**Psychometric validation of the Desire Thinking Questionnaire in a Turkish adolescent sample: Associations with Internet Gaming Disorder**

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Aydın, O.a\*, Ünal-Aydın, P.a, Caselli, G.b,c, Kolubinski, D. Cb, Marino, C.d & Spada, M. M.b

a Department of Psychology, International University of Sarajevo, Sarajevo, Bosnia and Herzegovina.

bDivision of Psychology, School of Applied Sciences, London South Bank University, London, UK.

cSigmund Freud University, Milan, Italy.

d Department of Psychology, University of Padua, Padova, Italy

\*Correspondence to: Orkun Aydın, Faculty of Arts and Social Sciences, Psychology Program, International University of Sarajevo, Sarajevo, Bosnia and Herzegovina. Hrasnicka Cesta 15, 71200, e-mail oaydin@ius.edu.ba

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**Abstract**

**Background**: Desire thinking is a conscious and voluntary cognitive process that consists of perseverative focus on information, memories, and prefiguration of images related to a desired target. The Desire Thinking Questionnaire (DTQ) is acknowledged as a reliable and valid tool to measure desire thinking in both adults and adolescents. The aim of the present study was to examine the psychometric properties of the DTQ in Turkish adolescent sample.

**Methods**: A convenience sample of 200 adolescents completed the Turkish version of the DTQ (DTQ-T) and an Exploratory Factor Analysis (EFA) was performed. Subsequently, a convenience sample of 701 adolescents completed the DTQ-T and a battery of questionnaires assessing personality traits, affect, boredom, impulsivity, and Internet Gaming Disorder (IGD). A Confirmatory Factor Analysis (CFA) was performed on the DTQ-T and validity was determined by examining correlations with other measures.

**Results**: A 9-item two-factor structure was observed in the EFA. An 8-item two-factor structure was established in the CFA. Results demonstrated that the DTQ-T yields adequate levels of reliability and concurrent validity. Additionally, an examination of incremental validity showed that DTQ-T significantly predicted IGD when controlling for personality traits, affect, boredom, and impulsivity.

**Conclusions**: The 8-item DTQ-T was found to be a reliable and valid measure of desire thinking among Turkish adolescents. Desire thinking may be a feasible target for mental health workers to alleviate the symptoms of IGD.

**Key words:** adolescents; affect; desire thinking; impulsivity; Internet Gaming Disorder; personality traits.

# Introduction

Desire thinking is a cognitive process consisting of the perseverative focus on images, memories and information relevant to a desired target in which an individual voluntarily engages in (Caselli & Spada, 2011). This perseverative focus exists on two levels: 1) Verbal Perseveration, which refers to the repetitive self-talk regarding the possibility of attaining the desired target; and 2) Imaginal Prefiguration, which refers to the formation of mental images of the desired target or of its context of consumption/engagement. The target of desire thinking may be an experience of a physiological or emotional state (e.g., elation), an activity (e.g., substance use, gambling), or the possession of an object (Kavanagh et al., 2005, 2009; Salkovskis & Reynolds, 1994).

To date, the key standard for measurement of desire thinking is the 10-item Desire Thinking Questionnaire (DTQ; Caselli & Spada, 2011). The original version consists of two factors including Verbal perseveration and Imaginal prefiguration. The DTQ has been adapted in Italian, French, Dutch, Turkish, Norwegian, German, Polish, Persian, and Hebrew versions (see Table 1). The Italian version (Caselli & Spada, 2011), the French version (Chakroun-Baggioni et al., 2017), the German version (Brandtner, Wegmann, & Brand, 2020), and the Persian version (Karami et al., 2020) of the DTQ were validated using healthy adult samples. The Dutch version (Markus et al., 2019) and the Turkish version (Alma-Uzuntuna, Yılmaz, & Spada, 2019) were validated in adult samples of alcohol users. The Norwegian version (Solem et al., 2021) was validated among adult alcohol, nicotine, and social media users. The Polish version (Dragan & Grajewski, 2021) was validated in both adults and adolescents whereas the Hebrew version (Efrati et al., 2020) recruited only adolescents for the validation purposes. All cross-cultural validation studies confirmed the two-factor model and demonstrated adequate fit alongside the original scale. However, Solem and colleagues (2020) excluded one item for loading on the opposite factor in the Norwegian adult version, and Efrati et al. (2020) removed four items due to cross-loadings on both factors in Hebrew version among adolescents. Markus et. al (2019) reported that two particular items belonging to the Verbal Perseveration factor yielded a decreased fit for the model, nevertheless, they included all items in the Dutch validation study. We acknowledged that the DTQ shows distinct psychometric properties across different cultures, age, and healthy vs. patient groups, therefore, Turkish adolescents may also demonstrate different features in desire thinking.

According to the model proposed by Caselli and Spada, desire thinking may, in the short term, reduce craving by shifting attention onto the desired target rather than actual experience (Caselli & Spada, 2010; 2013). However, the prolonged engagement in desire thinking may yield a paradoxical effect of intensifying craving, since the desired target is persistently focused upon, but not acquired/attained. Accordingly, the desired target may be recognized as the sole method to relieve from increasing distress (Caselli & Spada, 2011; 2015). The model of dysfunctional desire thinking stems from the metacognitive model of addictive behaviours (Spada, Caselli, Nikčević, et al., 2015). In this model metacognitions (beliefs about cognition and how to control it) lead to the activation of various forms of mental control (e.g., rumination, worry, thought suppression) in the presence of unpleasant thoughts which result in the escalation and maintenance of addictive behavior. Desire thinking is a constituent component of mental control in this model and is believed to lead to an escalation in craving and consequently engagement in addictive behavior.

