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ORIGINAL ARTICLE

Psychometric Properties of Turkish Version of Generalized Problematic Internet Use Scale-2 and the Relationship Between Internet Use Patterns and Problematic Internet Use

Sonay Caner-Yıldırım[1] · **Zahide Yıldırım**[2]

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Abstract
This study aimed to validate and evaluate the psychometric properties of the Turkish version of the Generalized Problematic Internet Use Scale-2 (GPIUS2), to categorize Internet use patterns (IUP) that are academic, social, and recreational, and to elucidate the current state of the relationships between demographic characteristics, problematic Internet use (PIU), and IUP. To this end, two studies were conducted 1 year apart at two different public universities in Turkey. The first study tested the psychometric properties of the Turkish version of the GPIUS2 for young adults alongside piloting the Internet Use Patterns Questionnaire (IUPQ) with a total of 328 university students in the fall semester of 2017–2018. In a follow-up study, the Turkish version of the GPIUS2 was further validated alongside the examination of IUP with 479 university students in the fall semester of 2018–2019. Factor analyses were conducted in both studies to examine the psychometric properties of the Turkish version of the GPIUS2. Pearson correlation, independent samples *T*-test, and ANOVA were conducted in the follow-up study to examine the relationship between demographic information, PIU, and IUP. In both the initial and follow-up studies, the translated version of the GPIUS2 proved to be a reliable, valid, and acceptable measurement instrument with 14 items and three factors. Regarding the relationship between IUP and PIU, duration of use rather than purpose of use frequency was found to be related to PIU. An increase in the duration of academic use implies a decrease in PIU, and the opposite is true for social and recreational use. The surprising, nonsignificant relationship between grade point average and PIU is discussed in line with the literature.

Keywords Problematic Internet use · GPIUS2 · Internet use patterns · Academic Internet use · Social Internet use · Recreational Internet use

✉ Sonay Caner-Yıldırım
sonaycaner@gmail.com

[1] Department of Computer Education and Instructional Technology, Faculty of Education, Erzincan Binali Yıldırım University, Erzincan, Turkey

[2] Department of Computer Education and Instructional Technology, Faculty of Education, Middle East Technical University, Ankara, Turkey

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Extensive exposure to the Internet leads to overuse, which can have negative social, psychological, and physical effects (Davis, 2001; Caplan, 2010; Dunbar et al., 2017). A growing number of studies have investigated this overuse and its effects. Although there is no consensus on the naming of exaggerated, unregulated Internet use behavior, the expression most commonly used is Problematic Internet Use (PIU) (Casale et al., 2016a; Mei et al., 2016; Mihara et al., 2016; Öztürk & Özmen, 2016; Calvete et al., 2017; Dunbar et al., 2017; Park & Lee, 2017; Öksüz et al., 2018; Laconi et al., 2019; Liu et al., 2021; Sayeed et al., 2021). Other research studies used the terms Internet addiction (Brenner, 1997; Greenfield, 1999), Internet dependence (Scherer, 1997), pathological Internet use (Morahan-Martin & Schumacher, 2000; Davis, 2001), and Internet addiction disorder (Goldberg, 1996). As one of the most used terms in recent research (Shapira et al., 2003; Aboujaoude, 2010; Caplan, 2010; Spada, 2014; Mihara et al., 2016; Prievara et al., 2018; Laconi et al., 2019), the term PIU was used in the research to refer to uncontrollable, excessive, and unregulated use of the Internet.

As with naming, there is no consensus on identifying the clinical nature of this condition. Several studies have identified PIU as a disorder (Young, 1998; Monaghan, 2014; Brand et al., 2016). Although PIU has not been officially identified as a disorder, the DSM-5 working group included Internet gaming disorder as a "condition for further research" (American Psychiatric Association [APA], 2013, p. 795). However, reducing the diagnosis to a single-use type (gaming) has been criticized in the literature for limiting its scope to many potential abuses of Internet technology (Monaghan, 2014; Brand et al., 2016; Kuss & Lopez-Fernandez, 2016). For this reason, the literature proposes a solution that characterizes this disorder as "Internet use disorder" and adds subtypes to it (Monaghan, 2014).

A growing body of research has focused on PIU, and many studies have aimed to develop measurement instruments. One of the most widely used instruments is the Generalized Problematic Internet Use Scale-2 (GPIUS2), a theory-based multidimensional psychometric instrument (Caplan, 2010), a revised and updated version of the Generalized Problematic Internet Use Scale (GPIUS) measurement instrument (Caplan, 2005) in English. The GPIUS2 consists of 15 items that measure cognitions, behaviors, and outcomes of generalized problematic Internet use. It is based on Davis's (2001) cognitive-behavioral model of generalized problematic Internet use.

In their review, Laconi et al. (2014) examined 45 measurement instruments related to Internet addiction and found that the psychometric properties of only 17 of these instruments were assessed at least twice. They also emphasized the need for further investigation of the effectiveness and reliability of these instruments in different cultural contexts. In this review, the GPIUS2 is considered one of the most widely used and promising measurement instruments. To date, the psychometric properties of the GPIUS2 have been tested and validated in many cultures, including Italian (Casale et al., 2016b), Spanish (Gámez Guadix et al., 2013), Mexican (Gámez-Guadix et al., 2012), German (Barke et al., 2014), and Portuguese (Pontes et al., 2016) samples of adolescents and young adults. In all of these studies, the GPIUS2 is found valid and reliable in measuring PIU. However, the GPIUS2 has been criticized in some validation studies for not consistently using an 8-point Likert scale (Laconi et al., 2014). Instead, 5-, 6-, or 7-point Likert scales have been used (Gámez-Guadix et al., 2012; Barke et al., 2014; Pontes et al., 2016). Therefore, this 8-point scale needs further verification.

In the cultural context of Turkey, the reliability and validity of the GPIUS2 have been investigated (Deniz & Ünal, 2016); however, two important drawbacks were identified in this adaptation. First, in the original GPIUS2, some items are expressed in the simple

present tense and some in the perfect tense. In the Turkish scale, the items with the present perfect are expressed as past perfect. Since it is assumed that the past perfect cannot reflect the current situation, the corresponding items are found to be insufficient in conveying the expected meaning of the original scale. Second, although the internal consistency coefficient of Cronbach's alpha for the GPIUS2 subscale "preference for online social interaction" is 0.50, this low value could not be explained. For the above reasons and in line with the recommendations of Laconi et al. (2014), it was decided to retranslate and validate the psychometric properties of the Turkish GPIUS2.

