiction, rather than the biological concepts used for other addiction, such as tolerance and withdrawal. It characterized GD using 3 domains: a) impaired control over gaming; b) increasing priority given to gaming to the extent that gaming takes precedence over other life interests and daily activities; and c) continuation or escalation of gaming despite negative consequences, and also noted that significant impairment must have been evident for a year (1).

While there is a body of research in the literature that sought to develop an assessment tool to screen for and assess the symptoms of GD, most of these studies were conducted before there was a unified or standardized definition of GD (5,8,9). Thus, the literature evaluating the epidemiological, clinical, and cross-cultural characteristics of GD is inconclusive and requires further clarification (9,10). It has also been noted that there is a need for up-to-date assessment instruments to help identify individual, clinical, and neurobiological features of GD, as well as to determine the epidemiology across cultures and contexts (3,9,11). Following the formal recognition of GD as a behavioral addictive disorder in the ICD-11, Pontes et al. (3) developed the Gaming Disorder Test (GDT), which was the first psychometric instrument to use the diagnostic framework proposed by the World Health Organization (WHO) to evaluate the symptoms of GD. The study included a total of 597 players from the United Kingdom and China, and resulted in a unidimensional factor structure for GD that was compatible with the findings

of previous studies seeking to develop a psychometric tool based on the DSM-5 criteria (11,12). A validity and reliability analysis of the instrument also yielded satisfactory results suggesting that the GDT was suitable as a means to assess GD in British and Chinese populations (3). The psychometric properties of the scale were evaluated in a recent study of young adults from Turkey and the scale was found to be valid and reliable (13). However, the reliability and validity of instruments evaluating GD may differ greatly across different cultures and contexts (3,14,15).

The progression of gaming behavior to a problematic level is mediated by certain cognitive factors related to gaming and games (16-19). Along with cognitive deficits, cognitive biases, such as cognitive dysfunctions and distortions about the self and the world have been shown to be strongly linked to the development and maintenance of problematic gaming behavior (17). Four cognitive factors underlying IGD have been identified: (a) beliefs about game reward value and tangibility, (b) maladaptive and inflexible rules about gaming behavior, (c) over-reliance on gaming to meet self-esteem needs, and (d) gaming as a method of gaining social acceptance (17,18). The important role of these cognitive variables has been recognized and examined (16). The identification of maladaptive cognitions in young subjects may deserve particular interest in terms of prevention and treatment strategies for gaming disorder (18).

The objective of this research was to develop a Turkish version of the 4-item GDT, examine its psychometric properties, and identify maladaptive cognitions among adolescents from Turkey that may potentially contribute to the disorder.

## METHOD

### Participants and Procedure

This research was approved by the Istanbul Medeniyet University Goztepe Training and Research Hospital Local Ethics Committee on March 2020 [IRB: March 2020-2020/0168]. Participants for this study were recruited from those who use gaming forums and/or platforms. The sample collection procedure was an online survey created and promoted on social media designed to obtain information regarding sociodemographic characteristics, gaming habits, and to test the psychometric properties of the GDT. The study participants were thoroughly informed about the research and reassured about confidentiality and anonymity. Participation in the survey was voluntary. The eligibility criteria were engagement in any activity

related to an online or offline game that can be played on computer/desktop, tablet, smartphone, gaming console or other devices, and agreeing to participate. A total of 606 subjects who met the criteria were included in the study. The mean age of the participants was  $15.73 \pm 3.93$  years (range: 11-18 years) and 51.4% were male.

## Instruments

### Sociodemographic and Gaming Activity Information Form

The authors created a form to collect sociodemographic data (age, sex, and education) and details of gaming habits, such as the time spent gaming per week, the type of gaming, and means of access to the internet.

### Internet Gaming Cognition Scale (IGCS)

The Internet Gaming Cognition Scale (IGCS) is a self-report scale developed by King and Delfabbro (18) to evaluate gaming-specific maladaptive cognitions. The scale consists of 24 items and uses 4 cognitive factors underlying IGD: beliefs about game reward value and tangibility (4 items), maladaptive and inflexible rules about gaming behavior (8 items), over-reliance on gaming to meet self-esteem needs (7 items), and gaming as a method of gaining social acceptance (5 items). Respondents are asked to indicate whether they agree (1 point), strongly agree (2 points), or do not agree (0 points) with a series of self-referential statements. The total score varies between 0 and 48, with higher scores reflecting a greater level of problematic cognition. A reliability and validity study of the Turkish version of the scale was conducted by Cakiroglu et al. (19).