Previous research has corroborated the associations between craving and desire thinking in problematic Internet use (Spada et al., 2014), Internet Gaming Disorder (IGD) (Dragan & Grajewski, 2021), nicotine use (Caselli et al., 2012a), alcohol use (Caselli et al., 2012b, Caselli, Gemelli, & Spada, 2017; Caselli & Spada, 2010), gambling (Fernie et al., 2014; Spada et al., 2015), food consumption (Spada et al., 2015), social media use (Marino et al., 2019), compulsive sexual behaviors (Efrati et al., 2020), and pornography (Allen, Kannis-Dymand, & Katsikitis, 2017).

**The associations between desire thinking and IGD**

IGD is defined as a psychiatric disorder in International Classification of Diseases, 11th version (ICD-11) that consists of loss of control in gaming, persistence in gaming activity despite adverse outcomes, and increased priority for gaming over life interests which cause significant functional impairments in everyday life during 12 months period (Rumpf et al., 2018). One recent meta-analysis has found the worldwide prevalence of IGD 3.05% (Stevens et al., 2021) and several studies have shown that IGD may accompany certain psychopathologies including negative psychosocial symptoms (Starcevic et al., 2011), lower life satisfaction associated with anxiety and depression (Mentzoni et al., 2011), attention deficits (Gentile et al., 2012), hostility (Gentile et al., 2004) and even violent behavior (Anderson & Carnagey, 2009; Williams et al., 2011). In a recent meta-analysis by Mansueto and colleagues (2019), the associations between desire thinking and several addictive behaviors such as alcohol/nicotine use, gambling, problematic Internet use were confirmed, however, to date, only two studies examined the relationship between desire thinking and IGD and one of them examined these associations in an adult sample (Brandtner, Wegmann, & Brand, 2020) whereas the other consisted of both adolescents and adults (age range 15-52) (Dragan & Grajewski, 2021). In these recent studies, the authors concluded that desire thinking may play a fundamental role in problematic gaming tendencies. In more detail, two facets of desire thinking namely Imaginal Prefiguration and Verbal Perseveration were found to mediate the relationship between initial urge and decision to start gaming behavior. According to the proposed model, controlling for the urge of gaming, desire thinking affected decision making towards engagement in IGD (Brandtner, Wegmann, & Brand, 2020).

## Aim of our study

Desire thinking is acknowledged as part of the metacognitive model of addictive behaviors (Spada et al., 2015; Caselli & Spada, 2015). We also know that metacognitive capabilities substantially improve with age and reach their highest function during late adolescence and plateauing in the adulthood period (e.g., Weil et al., 2013). It would thus appear vital to examine desire thinking in adolescence since it simultaneously thrives with metacognitive capabilities. In a recent validation study of Hebrew version of the DTQ (Efrati et al., 2020) that involved only adolescent participants, distinct psychometric properties were observed compared to validation studies with adult samples. To our knowledge, the DTQ has not been validated in Turkish adolescent population. Therefore, the main aim of our study was to validate a Turkish version of the DTQ, particularly among adolescents.

Furthermore, only two studies (Brandtner, Wegmann, & Brand, 2020; Dragan & Grajewski, 2021), to date, have examined the relationship between desire thinking and IGD. In these recent studies, the samples consisted of both adolescent and adult individuals, and psychosocial correlates of IGD such as personality traits and impulsivity were not controlled. However, particular personality traits (high levels of neuroticism and low levels of conscientiousness) have been found to be related to addictive behaviors including alcohol use (Malouff et al., 2007), nicotine use (Munafò et al., 2007), gambling (MacLaren et al., 2011), and problematic Internet use (Andreassen et al., 2013). Additionally, one recent study examined the role of both positive and negative affect on IGD and it was found that both affect types act as mediators of the pathway between impulsivity and IGD among young adults (Shin et al., 2019). Moreover, boredom proneness is acknowledged to be a potential trigger in Internet related disorders including problematic Internet use and Internet addiction (Li et al., 2015; Nichols & Nicki, 2004), online gambling (Goldstein et al., 2016) among non-clinical and clinical population (Chou et al., 2018). In a similar vein, a recent systematic meta-review has suggested that impulsivity may be considered a principal process that contributes to both substance and behavioral addictions to varying degrees (Lee et al., 2019). Furthermore, another recent meta-analysis has demonstrated the positive associations between higher impulsivity and IGD (Şalvarlı & Griffiths, 2019). Therefore, we assume that to control for these correlates is required and focusing upon sole adolescent group may provide greater insights in helping to identify the potential relationship between desire thinking and IGD.

**Study 1:** **Translation and adaptation of a Turkish Version of the Desire Thinking Questionnaire (DTQ-T)**

# Method

## Participants and procedure

The study comprised of a convenience sample of 200 adolescents recruited from two high schools based in Istanbul, Turkey (88 female; mean age = 15.56 years [SD = 0.61; range 14 to 18 years]). The participants were contacted by their school teachers and were informed about the aims of the study. After adolescents responded and agreed to participate, they were provided a link which to a webpage that included the study questionnaires. The completion of the battery of questionnaires lasted approximately 25 minutes per respondent. Informed consent was also obtained from respondent’s parent or caregiver who was informed about the respondent’s right to withdraw at any stage of the study without any penalty. No incentives, food or travel allowances were given to the participants. The Institutional Review Board of the International University of Sarajevo approved the study (3/9/2020; IUS-REC-01-1579/2020) and official permissions were received from the school directorates.