Examination of the literature on measuring PIU revealed several drawbacks. Time spent online has been identified in several surveys as an indicator of PIU (Young, 1998; Armstrong et al., 2000); however, professionals whose jobs require Internet use may be the cause of increased Internet use hours (Monaghan, 2014). Moreover, the literature has shown that as Internet use for academic purposes increases, PIU decreases (Romero-Rodríguez et al., 2021). On the other hand, longer hours of recreational and social Internet use lead to higher PIU (Aparicio-Martinez et al., 2020; Balhara et al., 2021; Brino et al., 2021; Romero-Rodríguez et al., 2021). In this sense, in the PIU literature, investigating problematic use without separating Internet use patterns (IUP) by sub-purposes (Jelenchick et al., 2014; Monaghan, 2014; Mei et al., 2016) has been shown to be a shortcoming. Therefore, in addition to examining the psychometric properties of the Turkish version of the GPIUS2, this study aimed to investigate the relationship between PIU and IUP.

Defining Internet Use Categories

As far as researchers are aware, there are only a limited number of studies that categorize IUP by underutilization. In their study to develop the Problematic and Risky Internet Use Screening Scale, Jelenchick et al. (2014) suggested that Internet use be categorized as either recreational or school-work. Monaghan (2014) used the same terminology and labeled all activities outside of school and work as recreational. The distinction of use categories such as social networking, academic activities, and online gaming was also addressed by Mei et al. (2016). Considering all these aspects, most studies classify school-work or academic activities as a type of Internet use. Since this study aimed to investigate university students' IUP, it was decided to refer to this type of use as "academic" rather than school-work. In its early years of public use, the Internet was mainly used for interpersonal communication (Kraut et al., 1998). In addition, there is a growing body of research on social Internet use (Rosen et al., 2013; Lau, 2017; Giunchiglia et al., 2018), and the GPIUS2 includes a subfactor for social Internet use (preference for online social interaction). Consequently, "social" Internet use is also identified as a type of use. Apart from social purposes, the Internet has evolved into a variety of functions that allow users to spend their time in different ways, such as watching movies, listening to music, searching for entertainment, and playing online games. Recreational use is the term used to describe these behaviors (Kim, 2011; Li et al., 2015). Consequently, "recreational" use has been chosen as the final category that encompasses the above activities. In this regard, in this study, it was decided to divide IUP into academic, social, and recreational categories. In line with this classification, to fill the gap in the literature, the purpose of this study is twofold:

- First, to validate and test the psychometric properties of the Turkish version of the GPIUS2.
- Second, to clarify the current relationship between the PIU and IUP of university students.

Method

The present study includes two cross-sectional studies conducted 1 year apart at two different public universities in Turkey. Since random sampling was difficult to achieve in both studies, convenience sampling was preferred due to the availability and willingness of the participants (Fraenkel et al., 1993).

Initial Study

Participants and Procedure

The initial study aimed to test the psychometric properties of the Turkish version of the GPIUS2 for young adults by conducting an Exploratory Factor Analysis (EFA) with 150 students (106 females, 44 males) and a Confirmatory Factor Analysis (CFA) with 178 students (114 females, 64 males) from the first university in the 2017–2018 fall term. The native language of participants and language of instruction was Turkish, and this university is located in the Eastern Anatolian Region.

Data Collection Tools

A questionnaire package that includes demographic and academic information (gender, age, and grade point average [GPA]), the first version of Internet Use Patterns Questionnaire (IUPQ), and the translated version of the GPIUS2 was utilized. Details about the IUPQ and the Turkish version of the GPIUS2 are provided below.

Internet Use Pattern Questionnaire The IUPQ was adapted from Monaghan's (2014) "Questionnaire on Use of the Internet and Related Behavior" in line with the literature review (Weiser, 2000; Choi & DiNitto, 2013; Monaghan, 2014; Kemp, 2017, 2018) and expert opinion (one from psychology department and three from instructional technology department). Based on the experts' suggestions, some sentences were revised to make them clearer and easier to understand, and an item about WhatsApp used extensively in Turkey was added in the questionnaire. From Monaghan's (2014) questionnaire, four questions on "the daily Internet use durations" (1 — whether people use the Internet every day, 2 — what the duration of the use is, 3 — whether they use the Internet outside of school and work, and 4 — what the duration of the use is) were adapted as "Approximately how many minutes do you use the Internet for academic/social/recreational purposes per day/week?" Additionally, 14 yes/no type questions on "Internet use purposes" were classified, adapted, and used to indicate *social* (four questions), *recreational* (two of the nine questions merged [1 — online buying and 2 — online selling merged as online shopping] to create eight questions), and *academic* (one question) purposes. Then, the researchers created four more questions regarding academic Internet use, and two more questions regarding social Internet use purposes considering both the literature review (Weiser, 2000; Choi & DiNitto,

2013; Monaghan, 2014; Kemp, 2017, 2018) and the Internet use context of Turkey. A total of 19 academic, social, and recreational Internet use purpose items were formed as yes/no type questions. To be more specific, "academic use" consists of five items (one adapted and four created): creating informative educational content on the Internet (adapted), sharing academic information on social networks (created), using MOOCS and online encyclopedias (created), using learning management systems (created), and accessing informative educational content (created). "Social use" consisted of six items (four adapted and two created), including use of direct messaging on social networks (adapted), use of WhatsApp (created), commenting on shared posts on social networks (adapted), creating posts for interaction purposes (created), commenting on online questions for communication purposes (adapted), and use of flirting apps (adapted). "Recreational use" had eight items (all nine items adapted, two of them online buying and online selling, which merged into online shopping), and the items were as follows: listening to music, watching videos/movies, searching the Internet, reading information from interesting websites, viewing photos, watching videos on social networks, individual gaming, multiplayer online gaming, online shopping, and reading books on Kindle. In addition, the "other" option in open-ended form was created under each use type to enable additional answers for each use type. Table 1 presents the sample questions for each use type.

IUPQ was piloted with the participants of the initial study. Based on the findings, several improvements were made regarding survey design, question order, and statements.

