

ORIGINAL ARTICLE

# *The Generalized Problematic Internet Use Scale 2 in a Polish sample: psychometric validation and relationship with specific Internet-related disorders and psychosocial functioning*

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## BACKGROUND

The present study aimed to adapt and psychometrically validate the Generalized Problematic Internet Use Scale 2 (GPIUS2) based on the cognitive-behavioral model of problematic Internet use. Furthermore, the study aimed to examine the relationship between problematic Internet use and other specific Internet-related disorders (i.e., social networking sites addiction, Facebook addiction, and problematic pornography use), as well as the relationships with indicators of poor psychosocial functioning.

## PARTICIPANTS AND PROCEDURE

GPIUS2 was administered to 1155 young Internet users. Participants completed a survey assessing problematic Internet use, specific Internet related-disorders, and indicators of poor psychosocial functioning (anxious and avoidant attachment, social anxiety, and loneliness) via two measuring contexts (online and offline).

## RESULTS

The results support a four-factor internal structure of the GPIUS2, similar to that initially proposed and the results

of the previous studies. GPIUS2 demonstrated good reliability as well as scalar invariance across online and offline measured contexts.

## CONCLUSIONS

Problematic Internet use is a multidimensional construct rather than a one-dimensional construct with strong but not overlapping positive relations with the other specific Internet-related disorders. Those relationships are especially strong among problematic activities related to the social context of Internet use. Furthermore, our findings prove the theoretical assumptions that psychosocial problems and poor social skills are related to problematic Internet use.

## KEY WORDS

problematic Internet use; insecure attachment; social anxiety; loneliness; scale adaptation

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## BACKGROUND

Problematic Internet use represents pattern of uncontrolled Internet consumption (Kuss & Lopez-Fernandez, 2016). Nonetheless, it has been questioned whether problematic Internet use reflects a maladaptive relation to the platform (i.e., the Internet per se) or a problematic relation to the content or activity performed (Starcevic & Billieux, 2017). Therefore, scholars further developed the conceptualization of specific problematic Internet use in the framework of specific Internet-related disorders, mainly based on the behavioral addictions theory and research (e.g., Brand et al., 2016).

Developing theory-driven and psychometrically robust measures to assess problematic Internet use could help better understand and classify excessive Internet use (Kuss & Lopez-Fernandez, 2016). In line with this, the present study aims to adapt and psychometrically validate the Generalized Problematic Internet Use Scale 2 (GPIUS2). Problematic Internet use might result from maladaptive cognitions and behaviors compounded by preexisting psychosocial problems, such as deficient social skills, loneliness, and/or depression (e.g., Brailovskaia et al., 2021; Marci et al., 2021; Sela et al., 2020). Furthermore, both problematic Internet use and specific Internet-related disorders, especially those connected with applications used for socializing, as well as sexual or relational purposes, are positively related to psychosocial problems (e.g., Tokunaga, 2017). Therefore, we aimed to examine the relationships between problematic Internet use and specific Internet-related disorders (i.e., social networking sites addiction, Facebook addiction, or problematic pornography use), as well as the relationships with indicators of poor psychosocial functioning.

### THEORETICAL MODEL OF PROBLEMATIC INTERNET USE

A cognitive-behavioral model of problematic Internet use (Davis, 2001) conceptualized it as a multidimensional syndrome consisting of the emotional, cognitive, and behavioral symptoms that lead to difficulties in using the Internet and dealing with one's daily functioning. Based on what type of activity an individual is mainly engaged in, it was proposed that problematic Internet use can be divided into generalized and specific. Generalized problematic Internet use is a set of symptoms containing maladaptive cognition and compulsive behaviors that are not linked to any particular Internet function or application, but to the communicative context of the Internet (Caplan, 2002). Meanwhile, specific problematic Internet use is related to overusing the Internet for a particular purpose, for example, socializing (i.e., social net-