## Measure

The original DTQ (Caselli & Spada, 2011) contains 10 items and has a two-factor structure (Verbal Perseveration and Imaginal Prefiguration). Caselli and Spada (2011) note that the DTQ has high levels of reliability (.80 and .81, respectively) and the two-factor solution provided a good fit to the data (RMSEA of .05 (p = .36), a CFI of .98, a GFI of .95 and a NNFI of .97) in the original validation study. Items were framed as statements to which participants could respond to on a four-point Likert-type scale to indicate their level of agreement (“1. Almost never”, “2. Sometimes”, “3. Often”, and “4. Almost Always”). The items were preceded by instructions that read as follows:

*“Youth feel a strong desire to do something different in their minds. Please read the statements and circle the number that describes the your experience when you feel a strong desire to perform some activity. In your answer, please refer to how you act in reality. There is no right or wrong answer.”*

The original English version of the DTQ was translated into Turkish separately by two Turkish authors of this study. Later these two translations were compared to draft a provisional translation, which was then back-translated into English by another independent translator and compared with the original version. Finally, one of the original authors of the DTQ was consulted regarding the content to detect any translation-related concerns. The final version was agreed and a pilot study with 10 adolescents was performed. There were no evident difficulties reported by adolescents for comprehension of the Turkish version of the DTQ (DTQ-T).

## Data analysis

A recently published validation of the Hebrew version (Efrati et al., 2020) and Norwegian version (Solem et al., 2021) of the DTQ identified that not all of the original items loaded onto the factors like the original, so an Exploratory Factor Analysis (EFA) was first performed using a minimum residual extraction method employing Jamovi, which uses the psych package for R (*Jamovi (Version 1.0)*, 2019; Revelle, 2013; Team R Development Core, 2018) . A parallel analysis was also conducted to verify the number of factors (Henson & Roberts, 2006; Patil et al., 2008). As was the case for the original DTQ (Caselli & Spada, 2011), it was decided a priori that items that loaded less than .4 on either factor would be discarded, as would be items that loaded above .4 on both factors. If, however, an item loaded more than .4 on only one factor, but the second factor loading was within .2 of the loading on the first factor, it would also be discarded. For example, if a factor loaded .5 on the first factor, it would be discarded if the loading on the second factor was above .3. This protocol was used in order to exclude items that influenced both factors and mirror that used in previous DTQ validation studies (Caselli & Spada, 2011; Efrati et al., 2020).

# Results

## EFA

Similar to the results of the original DTQ, the EFA led to a two-factor solution, which accounted for 67.8% of the variance (Table 2 shows the factor loadings of the individual items). One of the items (#9) came close to the .4 cutoff on both factors and was thus discarded. It may be the case that the phrasing of this item, particularly referring to imagining a desired activity like a movie may have different cultural connotations. Item #8 also loaded on the opposite factor to the original DTQ. Reliability indices were determined by computing Cronbach's alpha for the remaining 9 items. This coefficient was .94 for the total score, .93 for Factor 1 and .88 for Factor 2. This is very similar to the results prior to removing item #9 (.94, .93 and .87, respectively.

**Study 2: Validation of DTQ-T**

## Method

## Participants and procedure

A convenience sample of 701 (373 female; mean age = 15.16 years [SD = 1.29; range 13 to 19 years]) recruited from 8 high schools based in Turkey, completed a battery of online questionnaires. The same procedure in Study 1 was applied.

## Measures

### Personality traits

The shortened version of the Big Five Inventory (BFI-10; Rammstedt & John, 2007) is a 10-item measure based on the 44-item version by John and colleagues (1991). The measure was found to be valid and reliable among the Turkish population (Cronbach’s alpha= .81) (Horzum et al., 2017). Participants rate 10 items, two for each personality factor (Extraversion – “I am outgoing, sociable”, Agreeableness – “I am generally trusting”, Conscientiousness – “I do a thorough job”, Neuroticism – “I get nervous easily” and Openness – “I have an active imagination”), on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The BFI-10 has demonstrated good reliability and validity across many sample groups (Rammstedt & John, 2007). No Cronbach α was estimated in view of the brevity of this scale and the presence of only two items per factor (e.g., Soto & John, 2017).

### Affect

The 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a self-report measure which assesses positive and negative affect by asking individuals to rate the extent to which they have experienced 10 positive emotions (e.g., “Attentive”, “Active”, “Alert”) and 10 negative emotions (e.g., “Hostile”, “Irritable”, and “Ashamed”) on a 5-point Likert scale, where 1 = "little or no" and 5 = "very much". The scale was found to be valid and reliable in a Turkish sample (Cronbach’s alpha for positive and negative affect= .83, .86, respectively) (GENÇÖZ, 2000).The PANAS has demonstrated reliability and validity in a non-clinical sample (Crawford & Henry, 2004). Cronbach’s alpha in this sample was .56 for positive affect and .64 for negative affect.

### Boredom

The Leisure Boredom Scale (LBS; Iso-Ahola & Weissinger, 1990) is a 16-item self-report measure used to measure perceptions of boredom in leisure. It asks to indicate how one feels about their leisure time to which one can respond on a 1 to 5 Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. Items include “For me, leisure time just drags on and on” and “Leisure time activities do not excite me”. The measure was found to be valid and reliable among a Turkish population (Cronbach’s alpha= .72) (Gurbuz et al., 2014). Cronbach’s alpha for this study was .53.