Translated Version of the Generalized Problematic Internet Use Scale-2 The GPIUS2, the revised and updated version of the GPIUS measurement tool, is a theory-driven multidimensional psychometric tool written in the English language (Caplan, 2010). The GPIUS2 questionnaire contains 15 items that examine generalized problematic Internet use cognitions, behaviors, and outcomes. It is based on Davis's (2001) cognitive-behavioral model of PIU in general. Overall, the scale has a reliability of = 0.91. There are four constructs of the scale: 1 — *preference for online social interaction*; 2 — *mood regulation*; 3 — *deficient self-regulation* (3.1 — *compulsive use subscale*, 3.2 — *cognitive preoccupation subscale*), and 4 — *negative outcomes*. The GPIUS2 has a total of 5 factors as *deficient self-regulation* is a second-order factor with two first-order factors. Each factor consists of three items that are scored on an 8-point Likert scale (1 = "Strongly disagree"; … 8 = "Strongly agree"). The total score for the GPIUS2 index is computed by adding the scores of 15 items, and it ranges from 15 to 120. The higher the score, the more intense the

Table 1 Sample items for Internet use pattern questionnaire

Use type	Sample questions (Yes/No)
Academic	Accessing information from online encyclopedias, search engines, massive online open course resources or other educational resources (Google, Wikipedia, Coursera, edX, etc.)
Social	Socializing and chatting via WhatsApp
Recreational	Listening to music, watching videos/movies (YouTube, Netflix, Fizy, Spotify, Puhutv, online series/movie sites, etc.)

PIU. The data fit the model well, according to confirmatory factor analysis (CFA) results (Caplan, 2010).

The GPIUS2's original scale was translated into Turkish by a language expert in the translation process. The researchers then altered some terms in the translated scale, such as "online" and "offline," because these terms are not used in Turkish in the same way that they are in the original. The original scale and the Turkish version of the scale were then compared by two experts in the instructional technology field, and various changes were made according to their recommendations. For example, if the word used has more than one equivalent in Turkish, the words that are commonly used in the context of the Internet were preferred. For some items, prepositions were added to ensure the integrity of the Turkish meaning. Face validity of the scale was verified through an interview with an expert from the instructional technology field. The GPIUS2 items are shown in Table 2.

Data Analysis

After checking the assumptions, EFA was performed to understand how many dimensions are necessary to explain the relationships between the observed variables of the Turkish version of the GPIUS2, and CFA was performed to understand whether the factor structure of the scale is applicable to Turkish students or not. IBM SPSS 26 and AMOS 21 were used for the analyses.

Prior to the EFA, the correlation matrix was examined to see if there was a correlation greater than 0.30 between the pairs of variables (Tabachnick & Fidell, 2007). A Kaiser–Meyer–Olkin value greater than 0.50 (Hair et al., 2010) was used as a criterion for sample size adequacy. The scree plot breakpoint and eigenvalues greater than 1 (Kaiser, 1960) were used as indicators of factor number. To determine the rotation method, correlations between factors were examined as they have a theoretical basis (Field, 2009). The

Table 2 Items of the GPIUS2

Variable name	Description of the variable
GPIUS2-1	I prefer online social interaction over face-to-face communication
GPIUS2-2	I have used the Internet to talk with others when I was feeling isolated
GPIUS2-3	When I haven't been online for some time, I become preoccupied with the thought of going online
GPIUS2-4	I have difficulty controlling the amount of time I spend online
GPIUS2-5	My Internet use has made it difficult for me to manage my life
GPIUS2-6	Online social interaction is more comfortable for me than face-to-face interaction
GPIUS2-7	I have used the Internet to make myself feel better when I was down
GPIUS2-8	I would feel lost if I was unable to go online
GPIUS2-9	I find it difficult to control my Internet use
GPIUS2-10	I have missed social engagements or activities because of my Internet use
GPIUS2-11	I prefer communicating with people online rather than face-to-face
GPIUS2-12	I have used the Internet to make myself feel better when I've felt upset
GPIUS2-13	I think obsessively about going online when I am offline
GPIUS2-14	When offline, I have a hard time trying to resist the urge to go online
GPIUS2-15	My Internet use has created problems for me in my life

total variance explained was examined in accordance with Hair et al.'s (2010) recommendation of a value greater than 60% for the social sciences.

A CFA was performed to determine whether or not the factor structure of the original scale could be confirmed in Turkish culture. Regarding the sample size, the recommendation of Hair et al. (2010) was considered (five subjects per item). To measure the acceptability of the CFA model, several fit indices were examined. Overall goodness of fit was examined using χ^2/df (chi-square/degree of freedom), root-mean-square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), goodness of fit index (GFI), normed fit index (NFI), relative fit index (RFI), incremental fit index (IFI), adjusted goodness of fit index (AGFI), and Tucker-Lewis index (TLI). It is recommended to use the above statistics as each of them provides different information about model fit (Brown & Moore, 2012). CFI, GFI, NFI, RFI, IFI, AGFI, and TLI should have at least a value of 0.90 and 0.95 is accepted as a perfect value (Hooper et al., 2008). Moreover, RMSEA values smaller than 0.05 show excellent fit and values between 0.05 and 0.08 show good and acceptable fit (Brown, 2015). Regarding factor loadings, Stevens (2012) suggests that factor loadings for each item should be greater than 0.40.

Follow-Up Study

Participants and Procedure

The follow-up study aimed to further validate the psychometric properties of the Turkish version of the GPIUS2 for young adults and to examine the IUP with 479 students (291 females, 188 males) from the second university in the fall semester of 2018–2019. The native language of the participants was Turkish and the language of instruction at the university was English. This well-known university is located in the Central Anatolian Region.

Data Collection Tools

In the follow-up study, the Turkish version of the GPIUS2 was used, which consisted of 14 items and a 3-factor structure. In addition, the IUPQ in its final form was implemented. Based on the results of the pilot study, several improvements were made in IUPQ about design, question order, and statements: The pilot IUPQ asked first about the duration of Internet use and then about the frequency of subtypes of Internet use. The final version asked first about frequency of subtypes and then about duration of use so that participants could make more accurate predictions about the duration of their Internet use. It was also found that some participants were confused during the pilot application because questions were asked about three different types of Internet use, namely, academic, social, and recreational. For this reason, the IUPQ for the final application was created with a table design to make the distinction between the three different types of Internet use clearer. In addition, some phrases missed by participants were made more prominent by changing the word choice and writing style.