working sites) or sexual activity (i.e., pornography consumption; Davis, 2001). Caplan (e.g., 2002, 2006, 2010) developed the conceptual framework of the cognitive-behavioral model, mainly focusing on generalized problematic Internet use and highlighting the role of interpersonal problems and social deficits leading to deficient self-regulation of Internet use. Internet users with psychosocial deficits may prefer online interactions over face-to-face conversations, which may cause both cognitive (preoccupation with the Internet) and behavioral (compulsive Internet use) symptoms of deficient self-regulation. The link between maladaptive cognition and deficient self-regulation is strengthened by the motivation to use the Internet to regulate one's mood. When behavior becomes compulsive, and an individual no longer has control over his/her use, it might interfere with everyday activities, resulting in negative outcomes. According to the abovementioned mechanism, the updated cognitive-behavioral model of problematic Internet use comprises four core components: preference for online social interaction (POSI), mood regulation, deficient self-regulation, and negative outcomes (see Caplan, 2010, for more detail).

### THE GENERALIZED PROBLEMATIC INTERNET USE SCALE 2

Based on the two-step approach proposed by Anderson and Gerbing (1988), Caplan developed the theory of problematic Internet use, which was further validated through both measurement and structural models. The Generalized Problematic Internet Use Scale 2 is an updated version of the 29-item Generalized Problematic Internet Use Scale (GPIUS), previously based on Davis' cognitive-behavioral model (Caplan, 2002). The revised version is a 15-item questionnaire, with four core dimensions (POSI, mood regulation, deficient self-regulation, and negative outcomes) where one dimension (i.e., deficient self-regulation) contains two sub-dimensions: cognitive preoccupation and compulsive Internet use. The scale's structure reflects the conceptual model of problematic Internet use (Caplan, 2010). The psychometric properties of the GPIUS2 have been verified in German (Barke et al., 2014), French (Laconi et al., 2018), Italian (Casale et al., 2015; Fioravanti et al., 2013), Mexican (Gómez-Guadix et al., 2012), Spanish (Gómez-Guadix et al., 2013), Portuguese (Pontes et al., 2016), and Polish (Probiez et al., 2020) samples. Although some analyses produced a five-factor solution (Barke et al., 2014; Probiez et al., 2020), most of the analyses produced a four-factor solution, with four first-order factors with POSI, mood regulation, deficient self-regulation, and negative outcomes (Casale et al., 2015; Fioravanti et al., 2013; Gómez-Guadix et al., 2012, 2013; Laconi et al., 2018; Pontes et al.,

2016). Further, some yielded correlations of error variances between particular items (Fioravanti et al., 2013; Pontes et al., 2016). The scale was also adopted and used to measure other specific Internet-related disorders (e.g., problematic Facebook use) in other Italian (Marino et al., 2017) and Portuguese (Assunção & Matos, 2017) samples. Previous studies have examined the measurement equivalence of the scale across different groups (e.g., age and gender; Gámez-Guadix et al., 2012; Marino et al., 2017). Nonetheless, there is no study that has examined measurement invariance in online and offline measured contexts.

#### PROBLEMATIC INTERNET USE VS. SPECIFIC INTERNET-RELATED DISORDERS

Internet usage for specific purposes such as socializing or pornography consumption might be related to the development of problematic Internet use (Brand et al., 2016). In line with this, specific Internet-related disorders such as social networking sites (SNS) addiction, Facebook addiction, or problematic pornography use were further conceptualized and studied. SNS addiction can be conceptualized as a behavioral addiction as it reflects key components referring to the experience of a wide range of symptoms related to cognitive and behavioral salience, mood modification, tolerance, withdrawal, conflict, and relapse (Andreassen et al., 2016). In the context of SNS addiction theory and research, some studies have concentrated on Facebook, as one of the most popular SNS (e.g., Atroszko et al., 2018). SNS addiction and its specific example Facebook addiction are conceptualized as behavioral addictions (e.g., Kuss & Griffiths, 2017). Furthermore, online pornography use may also be an Internet-specific behavior with a risk for addiction (Kraus et al., 2016). Feelings of loss of control and persistent use despite negative consequences (regarding financial, legal, occupational, and relationship problems) are defined as problematic pornography consumption (Bóthe et al., 2018). Nowadays, pornography consumption is mainly by the Internet (Awan et al., 2021) and it is conceptualized and studied as a specific Internet-related disorder (e.g., Chen et al., 2018).