### Impulsiveness

The Barratt Impulsiveness Scale-11 (BIS-11; Patton, Stanford, & Barratt, 1995) is a 30-item measure of impulsivity. It employs a 4-point Likert scale (1 = *Rarely/Never* to  4 = *Almost always/Always*) and comprises three subscales: non-planning impulsiveness (e.g., “I am more interested in the present than the future”), motor impulsiveness (e.g., “I do things without thinking”) and attentional impulsiveness (e.g., “I get easily bored when solving thought problems”). The measure has been found to be valid and reliable in a Turkish sample (Cronbach’s alpha= .82) (Tamam et al., 2013). Patton and colleagues (1995) report internal consistency coefficients for the BIS-11 total score that range from .79 to .83 for various clinical and non-clinical populations. Cronbach’s alpha of the total score in this sample was .10 and for subscales, reliability was .25 for non-planning impulsivity, .61 for motor impulsivity and -.21 for attentional impulsivity, which are low, and in the case of the latter, violate the reliability model assumptions. However, there is evidence to suggest that these three subscales are not clearly defined across cultures (Vasconcelos et al., 2012).

### Internet Gaming Disorder

The Internet Gaming Disorder Scale-Short Form (IGDS9-SF; Pontes & Griffiths, 2015) is a 9-item measure of IGD which employs a 5-point Likert scale (1 = *Never* to  5 = *Very Often*). The items from this measure were adapted from the nine core criteria of IGD in DSM-5 (Association, 2013) and reflects a single dimension. The main objective of IGDS9-SF is to evaluate the severity of IGD and its harmful effects by examining both online and/or offline gaming activities occurring over a 12-month period. The scores are estimated according to the gamer’s responses and total score can range from 9 to 45. Higher scores indicate greater engagement in gaming behavior and elevated risk for IGD. However, this measure was not developed for diagnostic purposes, though Pontes and Griffiths (2015) recommend a potential cut-off score (36 out of 45) for discriminating individuals who are at higher risk for IGD. The measure was found to be valid and reliable among Turkish adolescents and young adult populations (Cronbach’s alpha= .82) (Arıcak et al., 2018). Cronbach’s alpha for this study was .87.

## Data analysis

To validate the DTQ-T, we first determined construct validity by running a Confirmatory Factor Analysis (CFA) using Lavaan in R (Rosseel, 2012; Team R Development Core, 2018). We utilized five indices to evaluate the fit of the model: A Chi-square measure of fit, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI: also known as the Non-Normed Fit Index), the Standardized Root Mean Square Residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA). **χ**2**/**df ≤ 2, CFI and TLI ≥ 0.95, and SRMR and RMSEA ≤ 0.05 were set as indicators of good fit and **χ**2**/**df ≤ 3, CFI and TLI ≥ 0.90, and RMSEA and SRMR ≤0.08 were set as indicators for acceptable fit (Browne and Cudeck ., 1993; Kline, 2015; Schermelleh-Engel et al., 2003)

Using SPSS, version 25 (IBM Corp, 2017), we then established concurrent validity by observing whether the two factors of the DTQ-T would correlate significantly with established measures of personality traits, affect, boredom, impulsivity and IGD. We then examined internal reliability and examined incremental validity by observing whether the DTQ-T would predict levels of IGD when controlling for other significant variables in correlational analyses.

# Results

## CFA

A CFA was performed on the data obtained from the participants using a robust weighted least square estimation (WLSMV). The analysis was conducted using Lavaan in R (Rosseel, 2012; Team R Development Core, 2018). We defined the latent variables as Verbal Perseveration and Imaginal Prefiguration and the 9 items as congeneric indicators of the latent variables.

The initial 9-item CFA assumed a covariance between the latent variables and resulted in a good fit: the chi-square test was significant (**χ**2 = 56.11, df = 26, p < .001) and the **χ**2**/**df= 2.16. This model generated a CFI of 0.97, a TLI of 0.96, a SRMR of .029 and an RMSEA of 0.041 (90% C.I. = 0.026 – 0.055). Parameter estimates were reviewed, however, as item #8 loaded on the opposite factor to the original DTQ in the EFA, which may question the construct validity. In the Hebrew version of the scale (Efrati et al., 2020) item #8 was removed due to loading on both factors and in Norwegian validity study (Solem et al., 2021), the same item was removed due to loading on opposite factor to the original DTQ. The re-specified model without item #8 retained the covariances between latent variables and slightly better fit of the data was demonstrated on each of the measures of fit. The chi-square remained significant, however (**χ**2 = 39.31, df = 19, p < .01; **χ**2**/**df= 2.07). This new model also yielded the following results: CFI of 0.98, TLI of 0.97, SRMR of .027 and RMSEA of 0.039 (90% C.I. = 0.021 – 0.056), demonstrating construct validity. Lastly, a CFA was conducted with all 10 items to ascertain if the removal of Item #9 yielded a better model. The results were: **χ**2 = 100.50, df = 34, p < .001; **χ**2**/**df= 2.96, CFI of 0.94, TLI of 0.93, SRMR of .039 and RMSEA of 0.053 (90% C.I. = 0.041 – 0.065). Based on these results, the DTQ-T was confirmed as having two correlated factors, Verbal Perseveration (DTQ-T-VP; 5 items) and Imaginal Prefiguration (DTQ-T-IP; 3 items).