### The Gaming Disorder Test (GDT)

A 4-item GDT, developed by Pontes et al. (3), is a standardized assessment instrument used to assess GD as defined by ICD-11. The items evaluate impaired control over gaming, increased priority given to gaming, continuation despite negative consequences, and the level of functional impairment. Respondents use a 5-point, Likert type scale ranging from 1 (never) to 5 (very often). The total score ranges between 4 and 20, with higher scores indicating more severe levels of disordered gaming. The test was not designed to be diagnostic, but rather a tool to assess severity, however, the authors suggested that any item scored 4 (often) or 5 (very often) be coded as endorsement of a specific GD criterion. This approach allows researchers to discriminate between potentially disordered and non-disordered gamers.

### Translation of the Gaming Disorder Test (GDT)

The process of translation and cultural adaptation of the GDT was conducted to maintain consistency with the WHO criteria. The instrument was translated from English to Turkish by 2 experienced independent translators and then back-translated into Turkish by 2 other independent translators. The initial Turkish version of the instrument was developed by the researchers after a careful discussion of these 3 versions (original and translations) in terms of content, choice of words, grammatical structure, and comprehensibility. A panel of 10 experts then evaluated the initial Turkish form of the instrument in terms of compliance with the Turkish language and culture. The items were further modified based on corrections suggested by the members of the panel. Lawshe's content validity ratio (CVR) was applied, and the final form was pilot tested with 30 subjects and the results indicated that the translated Turkish version was valid.

### Statistical Analysis

IBM SPSS Statistics for Windows, Version 24.0 and AMOS, Version 22.0 software (IBM Corp., Armonk, NY, USA) were used to perform the statistical analyses. Descriptive statistics of minimum, maximum, mean, and SD were used to report the sociodemographic characteristics of the study participants. Content validity of the scale was evaluated by calculating the content validity index. Item analysis was performed to assess the quality of the items and the item discrimination. The model was tested using confirmatory factor analysis (CFA). Model fit was evaluated using several fit indices (chi-squared relative to its degree of freedom, goodness-of-fit index, adjusted goodness-of-fit index, comparative fit index, root-mean-square error of approximation, and standard root-mean-square residual) (20,21). The internal consistency of the instrument was measured using Cronbach's alpha coefficient and the test-retest method was used to determine time invariance. The contributions of gaming-specific cognitions to GD were evaluated with multiple regression analysis.

## RESULTS

A total of 606 subjects were included in this study. The participants reported a mean of  $9.05 \pm 9.57$  hours a week playing games (males:  $10.50 \pm 10.88$  hours, females:  $7.51 \pm 7.69$  hours for females).

### Content and Criterion Validity

Lawshe's method of CVR indicated that a minimum value of 0.62 from 10 independent experts in the fields of adult, child, and adolescent psychiatry; linguistics; or assessment and evaluation were needed to confirm validity. The CVR values of the Turkish GDT items created in this study varied between 0.80-1.00, and the entire scale had a value of 0.91.

The criterion validity of the scale was examined by evaluating the correlation coefficient between the total scale score and the total score obtained from the IGCS. The Pearson correlation coefficient was determined to be 0.582 and there was a significant correlation between the 2 scales ( $p < 0.001$ ).

### Item Analysis

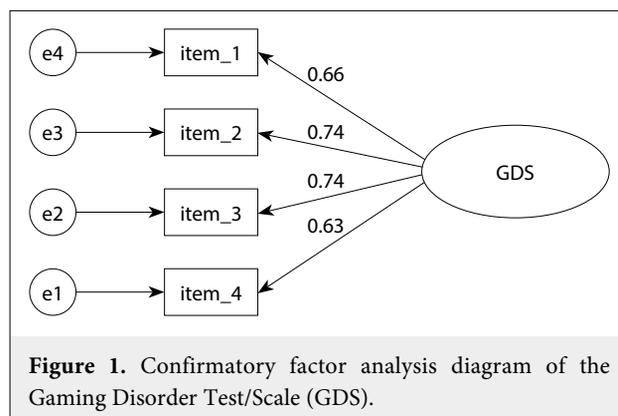
The findings of the item analysis revealed that the corrected item-total correlations of the scale items varied between 0.55-0.63. When the mean scores were sorted in descending order, the difference in the mean score of the upper 27% and the lower 27% group was found to be statistically significant (Table 1).

### Construct Validity

Construct validity of the scale was examined using CFA, which revealed that the standardized factor loading of the items of the scale varied between 0.63-0.74 (Fig. 1). Model fit indices also indicated a good fit (Table 2).

### Internal Consistency and Test-Retest Reliability

A Cronbach's alpha coefficient calculation was performed to evaluate the internal consistency of the scale. The value of the Turkish scale (consisting of 4 items and 1 factor) was determined to be 0.84. In order



to evaluate the time-dependent stability of the scale, the test-retest method was used. The scale was administered to 48 subjects with characteristics similar to those of the study sample twice within a 3-week interval. There was no significant difference between total scores of the baseline and the retest applications of the scale ( $1.86 \pm 0.66$  vs  $1.86 \pm 0.68$ ;  $t = -0.304$ ;  $p = 0.763$ ). There was also a positive correlation between the total scores of the 2 administrations of the scale ( $r = 0.878$ ;  $p < 0.001$ ).