Data Analysis

A follow-up CFA was performed for the Turkish version of the GPIUS2. Pearson correlation, independent samples *t*-test, and ANOVA were performed for demographic information, PIU, and academic, social, recreational IUP. IBM SPSS 26 and AMOS 21 were used

for analyses. For follow-up CFA, as in the first study, overall goodness of fit was examined by χ^2/df, RMSEA, SRMR, CFI, GFI, NFI, RFI, IFI, AGFI, and TLI.

Results

Initial Study

Exploratory Factor Analysis for Translated Version of Generalized Problematic Internet Use Scale-2

The factorability of the Turkish version of the GPIUS2 was investigated using the correlation matrix. The results showed reasonable correlations between the observable variables. The KMO value and Bartlett score is 0.86, and Bartlett's test for sphericity is significant ($p < 0.05$). Therefore, the assumption of sample size adequacy is met. The breakpoint of the Scree plot, eigenvalues greater than 1, provides the proofs of three factors for the translated version of the GPIUS2. Principal axis factoring was preferred as the extraction method because the *p*-value of the Mardia test was significant. Oblique rotation was preferred when performing EFA.

We reviewed the pattern matrix and found that GPIUS2-3 loads on two different factors with values 0.48 (on F1) and 0.35 (on F2). The literature suggests that there should be a difference of 0.15 or more between two factor loadings. GPIUS2-3 does not meet this criterion. Therefore, we decided to remove this item. Without GPIUS2-3, a new EFA was performed. The above assumptions of the EFA were also met with the new 14 item scale. Then we reviewed the correlation matrix of the factors (see Table 3).

Then, the Scree plot was examined to see the potential factor number. The Scree plot is presented in Fig. 1.

Table 3 Correlation matrix for translated GPIUS2

	I1	I2	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15
I1	-													
I2	0.21	-												
I4	0.09	0.22	-											
I5	0.07	0.12	**0.77**	-										
I6	0.29	**0.32**	0.10	0.13	-									
I7	0.11	**0.33**	**0.32**	0.29	0.24	-								
I8	0.18	0.26	**0.44**	**0.46**	**0.34**	**0.33**	-							
I9	0.03	0.17	**0.76**	**0.70**	0.08	**0.35**	**0.49**	-						
I10	0.16	0.25	**0.41**	**0.43**	0.19	**0.32**	**0.54**	**0.49**	-					
I11	**0.38**	**0.38**	0.17	0.20	**0.37**	0.11	**0.34**	0.22	**0.42**	-				
I12	0.20	**0.37**	0.26	0.23	0.19	**0.82**	**0.34**	**0.30**	**0.36**	0.19	-			
I13	0.23	0.27	**0.51**	**0.46**	0.22	**0.45**	**0.64**	**0.52**	**0.50**	0.23	**0.50**	-		
I14	0.15	0.20	**0.50**	**0.55**	0.15	**0.40**	**0.56**	**0.60**	**0.49**	0.21	**0.38**	**0.73**	-	
I15	0.22	0.23	**0.54**	**0.59**	0.10	0.23	**0.43**	**0.54**	**0.46**	0.26	0.22	**0.54**	**0.58**	-

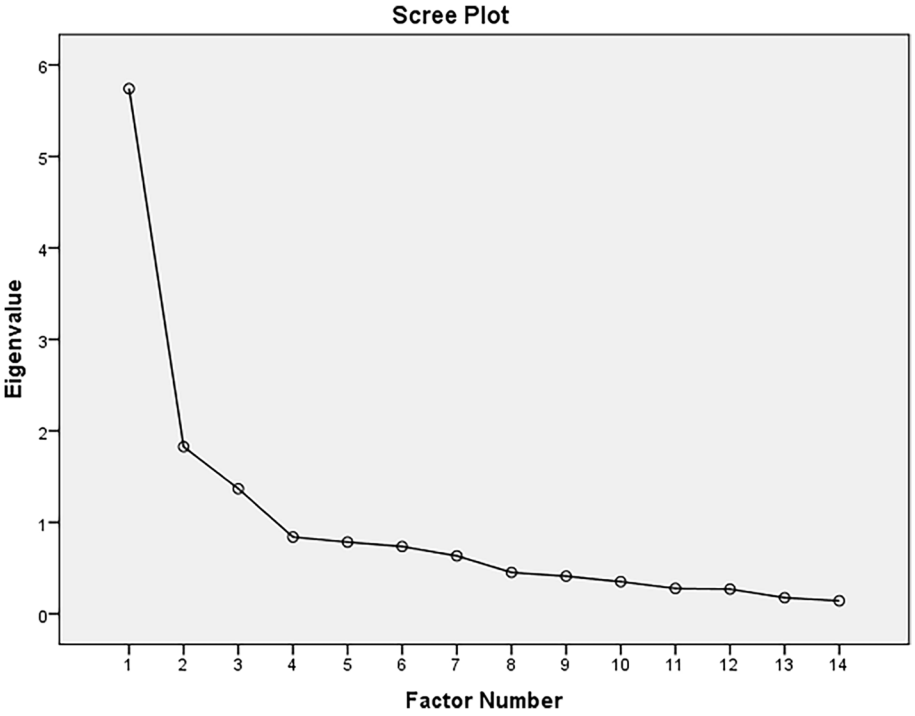

Fig. 1 Scree plot

Table 4 Summary of factor loadings for Oblimin three-factor solution for translated GPIUS2

Variable name	Factor loadings		
	F1	F2	F3
GPIUS2-5	**0.88**	−0.07	−0.10
GPIUS2-9	**0.87**	0.02	−0.12
GPIUS2-4	**0.85**	−0.01	-0.11
GPIUS2-15	**0.69**	−0.08	0.13
GPIUS2-14	**0.67**	0.16	0.05
GPIUS2-13	**0.56**	0.27	0.14
GPIUS2-8	**0.51**	0.08	0.30
GPIUS2-10	**0.48**	0.07	0.29
GPIUS2-7	0.06	**0.90**	0.05
GPIUS2-12	−0.01	**0.88**	−0.08
GPIUS2-11	0.09	−0.15	**0.75**
GPIUS2-6	−0.03	0.07	**0.53**
GPIUS2-1	−0.02	−0.01	**0.50**
GPIUS2-2	0.01	0.22	**0.41**
Factor correlations			
Factor 1	**-**		
Factor 2	0.39	-	
Factor 3	0.34	0.36	

Bold face indicates related factor loadings

For the first factor, factor loadings ranged from 0.88 to 0.48 with eight items, for the second factor from 0.90 to 0.88 with two items, and for the third factor from 0.75 to 0.41 with 4 items. Table 4 shows the factor structure of the translated GPIUS2.