## DTQ-T subscale reliability

Cronbach’s alpha was calculated using jamovi, which utilizes the psych package for R (*Jamovi (Version 1.0)*, 2019; Revelle, 2013; Team R Development Core, 2018). The DTQ-T-VP subscale consisted of 5 items (α = .89), demonstrating good levels of reliability. The DTQ-T-IP subscale consisted of 3 items (α = .83) also demonstrating good levels of reliability.

## Concurrent validity

Table 3 shows the means, standard deviations, and ranges for all the study variables. A series of Shapiro-Wilk tests of normality were conducted on the data, which suggested that all measurements were significantly different than normal. As a result, a series of non-parametric, Spearman’s Rho correlation analyses were conducted on the data (see Table 4). These revealed that the DTQ-T-IP and DTQ-T-VP were strongly and positively correlated with each other (rs = .69, *p* < .001). The DTQ-T-IP was strongly and positively correlated with the IGDS9-SF (rs = .51 p < .001). A moderate positive correlation with negative affect (rs = .32, p < .001) was also observed. Weak positive correlations were also observed with positive affect (rs = .14, p < .001), boredom (rs = .16, p < .001) and motor impulsivity (rs = .25, p < .001). There were also weak negative correlations between the DTQ-T-IP and three of the personality traits: extraversion (rs = -.09, p < .05), agreeableness (rs = -.16, p < .001) and conscientiousness (rs = -.09, p < .05).

The DTQ-T-VP was also strongly positively correlated with the IGDS9-SF (rs = .58, p < .001). It was also moderately positively correlated with motor impulsivity (rs = .31, p < .001). There were weak positive correlations with positive and negative affect (rs = .10, p < .05; rs = .29, p < .001, respectively), attentional impulsivity (rs = .10, p < .05) and boredom (rs = .19, p < .001) and weak negative correlations with the same three personality variables: extraversion (rs = -.13, p < .001), agreeableness (rs = -.20, p < .001) and conscientiousness (rs = -.20, p < .001).

## Incremental validity

Incremental validity was ascertained by performing a regression analysis in which the IGDS9-SF was the dependent variable. As gender was a nominal variable, it was not possible to conduct a Spearman’s Rho. Instead a t-test indicated that there was a significant difference between male (M = 19.58, S.D. = 7.61) and female (M = 15.13, S.D. = 6.41), t(699) = 8.40, p < .001. The predictor variables were entered in the following order: i) gender; ii) personality traits; iii) negative affect, boredom and motor impulsivity; and iv) desire thinking. Following the first four steps (see Table 5), gender, conscientiousness, negative affect, boredom and motor impulsivity accounted for a significant amount of the variance (R2 = .27, F(3, 691) = 33.02 p < .001). The addition of the DTQ subscales resulted in a significant change (R2 = .44, F(2, 689), p < .001), with both DTQ-T-IP and DTQ-T-VP subscales identified as significant predictors of the level of IGDS9-SF when controlling for the other variables (B = .62, p < .001 [LL = 0.34, UL = 0.90]; B = .70, p < .001 [LL = 0.54, UL = 0.87], respectively). In this model, after the addition of the DTQ-T, negative affect became a non-significant predictor of IGDS9-SF.

**Discussion**

The objective of our study was to examine psychometric properties of the Turkish version of the DTQ among adolescents. The current study confirmed the two-factor structure of the DTQ, and the separation between Imaginal Prefiguration and Verbal Perseveration. The DTQ-T also showed a good internal consistency, reliability and concurrent validity in line with Caselli's and Spada's (2011) original version of DTQ. On the other hand, we removed item #8 due to loading on the Verbal Perseveration (opposite) factor instead of Imaginal Prefiguration factor and item #9 due to cross loading on both factors of DTQ. In the Hebrew version of the DTQ, item #8 was excluded due to loading on both factors and item #9 was discarded due to the cross correlation in CFA (Efrati et al., 2020) and in the Norwegian validity study (Solem et al., 2021), item #8 was removed due to loading on the opposite factor. Additionally, the French validation study found that item #8 has a side loading and item #9 had the weakest factor loading, however, they did not remove any items from the DTQ (Chakroun-Baggioni et al., 2017). Differences spotted in this study could be due to sample variation, translation matters, and cultural dissimilarities. Our study sample was younger than the samples in other DTQ validation studies and the mean scores of the DTQ-T subscales were comparatively low in this adolescent sample compared to adult samples. Considering simultaneous development of desire thinking and metacognition in adolescence (Caselli & Spada, 2015), premature metacognitive development may be linked to lower levels of desire thinking patterns among adolescents. Moreover, the phrasing of item #9, particularly referring to viewing imaging a desired activity like a movie may have dissimilar cultural implications.

Incremental validity results have shown that the Imaginal Prefiguration and Verbal Perseveration components of the DTQ-T both predicted levels of IGD while controlling for personality traits, negative affect, boredom, and impulsivity among adolescents. This finding was in line with previous studies that showed desire thinking’s potential role in various addictive behaviors (Caselli & Spada, 2015; Mansueto et al., 2019). In a similar vein, one recent study found out the significant contribution of desire thinking to problematic gaming behavior among adult participants (Brandtner, Wegmann, & Brand, 2020). In this study it was suggested that desire thinking may act as a mediator in the transition from initial urge to final decision for engaging in internet gaming. Thus, maladaptive cognitive strategies related to desire thinking may increase the tendency for IGD in adults. It can therefore be assumed that desire thinking may be a key construct in facilitating the switch from normal gaming behavior to problematic engagement. According to our knowledge, our study was the first attempt to assess desire thinking’s predictive role in IGD among an adolescent sample.