### Contribution of Gaming-Specific Cognitions

First, the correlations between the total score and the subdimensions of the GDT and IGCS were evaluated. Analysis revealed a moderate, yet significant relationship ( $0.489-0.582$ ;  $p < 0.001$ ). Subsequently, regression analysis was conducted to examine the predictability of the variables. Multiple regression analysis was performed to evaluate the contributing effects of gaming-specific cognitions to GD. Each subdimension of the IGCS was included in the analysis as an independent variable. Prior to the regression

**Table 1: Results of Gaming Disorder Test item analysis**

	Mean (SD)	Corrected item-total correlation	Cronbach's alpha value if item deleted	27% upper-lower scores	
				t	p
Item 1	2.01 (1.15)	0.58	0.74	-25.333	<0.001
Item 2	1.83 (1.00)	0.63	0.71	-22.273	<0.001
Item 3	1.86 (1.09)	0.62	0.72	-24.773	<0.001
Item 4	1.53 (.94)	0.55	0.75	-16.649	<0.001

**Table 2: Results of confirmatory factor analysis**

	$\chi^2$	df	$\chi^2/df$	GFI	AGFI	CFI	RMSEA	RMR	SRMR
Model fit indices	5.494	2	2.747	0.996	0.978	0.995	0.054	0.17	0.713
Reference values of good model fit indices			<3	>0.90	>0.90	>0.95	<0.050	<0.050	<0.80

$\chi^2$ : Chi-squared, AGFI: Adjusted Goodness-of-fit index, CFI: Comparative fit index, df: Degrees of freedom, GFI: Goodness-of-fit index, RMR: Root-mean-square residual, RMSEA: Root-mean-square error of approximation, SRMR: Standardized root-mean-square residual

**Table 3: Contribution of game-specific cognitions to gaming disorder (total sample)**

Independent variables	B	Std. Error	Beta	t	p	Zero-order	Partial
Overvaluing gaming rewards	0.434	0.156	0.203	2.786	0.006	0.510	0.155
Maladaptive and inflexible rules about gaming	0.242	0.074	0.218	3.248	0.001	0.509	0.180
Gaming self-esteem beliefs	0.063	0.099	0.051	0.629	0.530	0.486	0.035
Gaming for social identity	0.312	0.118	0.191	2.639	0.009	0.500	0.147

R=0.579, R<sup>2</sup>=0.184, F=39.767; p<0.01.  
Dependent variable: Gaming disorder

**Table 4: Contribution of game-specific cognitions to gaming disorder (subjects with a score of ≥10 on IGCS)**

Independent variables	B	Std. Error	Beta	t	p	Zero-order	Partial
Overvaluing gaming rewards	-0.164	0.249	-0.144	-0.658	0.514	0.227	-0.100
Maladaptive and inflexible rules about gaming	0.311	0.145	0.458	2.142	0.038	0.406	0.310
Gaming self-esteem beliefs	0.114	0.151	0.183	0.752	0.456	0.307	0.114
Gaming for social identity	-0.105	0.180	-0.126	-0.584	0.562	0.203	-0.089

R=0.428, R<sup>2</sup>=0.335, F=2.418; p=0.63.  
Dependent variable: Gaming disorder. IGCS: Internet Gaming Cognition Scale

analysis, the correlation between each subdimension and GDT scores was assessed to confirm that the linearity and singularity assumptions were met. A linear relationship between dependent and independent variables and no connectedness between subdimensions was confirmed ( $r < 0.70$ ).

Multiple regression analysis was first conducted using the total GDT score of the entire group of participants. Next, multiple regression analysis was used to examine subjects with a score of  $\geq 10$  on the IGCS ( $n=48$ ). In the first analysis, the subdomains of overvaluing gaming rewards, maladaptive and inflexible rules about gaming, and gaming for social identity were found to predict GD (the self-esteem beliefs subdomain did not predict GD). However, these findings were not confirmed in the second analysis of subjects with an IGCS score of  $\geq 10$ . The details of the results are presented in Table 3 and Table 4.

## DISCUSSION

This study was a transcultural adaptation of the 4-item GDT, which was the first psychometric instrument to evaluate GD according to the WHO diagnostic criteria and the ICD-11 (1,3). We also evaluated the contributing effects of gaming-specific cognitions to GD. GD is a relatively new diagnosis in diagnostic systems and there is a need for up-to-date assessment instruments to facilitate further clinical and epidemiological research in the field. Development of the original GDT for another or cross-cultural setting may be valuable (3). We translated the GDT-4 into Turkish and evaluated its

psychometric properties and found satisfactory results in terms of overall reliability and validity of the Turkish version of the scale.