The initial eigenvalues were examined to see what variances were explained by these three factors individually and together. The first factor explained 41.00% of the variance, the second factor explained 13.04% of the variance, and the third factor explained 9.77% of the variance. In total, 63.81% of the variance was explained by all factors. Table 5 shows the eigenvalues, percentage of variance, and cumulative percentage for the factors in the scale.

The original scale consists of four factors, namely, 1 — preference for online social interaction, 2 — mood regulation, 3 — deficient self-regulation (3.1 — compulsive use subscale, 3.2 — cognitive preoccupation subscale), and 4 — negative outcomes. In light of the above information, three factor structures are determined for this scale. In the original scale, *the preference for online social interaction* factor includes GPIUS2-1, GPIUS2-6, and GPIUS2-11. In the translated version, in addition to GPIUS2-1 = 0.50, GPIUS2-6 = 0.53, and GPIUS2-11 = 0.75 items, GPIUS2-2 = 0.41 also loaded on this factor, which loaded on the mood regulation factor in the original scale. GPIUS2-7 and GPIUS2-12, which loaded on the factor mood regulation in the original scale, also loaded on the same factor in the Turkish version with GPIUS2-7 = 0.91, GPIUS2-12 = 0.89 factor loadings. GPIUS2-4 = 0.81, GPIUS2-8 = 0.64, GPIUS2-9 = 0.84, GPIUS2-13 = 0.71, and GPIUS2-14 = 0.75 items loaded on the factor deficient self-regulation, which is a second order factor in the original scale. In addition to these items, GPIUS2-5 = 0.82, GPIUS2-10 = 0.60, and GPIUS2-15 = 0.71 also loaded on the factor deficient self-regulation, which was part of the factor negative outcomes in the original scale. The results of the reliability analysis showed that the deficient self-regulation factor with Cronbach's $\alpha = 0.91$ and the mood regulation factor with Cronbach's $\alpha = 0.90$ had internal consistency values and reflected good reliability. The internal consistency of preference for online social interaction, on the other hand, was found to be Cronbach's $\alpha = 0.65$, which is a relatively low value. However, it is still acceptable in the social sciences for exploratory research (MacCallum et al., 1994; George & Mallery, 2003). Based on the EFA results, the Turkish version of the GPIUS2 is thus a valid and reliable scale consisting of three factors, namely, deficient *self-regulation*, *mood regulation*, and *preference for online social interaction*, explaining 63.81% of the total variance.

Confirmatory Factor Analysis for the Translated Version of the Generalized Problematic Internet Use Scale-2

Sample size assumption was met with 178 university students (114 female, 66 male) for the 14-item scale. The results show that the Turkish version of the GPIUS2 has an acceptable χ^2/df value of 1.62. For this study, the RMSEA value was 0.06, 95% CI (0.04, 0.08), showing good fit. The other critical values were as follows: SRMR = 0.05, CFI = 0.95,

Table 5 Eigenvalues, percentages of variance, and cumulative percentage for factors of translated GPIUS2

Factor	Eigenvalues	% of variance	Cumulative %
1	5.74	41.00	41.00
2	1.83	13.04	54.05
3	1.37	9.77	63.81

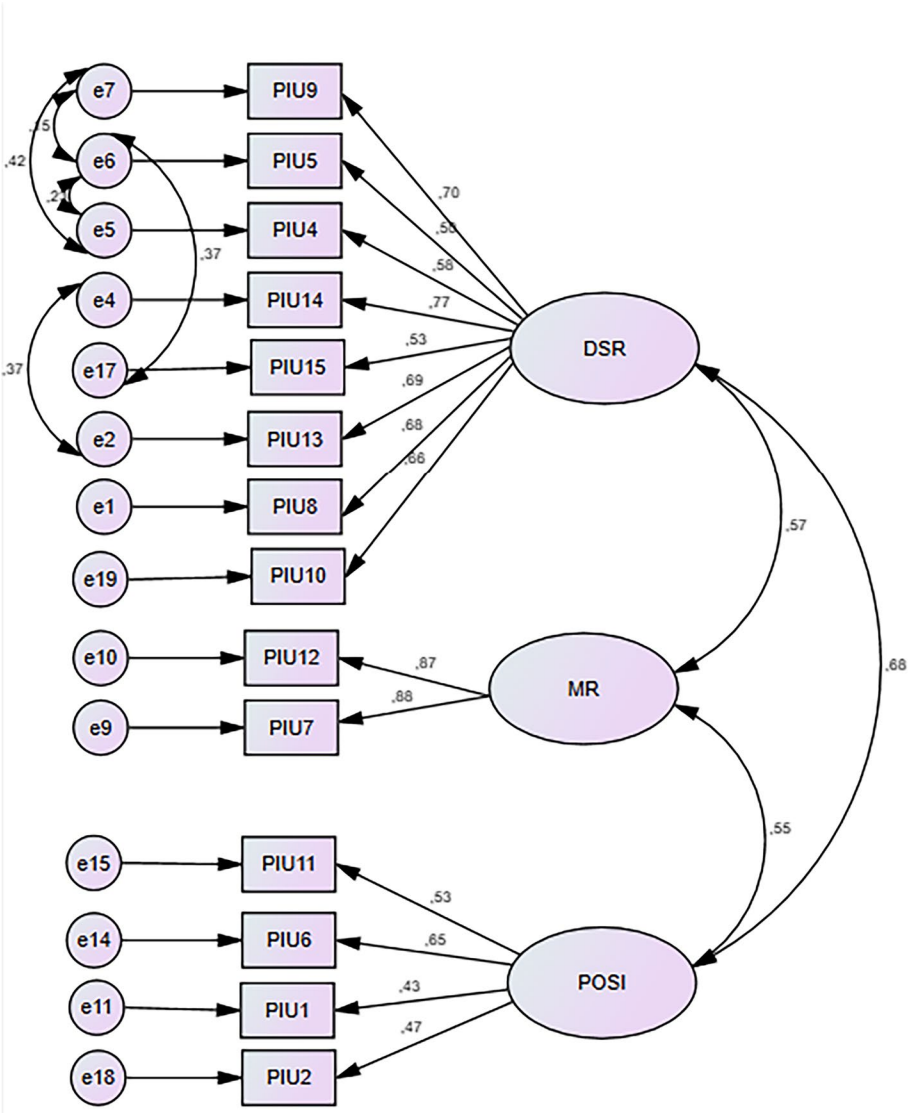

Fig. 2 Item-factor structure of Turkish GPIUS2. Note: DSR deficient self-regulation, MR mood regulation, POSI preference for online social interaction

GFI = 0.92, NFI = 0.89, RFI = 0.85, IFI = 0.95, AGFI = 0.88, and TLI = 0.94. As seen, the NFI, RFI, and AGFI values were below the acceptable limits, but they were very close to the acceptable lower limit of 0.90. Based on the criteria reported in the literature, the CFA model has both acceptable and perfect values. Based on the standardized path diagrams, the items of the current scale ensure factor loadings that are above the criterion of 0.40 (see Fig. 2).