This combination of findings provides some support for a variety of clinical implications. Previous studies validated the negative outcomes of long-term exposure to IGD, particularly for brain maturation of adolescents (Han et al., 2012), therefore, early precautions related to maladaptive desire thinking may interrupt problematic engagement for young vulnerable individuals in online gaming. For instance, psychoeducational training that targets desire thinking as a form of maladaptive coping may encourage adolescents to reduce involvement in problematic gaming behaviors (Nikčević et al., 2015; Spada et al., 2013). Additionally, Metacognitive Therapy (Wells, 2008) that includes the direct restructuring of metacognitions as well as techniques aimed at interrupting rumination and worry (detached mindfulness and postponement), potentiating attentional flexibility (attention training technique), and re-appraising the beliefs about the benefits and uncontrollability of desire thinking may also be useful (Caselli & Spada, 2016) for problem-solving and engagement with the IGD.

With regards to the current study, some limitations need to be acknowledged. Although the reliability of the DTQ-T was good, the reliability of other measures used in this study was low. This may be due to lack of available validated measures for Turkish adolescents in the assessed parameters such as affect, boredom, and impulsivity. In some cases, the reliability was negative. This does also raise some concerns about the results of the regression analysis. The data used may have been manipulated by not randomly selected sample and the use of self-report questionnaires which may affect response accuracy and recall bias. The causality inferences cannot be performed due to the cross-sectional design. Lack of structured clinical interview with the participants may hinder the estimation of concurrent psychiatric comorbidities which could affect study variables. Further longitudinal research should allow the observation of changes in desire thinking patterns and IGD to ascertain the interaction between them under different conditions.

In conclusion, the present study adds to the growing body of research that indicates the desire thinking’s fundamental role in addictive behaviors. The DTQ-T acts as a reliable and valid measure of desire thinking in adolescents and provides a predictive role in IGD independently of historically related variables. Further research focusing on the association between metacognitions, desire thinking and IGD may shed light on the possible interactions between these constructs (Hamonniere & Varescon, 2018). We also suggest that mental health workers consider working on maladaptive desire thinking forms in adolescence to alleviate the craving of internet gaming.

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Table 1: The validity and reliability studies of the Desire Thinking Questionnaire.

|  |  |  |  |
| --- | --- | --- | --- |
| **Version** | **Sample** | **Factors and item counts** | **Item loadings** |
| Italian\* | Adults (n=290) | DTQ-IP, DTQ-VP (10 items) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| French\* | University Students (n=457) | DTQ-IP, DTQ-VP (10 items, Item 9 had weakest factor loading and Item 8 had side loading but not excluded) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| Dutch\* | Adult alcohol users and healthy controls (n=372) | DTQ-IP, DTQ-VP (10 items, Item 7 and 10 decreased the fit but not excluded) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| Turkish\* | Adult alcohol users (n=100) | DTQ-IP, DTQ-VP (10 items) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| Norwegian\* | Adult alcohol users (n=588), nicotine users (n=446), social media users (n=359) | DTQ-IP, DTQ-VP (9 items-Item 8 was removed) | Items 1,2,3,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| German\* | Adults who are active users of online social platforms (n=925) | DTQ-IP, DTQ-VP (10 items) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| Polish\* | Adolescent and adult online/offline game players (n=719) | DTQ-IP, DTQ-VP (10 items) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| Persian\* | University Students (n=510) | DTQ-IP, DTQ-VP (10 items) | Items 1,2,3,8,9 on DTQ-IP, items 4,5,6,7,10 on DTQ-VP |
| Hebrew\* | Adolescents (n=718) | DTQ-IP, DTQ-VP (6 items-Items 5, 6, 8, 9 were removed) | Items 1,2,3 on DTQ-IP, items 4,7,10 on DTQ-VP |

Note: \* Relevant references are cited in the text. DTQ-IP = Desire Thinking Questionnaire Imaginal Prefiguration; DTQ-VP = Desire Thinking Questionnaire Verbal Perseveration.

Table 2: Factor loadings from exploratory factor analysis.

|  |  |  |  |
| --- | --- | --- | --- |
| **Original Items** | **Turkish Items** | Factor 1 | Factor 2 |
| 1. I imagine myself doing the desired activity | Kendimi, arzuladığım etkinliği yaparken hayal ederim. | .03 | **.84** |
| 2. I imagine how I would feel like when engaging in the desired activity | Arzuladığım aktiviteyi deneyimlerken nasıl hissedeceğimi hayal ederim. | .13 | **.77** |
| 3. I anticipate the sensations I would feel practicing the desired activity | Arzuladığım aktiviteyi gerçekleştirirken bedenimde hissedebileceğim duyumları tahmin etmeye çalışırım. | -.07 | **.85** |
| 4. If I were not practice the desired activity for a long time, I would think about it continuously | Arzuladığım aktiviteyi uzun zamandır gerçekleştirmediysem, sürekli onun hakkında düşünürüm. | **.80** | -.06 |
| 5. When I begin to think about the desired activity, I find it difficult to stop | Arzuladığım aktiviteyi düşünmeye başlayınca, kendimi durdurmakta zorlanırım. | **.89** | -.10 |
| 6. When I begin to think about the desired activity I continue until I manage to engage in it | Arzuladığım aktiviteyi düşünmeye başlayınca, onu gerçekleştirmenin bir yolunu bulana dek düşünmeye devam ederim. | **.71** | .15 |
| 7. I repeat mentally to myself that I need to practice the desired activity | Arzuladığım aktiviteyi gerçekleştirmem gerektiğini, kendi kendime zihnimde tekrar edip dururum. | **.91** | -.01 |
| 8. I begin to imagine the desired activity every time it comes to my mind | Arzuladığım aktivite aklıma her geldiğinde, onu hayalimde canlandırmaya başlarım. | **.57** | .36 |
| 9. I imagine myself involved in the desired activity as if it were a movie | Arzuladığım aktiviteyi gerçekleştiriyor olduğumu bir filmin içindeymişçesine hayal ederim. | .36 | .38 |
| 10. My mind is focused on repeating what I desire till I manage to satisfy it | Yapana dek, arzuladığım şey zihnimde tekrarlanıp durur. | **.71** | .13 |