#### PROBLEMATIC INTERNET USE AND ITS RELATIONSHIPS WITH PSYCHOSOCIAL FUNCTIONING

According to Caplan's theory of problematic Internet use, individuals with poor social skills may develop a POSI as they might perceive online interactions to be less threatening than those offline. Psychosocial problems predispose Internet users to develop maladaptive cognition (e.g., POSI), which leads to dif-

ficulties with impulse control, resulting in negative consequences related to Internet use (Caplan, 2006). Problematic Internet use and specific Internet-related disorders share similar patterns of relationships with specific poor social functioning indicators. Previous studies showed that they are both related to anxious and avoidant attachment (e.g., D'Arienzo et al., 2019; Kor et al., 2014; Marci et al., 2021), feelings of social isolation and loneliness (Biolcati et al., 2018; Bóthe et al., 2018), and social anxiety (Atroszko et al., 2018; Prizant-Passal et al., 2016; Wéry et al., 2020).

#### CURRENT STUDY

The present study aims to expand previous empirical research by adopting and examining the psychometric properties of the GPIUS2 in a sample of young adults in Poland. Since GPIUS2 is a widely used scale across various contexts, it is crucial to evaluate its psychometric properties, including its equivalence among online and offline assessments. Measurement invariance allows one to examine the extent to which scale-relevant results obtained in different measurement contexts, for example online vs. offline ways of collecting data, are comparable (Meredith, 1993). Therefore, the study aims to examine the measurement invariance of the GPIUS2 between online and paper and pencil assessment. Moreover, we intend to examine the criterion validity of this scale through the relationships with other measures of specific Internet-related disorders (i.e., Facebook addiction, SNS addiction, and problematic pornography consumption), as well as variables related to psychosocial functioning such as attachment dimensions, loneliness, and social anxiety. Therefore, we expected that the GPIUS2 would be a valid and reliable measure reflecting the theoretical model of problematic Internet use (H1); that GPIUS2 would allow for reliable comparisons across different measurement contexts as it is equivalent in the offline group and the online group of Internet users (H2); that there would be a positive relationship between problematic Internet use and other specific Internet-related disorders (i.e., Facebook addiction, SNS addiction, problematic pornography consumption; H3); there would be a positive relationship between problematic Internet use and indicators of poor psychosocial functioning (i.e., anxious attachment, avoidant attachment, loneliness, and social anxiety; H4).

#### PARTICIPANTS AND PROCEDURE

##### SAMPLE, PROCEDURE AND ETHICS<sup>1</sup>

The study was approved by the Research Ethics Committee at the Institute of Psychology, University of

**Table 1***Descriptive statistics of sociodemographic characteristics of the whole sample and the subsamples*

	Whole sample (N = 1155)		Offline subsample (n = 642)		Online subsample (n = 513)	
	Frequencies (f)	Percentages/ M (SD)	Frequencies (f)	Percentages/ M (SD)	Frequencies (f)	Percentages/ M (SD)
Females	816	70.6%	448	69.8%	368	71.7%
Males	331	28.7%	186	29.0%	145	28.3%
Unknown gender	8	0.7%	8	1.2%	0	0.0%
Age		21.41 (2.82)		21.06 (2.58)		21.84 (3.03)
Studying	1089	94.3%	640	99.7%	449	87.5%
Working students	352	30.5%	194	30.2%	158	30.8%
Working	52	4.5%	0	0.0%	52	10.1%
Unemployed	12	1.0%	0	0.0%	12	2.3%
Unknown activity	2	0.2%	2	0.3%	0	0.0%

Gdansk, Poland (reference number: 15/2019) and carried out in accordance with the Declaration of Helsinki. The procedure of the study has been described in detail by Balcerowska et al. (2022). Initially, the sample comprised 1183 respondents. After list-wise deletion of observations with missing data on any of the GPIUS2 items, the final sample comprised 1155 individuals: 642 individuals who completed an offline questionnaire, and 513 individuals who completed an online questionnaire. Sociodemographic characteristics of the whole sample and the subsamples are presented in Table 1.