This initial study aimed to find out how many dimensions are necessary to explain the relationships between the observed variables of the Turkish version of the GPIUS2 and whether or not the factor structure of the scale is applicable to Turkish students. Based on the above results, the translated version of the GPIUS2 is a reliable, valid, and acceptable measurement instrument. Therefore, it can be used to measure the PIU of university students in Turkish.

Follow-Up Study

This follow-up study aimed to revalidate psychometric properties of the Turkish version of GPIUS-2 and examine the relationship between IUP and PIU. First, the results of the follow-up CFA and then the findings on the relationship between IUP and PIU are presented.

Follow-Up Confirmatory Factor Analysis for Translated Version of Generalized Problematic Internet Use Scale-2

483 participants from a well-known public university in Turkey participated in the study. Prior to analysis, missing data and incomplete responses were reviewed. Due to four highly problematic cases, the study sample consisted of $N=479$ students. There were some missing values, and in order not to lose the variation in the data, mean imputation was performed by replacing the missing values with the mean of the available cases. Table 6 shows the gender and age characteristics of the participants.

A CFA with 14 items and three factors was conducted to revalidate the factorial structure of the Turkish version of the GPIUS2. The adequacy of the sample size and the normality assumption were both met. Bootstrapping was used for the analysis due to the violation of multivariate normality assumption. To check linearity, bivariate scatter plots of the pairs of variables were examined since the presumed oval shape was observed. Regarding influential outliers, there were 16 cases that exceeded the cutoff of 36.12 at the alpha level of 0.001. Validity tests were performed with and without these outliers. The data set with outliers had a more stable structure. Therefore, no cases were excluded from the CFA analysis.

The model yielded an acceptable fit with indices $\chi^2/df=2.87$, $p=0.00$, TLI = 0.95, CFI = 0.97, SRMR = 0.046, and RMSEA = 0.06, 95% CI (0.05, 0.07). In addition, other critical values are as follows: GFI = 0.95, NFI = 0.95, RFI = 0.93, IFI = 0.97, and AGFI = 0.92. For the fit indices, a minimum value of 0.90 is accepted as a good value and

Table 6 Distribution of the gender and age group of the participants ($N=479$)

Gender	*f*	%
Female	291	60.8
Male	188	39.2
Age	*f*	%
17–18	22	4.6
19–20	230	48.0
21–22	124	25.9
23–24	84	17.5
25–37	19	4.0

Table 7 CFA indices of original, translated, and follow-up results of GPIUS2

	Original results	Initial results	Follow-up results
χ^2/df	5.14	1.62	2.87
RMSEA	0.07	0.06	0.06
SRMR	0.05	0.05	0.05
CFI	0.95	0.95	0.95
GFI	-	0.92	0.95
NFI	-	0.89	0.95
RFI	-	0.85	0.95
IFI	-	0.95	0.97
AGFI	-	0.88	0.92
TLI	-	0.94	0.95

0.95 as a perfect value. As seen, the RFI and AGFI values are the acceptable values and all others are perfect values. Based on these criteria, the present CFA model has both acceptable and perfect values. Table 7 shows the comparison of goodness-of-fit statistics for the original, translation, and follow-up results.

Reliability analyses were performed to determine the internal consistency of the factors. The results showed that Cronbach's alpha for deficient self-regulation was 0.91, for mood regulation, 0.91, and preference for online social interaction 0.69.

Based on the follow-up results, it is again proved that the translated version of the GPIUS2 is a reliable, valid, and acceptable measurement instrument with three factors and 14 items: deficient self-regulation, mood regulation, and preference for online social interaction. Therefore, it can be used to measure university students' PIU behavior in Turkish.

Relationship Among Demographics, Problematic Internet Use, and Internet Use Patterns

This section examined the relationship between demographic information, PIU, and IUP. Participants' IUP was examined using Internet use duration for each use type and frequency of Internet use for each use type (academic, social, and recreational). In Table 8, participants' daily academic, social, and recreational Internet use durations (in minutes) and number of academic, social, and recreational Internet sub-uses are presented.

Table 8 Amount of time spent on and number of academic, social, and recreational Internet use types

Amount of time participants spend on academic, social, and recreational Internet use type in a day

Use Type	*M* (minutes)	*SD*
Academic	104.92	71.45
Social	134.64	125.89
Recreational	134.55	102.32

Number of academic, social, and recreational Internet use types

Use type	*M*	*SD*	*Min*	*Max*
Academic	3.52	1.07	1	5
Social	2.72	1.32	1	6
Recreational	3.95	1.55	1	8

No significant gender differences were found with respect to PIU. The relationships between age and PIU, on the one hand, and GPA and PIU, on the other, were not significant. To examine the relationship between duration of academic, social, and recreational Internet use and PIU, several correlation analyses were conducted. The results showed a small negative correlation between duration of academic Internet use and PIU $r = -0.11$, $n = 431$, $p = 0.026$.; a small positive correlation between duration of social Internet use and PIU $r = 0.28$, $n = 431$, $p = 0.000$; and duration of recreational Internet use and PIU $r = 0.23$, $n = 431$, $p = 0.000$. There were no significant correlations between frequency of academic and recreational Internet use and PIU. However, overall frequency of social Internet use correlated positively with PIU with a low correlation $r = 0.24$, $n = 431$, $p < 0.001$.

Relationship Between Internet Use Duration and Demographic Information According to independent samples *t*-test analysis results, there were no significant gender differences in PIU and academic, social, and recreational Internet use duration. Besides, there was no significant relationship between age and recreational Internet use duration. There was a positive low correlation between age and academic Internet use duration, $r = 0.14$, $n = 431$, $p = 0.004$, and a negative low correlation between age and social Internet use duration, $r = -0.12$, $n = 431$, $p = 0.012$. There was no significant relationship between GPA and academic, social, and recreational Internet use duration.