Table 3: Means, SDs, and ranges for all study variables.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Means | SD | Range | Skewness | Kurtosis |
| 1. DTQ-T-IP | 4.73 | 2.15 | 3 to 12 | 1.406 | 1.668 |
| 1. DTQ-T-VP | 7.86 | 3.56 | 5 to 20 | 1.341 | 1.187 |
| 1. BFI-10-E | 6.75 | 1.78 | 2 to 10 | -.225 | -.216 |
| 1. BFI-10-A | 7.84 | 1.71 | 2 to 10 | -.761 | .197 |
| 1. BFI-10-C | 6.80 | 1.64 | 2 to 10 | -.131 | -.090 |
| 1. BFI-10-N | 5.81 | 1.87 | 2 to 10 | .110 | -.282 |
| 1. BFI-10-O | 6.47 | 1.34 | 2 to 10 | .234 | .604 |
| 1. PANAS-P | 30.44 | 4.96 | 10 to 47 | -.215 | .628 |
| 1. PANAS-N | 26.50 | 5.48 | 11 to 50 | .663 | 1.499 |
| 1. LBS | 36.36 | 5.83 | 12 to 60 | -.105 | 1.803 |
| 1. BIS-NP | 12.70 | 2.20 | 5 to 20 | -.305 | 1.076 |
| 1. BIS-M | 9.80 | 2.82 | 5 to 20 | .806 | .745 |
| 1. BIS-A | 8.79 | 1.54 | 4 to 15 | .483 | .931 |
| 1. IGDS9-SF | 17.21 | 7.34 | 9 to 40 | .831 | -.162 |

Note: DTQ-T-IP = Turkish Desire Thinking Questionnaire (Imaginal Prefiguration); DTQ-T-VP = Turkish Desire Thinking Questionnaire (Verbal Perseveration); BFI-10-E = Big Five Inventory (Extraversion); BFI-10-A = Big Five Inventory (Agreeableness); BFI-10-C = Big Five Inventory (Conscientiousness); BFI-10-N = Big Five Inventory (Neuroticism); BFI-10-O = Big Five Inventory (Openness); PANAS-P = Positive and Negative Affect Schedule (Positive); PANAS-N = Positive and Negative Affect Schedule (Negative); LBS = Leisure Boredom Scale; BIS-NP = Barratt Impulsivity Scale (Non-Planning); BIS-M = Barratt Impulsivity Scale (Motor Impulsivity); BIS-A = Barratt Impulsivity Scale (Attentional Impulsivity); IGDS9-SF = Internet Gaming Disorder Scale-Short Form; *n* = 701.

Table 4: Correlation matrix of the study variables.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1. DTQ-T-IP |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. DTQ-T-VP | .69\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Age | .02 | .01 |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. BFI-10-E | -.09\* | -.13\*\* | .02 |  |  |  |  |  |  |  |  |  |  |  |
| 1. BFI-10-A | -.16\*\* | -.20\*\* | -.07 | .17\*\* |  |  |  |  |  |  |  |  |  |  |
| 1. BFI-10-C | -.09\* | -.20\*\* | -.02 | .22\*\* | .33\*\* |  |  |  |  |  |  |  |  |  |
| 1. BFI-10-N | .06 | .06 | -.04 | -.39\*\* | -.02 | -.11\*\* |  |  |  |  |  |  |  |  |
| 1. BFI-10-O | -.03 | .05 | -.05 | -.02 | .10\*\* | -.05 | .12\*\* |  |  |  |  |  |  |  |
| 1. PANAS-P | .14\*\* | .10\* | .02 | .09\* | .04 | .18\*\* | .07 | -.10\* |  |  |  |  |  |  |
| 1. PANAS-N | .32 | .29\*\* | .14\*\* | -.11\*\* | -.17 | -.08\* | .16\*\* | -.24\*\* | .53\*\* |  |  |  |  |  |
| 1. LBS | .16\*\* | .19 | .03 | -.08\* | .00 | -.09\* | .23\*\* | -.28\*\* | .16\*\* | .21\*\* |  |  |  |  |
| 1. BIS-NP | .01 | .00 | -.05 | -.14\*\* | -.04 | -.23\*\* | .06 | -.03 | -.34\*\* | -19\*\* | -.08\* |  |  |  |
| 1. BIS-M | .25\*\* | .31\*\* | .07 | -.12\*\* | -.29 | -.34\*\* | .07 | -.24\*\* | -.01 | .24\*\* | .18\* | -.01 |  |  |
| 1. BIS-A | .07 | .10\* | .06 | .04 | -.10\*\* | .10\*\* | -.15\*\* | .13\*\* | .09\* | .05 | -.09\* | -.08\* | .11\*\* |  |
| 1. IGDS9-SF | .51\*\* | .58\*\* | -.02 | -.13 | -.14\*\* | -.24 | .08\* | -.41\*\* | .07 | .22\*\* | .25\*\* | .05 | .24\*\* | -.04 |

*n* = 701; \*p < .05; \*\*p < .01.