## INSTRUMENTS

*The Generalized Problematic Internet Use Scale 2* (GPIUS2; Caplan, 2010) consists of 15 items. Originally, it measured five factors (each with three items): (a) preference for online social interaction, (b) mood regulation, (c) cognitive preoccupation, (d) compulsive Internet use, and (e) negative outcomes, and one higher-order factor (i.e., deficient self-regulation) which comprises cognitive preoccupation and compulsive Internet use. The responses are provided on a 7-point Likert scale ranging from 1 (*definitely disagree*) to 7 (*definitely agree*). The GPIUS2 was translated in a multistep, standardized procedure to ensure linguistic equivalence of the Polish version (Gudmundsson, 2009). In this sample, the Cronbach's  $\alpha$  reliability coefficient values were .85 for preference for online social interaction, .82 for mood regulation, .82 for cognitive preoccupation, .77 for compulsive Internet use, .75 for negative outcomes, and .88 for deficient self-regulation. A list of all GPIUS2 items can be found in Supplemental Materials.

*The Bergen Facebook Addiction Scale* (BFAS; Andreassen et al., 2012) and the *Bergen Social Media Addiction Scale* (BSMAS; Andreassen et al., 2016) have been described in detail in a previous study based on this sample (Balcerowska et al., 2022). The Cronbach's  $\alpha$  reliability coefficient was .81 for BFAS and .77 for BSMAS.

*The Problematic Pornography Consumption Scale* (PPCS; Bóthe et al., 2018; Polish version: Biernatowska, 2018) consists of 18 items (e.g., "I unsuccessfully tried to reduce the amount of porn I watch"), which are based on the six symptoms of addiction (each symptom is measured with three items; Griffiths, 2005). The responses are provided on a 7-point Likert scale ranging from 1 (*never*) to 7 (*all the time*). In this sample, the Cronbach's  $\alpha$  reliability coefficient was .94.

*The Experience in Close Relationships-Revised* (ECR-R; Fraley et al., 2000) in the short Polish version (Lubiewska et al., 2016) consists of 16 items. Eight items measure anxious attachment (e.g., "I'm afraid that I will lose my partner's love") and eight items measure avoidant attachment (e.g., "I prefer not to show a partner how I feel deep down"). The responses are provided on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). In this sample, the Cronbach's  $\alpha$  reliability coefficient values were .89 for anxious attachment and .90 for avoidant attachment.

*The Three-Item Loneliness Scale* (Hughes et al., 2004; Polish version: Czerwiński & Atroszko, 2021) consists of three items (e.g., "How often do you feel that you lack companionship?"). The responses are provided on a 3-point response format scale ranging from 1 (*almost never or never*) to 3 (*often*). In this sample, the Cronbach's  $\alpha$  reliability coefficient was .83.

*The Brief Self-Report Version of the Liebowitz Social Anxiety Scale* (LSAS-SR-Brief; Polish version: Wróbel et al., 2020), which is based on the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), consists of five items concerning the component of fear experienced in social situation (e.g., “working with other people”). The responses are provided on a 4-point scale ranging from 0 (*none*) to 3 (*severe*). In this sample, the Cronbach’s  $\alpha$  reliability coefficient was .75.