Relationship Between Internet Use Purpose Frequencies and Demographic Information There were no significant gender differences in the frequency of Internet use for academic, social, and recreational purposes. There was no significant association between age and frequency of academic, social, and recreational Internet use. There was no significant relationship between GPA and frequency of Internet use for academic, social, and recreational purposes.

In the follow-up study, the Turkish version of the GPIUS2 was revalidated. In addition, the relationship between IUP and PIU was examined based on the duration of academic, social, and recreational Internet use, as well as the frequency of use. It was found that duration of Internet use was related to PIU for all types of use, but frequency of use was related only for social use.

Discussion

Factor Analysis Results

The current study tested the psychometric properties of the Turkish version of the GPIUS2 and conducted a follow-up study after a year. Factor analyses revealed that the translated version of the GPIUS2 is a reliable, valid, and acceptable measurement tool with 14 items belong to three factors: deficient self-regulation with eight items, mood regulation with two items, and preference for online social interaction with four items. Cronbach alpha values for deficient self-regulation and mood regulation were quite high for both of the studies; on the other hand, for preference for online social interaction, it was lower than the acceptable criteria 0.70 (0.65 for the initial study, 0.69 for the follow-up study). However, these values were very close to the acceptable criteria 0.70 and found adequate in the literature (Nunnally, 1978; Cortina, 1993).

In the original scale, there were four factors: deficient self-regulation, mood regulation, preference for online social interaction, and negative outcomes, and the factor deficient self-regulation had two subfactors, cognitive preoccupation and compulsive Internet use (with three items each). In the Turkish version of the GPIUS2, the subdimensions of deficient self-regulation did not occur separately, and one item of cognitive preoccupation ("When I haven't been online for some time, I become preoccupied with the thought of going online") loaded on both deficient self-regulation (0.48) and mood regulation (0.35) in the translated version. One explanation for these loadings could be that being preoccupied with the Internet also might mean that mood needs to be regulated. Also, the difference between two factor loadings should be at least 0.15 or higher. Since this item did not meet this criterion, the decision was made to delete it. In addition, all items in the negative outcome factor in the original scale also loaded on the deficient self-regulation factor. Caplan (2010) stated that the subfactors of deficient self-regulation represent the behavioral and cognitive dimensions of poor self-regulation. When cognitive symptoms are severe enough, behavioral symptoms occur, eventually leading to negative outcomes. In the current studies conducted 7 and 8 years after the development of the GPIUS2, it was observed that the distinction between cognitive and behavioral aspects of deficient self-regulation and its negative consequences disappears. This could be related to the increase in the prevalence, duration, and variety of Internet use. According to a study on Internet use in 2011, 30% of the world's population were Internet users and 22% were social media users. In recent years, the percentage has increased to 57% Internet users and 45% social media users (Kemp, 2019). In 2011, the duration of Internet use with laptops was 43 min and with mobile devices 32 min. (Zenith, 2019). Currently, this duration has increased to 6 h and 42 min with both devices per day. In addition to the increase in prevalence and duration, the type of Internet use has also diversified. Based on 2018 data, 92% of Internet users watch videos online, 58% stream TV content, 30% play live stream games, 23% watch live stream games, and 16% watch e-sports over the Internet (Kemp, 2019). Seven or 8 years earlier, such diversity and prevalence of Internet use did not exist. Moreover, some of the popular social media platforms such as Instagram, Snapchat, Periscope, Vine, and Pinterest only entered our lives after 2010. That is, the duration, prevalence, and types of Internet use have increased and diversified from 2010 to 2017–2018. This may be the reason for the appearance of cognitive preoccupation, compulsive use, and negative outcomes in a single factor, which previously appeared as different factors. On the other hand, the contents of negative outcomes items reflect deficient self-regulation. As mentioned earlier, deficient self-regulation is characterized by decreased self-control (LaRose et al., 2003). Furthermore, Caplan (2010) expresses that deficient self-regulation refers to Bandura's (1986) definition of self-control — not adequately monitoring, assessing, and adjusting one's use of the Internet. In this regard, the items in the negative outcomes factor describe possible outcomes of decreased self-control and inadequate self-regulation. Based on these statements, the decision was made to include the above items under the deficient self-regulation factor. In addition, the correlation between deficient self-regulation and the above factors in the original scale was higher than 0.75, which also supports the current merge.

In the original scale, one item of the factor mood regulation loaded on the factor preference for online social interaction in the translated version. The reason for this might be as follows: the scale was developed in 2010, and in those years, communication via the Internet was one of the most common applications for regulating mood. In recent years, for mood regulation, people no longer communicate only with other people, but watch movies

and videos, listen to music from numerous sources, and achieve and generate diverse, rich content according to their interests. Considering these new and diverse activities, people prefer activities as attractive as communicating with other people to regulate their mood. Therefore, the social use of the Internet to regulate mood has shifted from the mood regulation factor to the preference for online social interaction factor. Because of this shift, the mood regulation factor has two items. In the literature, a factor with two items is considered reliable only if the variables are significantly related ($r > 0.70$), but not with other variables (Worthington & Whittaker, 2006). In this study, the correlation between Item7 and Item12 is 0.82 and the correlations between them and the other items are mostly in the range of 0.30 to 0.40. Therefore, this two-item factor meets the reliability criterion.

Relationship Among Demographics, Problematic Internet Use, and Internet Use Patterns

In the follow-up study, academic, social, and recreational IUP of university students and their relationship with PIU examined. No gender difference was found in PIU behavior, as was the case in some previous studies (Vigna-Taglianti et al., 2017; Yu et al., 2018). However, some studies have shown that males exhibit more PIU behavior (Shaw & Black, 2008; Anderson et al., 2017; Schimmenti et al., 2019), while others show that females exhibit more PIU behavior (Yang et al., 2019). The differences regarding gender and PIU relationship might indicate the existence of mediator variables (Anderson et al., 2017). There was no significant correlation between age and PIU, which is consistent with the results of previous studies (Poli & Agrimi, 2012; Soh et al., 2018).