Note: DTQ-T-IP = Turkish Desire Thinking Questionnaire (Imaginal Prefiguration); DTQ-T-VP = Turkish Desire Thinking Questionnaire (Verbal Perseveration); BFI-10-E = Big Five Inventory (Extraversion); BFI-10-A = Big Five Inventory (Agreeableness); BFI-10-C = Big Five Inventory (Conscientiousness); BFI-10-N = Big Five Inventory (Neuroticism); BFI-10-O = Big Five Inventory (Openness); PANAS-P = Positive and Negative Affect Schedule (Positive); PANAS-N = Positive and Negative Affect Schedule (Negative); LBS = Leisure Boredom Scale; BIS-NP = Barratt Impulsivity Scale (Non-Planning); BIS-M = Barratt Impulsivity Scale (Motor Impulsivity); BIS-A = Barratt Impulsivity Scale (Attentional Impulsivity); IGDS9-SF = Internet Gaming Disorder Scale-Short Form; *n* = 701.

Table 5: Regression coefficients for the DTQ-T, accounting for gender, personality traits, negative affect, boredom, and motor impulsivity.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| B | Std. Error | Beta | Lower Bound | Upper Bound |
| 1 | (Constant) | 10.678 | .821 |  | 13.006 | .001 | 9.066 | 12.290 |
| Gender | 4.451 | .530 | .303 | 8.404 | .001 | 3.411 | 5.490 |
| 2 | (Constant) | 15.365 | 2.437 |  | 6.304 | .001 | 10.579 | 20.150 |
| Gender | 4.675 | .529 | .318 | 8.844 | .000 | 3.637 | 5.713 |
| BFI-10-E | -.281 | .160 | -.068 | -1.752 | .080 | -.595 | .034 |
| BFI-10-A | -.183 | .159 | -.043 | -1.154 | .249 | -.494 | .128 |
| BFI-10-C | -.810 | .167 | -.181 | -4.842 | .000 | -1.138 | -.481 |
| BFI-10-N | .370 | .155 | .094 | 2.395 | .017 | .067 | .674 |
| BFI-10-O | .258 | .196 | .047 | 1.316 | .189 | -.127 | .643 |
| 3 | (Constant) | -3.895 | 2.997 |  | -1.300 | .194 | -9.779 | 1.989 |
| Gender | 4.662 | .498 | .317 | 9.369 | .000 | 3.685 | 5.639 |
| BFI-10-E | -.262 | .150 | -.063 | -1.745 | .081 | -.557 | .033 |
| BFI-10-A | .029 | .154 | .007 | .187 | .852 | -.273 | .331 |
| BFI-10-C | -.572 | .162 | -.128 | -3.537 | .000 | -.890 | -.255 |
| BFI-10-N | .120 | .148 | .030 | .806 | .421 | -.172 | .411 |
| BFI-10-O | .179 | .184 | .033 | .969 | .333 | -.183 | .540 |
| PANAS-N | .157 | .047 | .117 | 3.356 | .001 | .065 | .248 |
| LBS | .242 | .043 | .192 | 5.670 | .000 | .158 | .326 |
| BIS-M | .500 | .095 | .192 | 5.245 | .000 | .313 | .687 |
| 4 | (Constant) | -1.940 | 2.626 |  | -.739 | .460 | -7.097 | 3.216 |
|  | Gender | 3.005 | .451 | .205 | 6.661 | .000 | 2.119 | 3.891 |
| BFI-10-E | -.165 | .131 | -.040 | -1.260 | .208 | -.423 | .092 |
| BFI-10-A | .156 | .135 | .036 | 1.158 | .247 | -.109 | .421 |
| BFI-10-C | -.563 | .142 | -.126 | -3.967 | .000 | -.842 | -.285 |
| BFI-10-N | .057 | .130 | .014 | .438 | .661 | -.198 | .312 |
| BFI-10-O | .139 | .162 | .025 | .862 | .389 | -.178 | .457 |
| PANAS-N | .021 | .042 | .015 | .485 | .628 | -.063 | .104 |
| LBS | .180 | .038 | .143 | 4.810 | .000 | .107 | .254 |
| BIS-M | .174 | .086 | .067 | 2.020 | .044 | .005 | .343 |
| DTQ-T-IP | .615 | .143 | .180 | 4.307 | .000 | .335 | .895 |
| DTQ-T-VP | .702 | .085 | .341 | 8.264 | .000 | .536 | .869 |
|  |  |  |  |  |  |  |  |  |
| a. Dependent Variable: IGDS9-SF | | | | | | | | |

Note: IGDS9-SF = The Internet Gaming Disorder Scale-Short Form; BFI-10-E = Big Five Inventory (Extraversion); BFI-10-A = Big Five Inventory (Agreeableness); BFI-10-C = Big Five Inventory (Conscientiousness); BFI-10-N = Big Five Inventory (Neuroticism); BFI-10-O = Big Five Inventory (Openness); PANAS-N = Positive and Negative Affect Schedule (Negative); LBS = Leisure Boredom Scale; BIS-M = Barratt Impulsivity Scale (Motor Impulsivity); DTQ-T-IP = Turkish Desire Thinking Questionnaire (Imaginal Prefiguration); DTQ-T-VP = Turkish Desire Thinking Questionnaire (Verbal Perseveration); *n* = 701.