The current scale was based on the ICD-11 framework (1,3). The suggested GD diagnostic criteria were used: impaired control over gaming activity, increasing priority given to gaming to the extent that it takes precedence over other life interests and daily activities, and continuation or escalation of gaming despite negative consequences (1). The 4 items designed to evaluate these features were: 1) "I have had difficulties controlling my gaming activity," 2) "I have given increasing priority to gaming over other life interests and daily activities," 3) "I have continued gaming despite negative consequences," and 4) "I have experienced significant problems in life (e.g., personal, family, social, educational, occupational) due to the intensity of my gaming behavior." The first statement, referring to a lack of control, describes the inability to control the activity in a number of different aspects (frequency, duration, termination). The second item emphasizes the increasing priority given to playing games in a way that supersedes other daily living activities; the game becomes the center of the gamer's life over time and the individual gives up their other interests. The final 2 items are related to negative results in various functional areas (educational, social, academic, self-care skills) and persistence despite those consequences.

Item analysis indicated that the corrected item-total correlations of the scale items varied between 0.55-0.63, and there was a statistically significant relationship for all of the items. Our results also indicated that there were

strong and statistically significant correlations between the scores of all of the items and the total score. The findings of the subsequent confirmatory factor analysis revealed that the standardized factor loadings of the items and the model fit indices of the scale were satisfactory (Table 2) (22). The overall findings of CFA analysis indicated that the standardized factor loadings of the items were sufficient and that the scale has a strong factor structure with adequate psychometric properties.

The internal consistency of the scale measured using the Cronbach's alpha coefficient was 0.84. Pontes et al. (3) reported a Cronbach's alpha coefficient value of 0.84 for the original scale. Our results suggest that the internal consistency of the Turkish version of the scale is acceptable (23). We used a test-retest procedure of the scale with 30 subjects during a 3-week interval. No significant differences were found between the total score of the baseline and retest applications, which indicates time-dependent invariance. Moreover, a statistically significant, strong, and positive correlation was observed between the total scores.

### Contributions of Gaming-Specific Cognitions

Cognitive factors related to gaming disorder may be broadly categorized into 2 groups: cognitive deficits and cognitive biases (17). In another cognitive model of gaming disorder, King and Delfabbro (18) identified 4 cognitive factors for gaming disorder: (a) overvaluing game rewards and identity, (b) maladaptive and inflexible rules about gaming behavior, (c) over-reliance on gaming to meet self-esteem needs, and (d) gaming as a method of gaining social acceptance. Each of these cognitive factors has been examined in different studies on different populations, however, subdomains of maladaptive and inflexible rules about gaming behavior and gaming to meet self-esteem needs are thought to be primary examples of problematic cognition in addicted populations (24). In contrast to some of the previous literature, our results did not support a predictive value for cognitions related to self-esteem needs. Moreover, the contributing effects of other cognitive subdomains that were found to be significantly predictive of GD in the first analysis (whole sample) were not found to be significant in the second analysis (subjects with a score of  $\geq 10$  on IGCS). This may indicate that these cognitive factors may be more important in development of GD, rather than continuance of problematic gaming behavior. In the context of the ICD-11 diagnostic criteria, the first criterion for the progression of gaming behavior to a disorder is the loss of control. Cognitive biases may play an important role in losing long-term

control over gaming behavior and may have an effect on initiating gaming behavior, while cognitive deficits (e.g. executive dysfunction) may primarily have an effect on the establishment of disorder. However, given that gaming behavior occurs on a spectrum, it is inevitable that various factors may exert varied influence at any point on the spectrum.

Identifying problematic cognitive factors and developing intervention strategies for those maladaptive cognitions may be important for young people who are at risk.

Some limitations of the current study include recognition that the participants were assembled using an online survey, which may lead to underrepresentation of gamers who primarily play offline games or prefer playing via a gaming console. Secondly, obtaining the data for the analyses via self-reports without collateral information may pose a risk of answer bias.

Nonetheless, our results indicated that this version of the GDT-4 is a valid and reliable instrument to assess the symptoms and prevalence of GD among Turkish adolescents and young adults.

Contribution Categories		Author Initials
Category 1	Concept/Design	S.C.
	Data acquisition	S.C.
	Data analysis/Interpretation	S.C.
Category 2	Drafting manuscript	A.A.
	Critical revision of manuscript	A.A.
Category 3	Final approval and accountability	S.C., A.A.
Other	Technical or material support	N/A
	Supervision	N/A

**Ethics Committee Approval:** This research was approved by the Istanbul Medeniyet University Goztepe Training and Research Hospital Local Ethics Committee on March 2020 [IRB: March 2020-2020/0168].

**Informed Consent:** The patients enrolled were informed about the study and provided written consent.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Financial Disclosure:** None declared.

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