Numerous studies investigated the relationship between PIU and academic performance and most of them claimed a negative relationship (Kubey et al., 2001; Kirschner & Karpinski, 2010; O'Brien, 2011; Eldeleklioğlu & Vural, 2013; Singh & Barmola, 2015; Lau, 2017; Strasser, 2017). However, in the current study, no significant relationship was found between PIU and academic performance. The majority of participants were first year students and most courses taken by first year students are those that can be mastered with the knowledge they bring from high school. The relationship between PIU and academic performance may have been non-significant for this reason. In addition, GPA alone may not be a reliable measure of academic performance. This could be another reason for the non-significant relationship. It might be beneficial to examine other variables that could mediate or moderate the relationships.

This study examined the relationship between IUP and PIU. The total time spent on each use type (Internet use duration) and the frequency of sub-uses under each use type (Internet use purpose frequency) determine IUP. PIU is negatively related to total time spent on academic activities. That is, as the duration of Internet use for academic purposes increases, problematic Internet use behavior decreases. The duration of Internet use is considered as a single variable in previous research focusing on it and is not divided into subtypes. Vally (2019) emphasized that the relationship between PIU and Internet use duration may be mediated by the preferred type of activity on the Internet. The results of the current study support this claim. While academic use duration is negatively correlated with the level of PIU (Romero-Rodríguez et al., 2021), social (Van Rooij et al., 2017; Brino et al., 2021), and recreational use durations (Beutel et al., 2011; Jelenchick et al., 2015; Romero-Rodríguez et al., 2021) are positively correlated with it. Although the correlations between academic, social, and recreational Internet use duration and PIU are significant, only the correlation between social Internet use purpose frequency and PIU is significant. PIU is

related to both frequency of social use and duration of social use. That is, social use behavior (frequency and duration) can be fully related to PIU. Moreover, it can be claimed that it is not the variety of academic and recreational uses, but the duration of these uses that is related to problematic behavior (Romero-Rodríguez et al., 2021).

Academic, social, and recreational Internet use duration and academic performance, as well as academic, social, and recreational Internet use purpose frequencies and academic performance, were found to have no significant relationship. The literature on the association between Internet use and academic performance found a negative relationship (Uzun & Kilis, 2019; Xu et al., 2019). These findings are in direct contradiction to those of the current study. Furthermore, Huang (2018) studied the association between social media use and academic performance in a meta-analysis study and discovered a slight negative association between social media use and academic performance. Some of the papers in this meta-analysis examined the associations between social media use and academic performance by focusing on Internet use duration, while others focused on Internet use frequency, but some also studied both factors. When duration and frequency were taken into account in the current investigation, non-significant associations appeared. It is possible that mediator variables account for these non-significant associations. While Uzun and Kilis (2019) reported a negative association between Internet use and academic performance, they also found a non-significant association between video gaming and academic performance, as well as a non-significant association between Internet searches and academic performance.

It is important to note for researchers that there are some limitations of the study. Although the psychometric measurements of the GPIUS2 in this study were conducted one year apart at two different universities with different student characteristics, the participants were selected through convenient sampling method in both studies.

PIU is a behavior with cognitive and behavioral components. For this reason, it might be difficult for individuals to objectively evaluate themselves in relation to such behavior. On the other hand, the study of problematic Internet use behaviors by an outside observer is often not an ethical or logical method of data collection. For this reason, only self-report data were obtained from individuals regarding PIU behaviors. The results of this study fall within this limitation.

This study is a study with young adults whose problematic Internet use is highlighted in the literature. Nowadays, technological tools and the Internet are more widely used by different age groups. However, the findings of this study are limited to young adults and not to other age groups.

Conclusion and Future Directions

In the current study, the psychometric properties of the Turkish version of the GPIUS2 were tested with young adults and a follow-up study was conducted after 1 year. The follow-up study also examined the academic, social, and recreational IUP of university students and their relationship with PIU. Factor analyses revealed that the translated version of the GPIUS2 is a reliable, valid, and acceptable measurement tool with 14 items belong to three factors: deficient self-regulation with eight items, mood regulation with two items, and preference for online social interaction with four items. Although the sample of the initial study and the follow-up study were demographically different (language of education, geographic region, and university success ranking), similar results were obtained in both

CFAs, i.e., the three-factor model was well fitted in both samples. Achieving similar results in two samples with different characteristics may indicate that the validity and reliability of the translated scale is high.

In the present study, patterns of Internet use were described in three categories: academic, social, and recreational, and accordingly, their relationship with problematic use was examined. It can be concluded from the findings that the duration of use outweighs the variety of subcategories of use in relation to problematic behavior. More specifically, problematic Internet use decreases among university students when their Internet use duration for academic purposes increases. In other words, individual use of the Internet for academic improvement is a situation that decreases problematic use. While the variety of academic and recreational Internet use did not affect the problematic use, it was observed that PIU increased when the duration of variety of social Internet use increased.

Based on the findings of this study, it is suggested that research studies should be conducted to investigate PIU and IUP, and their relationships further by considering developments in the field. The relationship between gender and PIU behavior is not significant in the current study. It varies in the literature. The differences in the results on the relationship between gender and PIU may be due to moderator or mediator variables such as online gaming and social media use which were not examined in this study. These variables need to be further investigated.

In the current study, there was no significant relationship between academic performance and PIU behavior. In this study, only GPA was examined as an indicator of academic performance. In future studies, investigating the relationship between PIU behavior and individual course, a semester or whole academic year performances will help better understand this relationship. Additionally, unlike the findings of this study, the literature on the relationship between Internet use and academic performance found a negative relationship (Uzun & Kilis, 2019; Xu et al., 2019). These results are in direct contradiction with those of the current study. Despite the fact that they contradict the results of the current study, this situation demonstrates the need for further research on the relationship between Internet use and academic performance.

In this study, the IUPQ was validated and refined by the researchers based on a previously developed Internet use patterns questionnaire. Validation of this questionnaire in future studies is important for two reasons: First, the items of the questionnaire were classified as academic, social, and recreational for the first time. Therefore, additional studies will increase its validity. Second, IUP are becoming more diverse, and the number of users and tools is increasing. For these reasons, this questionnaire should be constantly developed to be up to date.

Lastly, in addition to data collection instruments used in this study, qualitative data collection instruments may be implemented to collect qualitative data in future studies. The qualitative data may provide in-depth explanations about the relationships among the variables that may guide the researchers in developing an intervention to regulate PIU behavior.

Declarations

Ethical Committee Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Human Subjects Ethics Committee (Ref. No. 28620816/363) of Middle East Technical University, Ankara, Turkey.

Conflict of Interest The authors declare no competing interests.

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