## STATISTICAL ANALYSES

All statistical analyses were performed using R 4.0.2 (R Core Team, 2020). We started by performing a series of confirmatory factor analyses separately in the offline and online groups. After identifying a configural model which adequately fits the data in both the offline group and the online group, we performed a multigroup confirmatory factor analysis in order to investigate measurement invariance of the GPIUS2 between the offline group and the online group. As the response scale of the items of the GPIUS2 is ordinal we followed the guidelines proposed by Wu and Estabrook (2016) to investigate measurement invariance of the GPIUS2 and estimated four nested models with increasingly constrained model parameters. In Model 1, item thresholds, factor loadings, and item intercepts were freely estimated in both groups. In Model 2, item thresholds were set to be equal among groups and factor loadings and item intercepts were freely estimated in both groups. In Model 3, item thresholds and factor loadings were set to be equal among groups and item intercepts were freely estimated in both groups. In Model 4, item thresholds, factor loadings, and item intercepts were set to be equal among groups. Finally, we estimated a structural model of problematic Internet use proposed by Caplan (2010).

We performed the confirmatory factor analysis and structural equation modeling with the lavaan 0.6-3 package (Rosseel, 2012). We used the robust weighted least squares estimator (WLSMV) due to the non-normality of item distributions and ordinal character of the item response scales (Savalei & Rhemtulla, 2013). We evaluated fit of the configural model of the GPIUS2 in both groups and fit of the structural equations model with the following fit indices:  $\chi^2$ , comparative fit index (CFI), Tucker-Lewis index (TLI), root mean squared error of approximation (RMSEA), and standardized root mean square residual (SRMR). Suggested cut-off points for these indices for acceptable fit are: CFI  $\geq$  .95, TLI  $\geq$  .95, RMSEA  $\leq$  .06 to .08, and SRMR  $\leq$  .08 (Hu & Bentler, 1999; Schreiber et al., 2006). To evaluate measurement invariance of the GPIUS2 we used delta parameterization and compared fit indices of the fol-

lowing pairs of models: M1 vs. M2, M2 vs. M3, and M3 vs. M4. The following differences in fit indices were suggested as an indication of measurement invariance on a higher level of parameter constraints:  $\Delta\text{CFI} \geq -.010$ ,  $\Delta\text{RMSEA} \leq .015$ , and  $\Delta\text{SRMR} \leq .010$  (Chen, 2007; Cheung & Rensvold, 2002).

We calculated means, standard deviations, and correlation coefficients for the whole sample, the offline group, and the online group. To compare correlation coefficients between the offline group and the online group we used a  $z$  test for independent groups as implemented in the cocor 1.1-3 package (Diedenhofen & Musch, 2015). We calculated four Student’s  $t$ -tests and Cohen’s  $d$  for independent samples to investigate differences in POSI, mood regulation, deficient self-regulation, negative outcomes, and criterion variables between the offline group and the online group. All tests were two-tailed, and  $\alpha$  level was set to .001. We performed a post hoc power analysis (with  $\alpha$  set to .001). In the case of measurement invariance we used the semPower 1.3.0 package (Jobst et al., 2021), which calculates the post hoc power of the analyses based on RMSEA values, difference in degrees of freedom, and number of observations in each group. In the case of Student’s  $t$ -tests and correlation coefficients, we used the pwr 1.3-0 package (Champely, 2020) to investigate the minimal effect sizes required to obtain a power of .80. The analytic code for all analyses performed in this study is available at [https://osf.io/d2t3r/?view\\_only=5c35dc09af014eaab851e695e6d286c2](https://osf.io/d2t3r/?view_only=5c35dc09af014eaab851e695e6d286c2)

## RESULTS

### FACTOR ANALYSIS AND MEASUREMENT INVARIANCE OF THE GPIUS2

We tested three models as candidates for the configural model for measurement invariance. The models and their fit measures are presented in Supplemental Materials. Based on the results, for further analyses we chose the four-factor model of the GPIUS2 in which cognitive preoccupation and compulsive Internet use were combined into a single factor of deficient self-regulation and covariances between these two pairs of items were allowed. It showed adequate fit to the data (offline group:  $\chi^2 = 468.28$ ,  $df = 82$ ,  $p < .001$ , CFI = .974, TLI = .967, RMSEA = .086, 90% CI [.078, .093], SRMR = .047; online group:  $\chi^2 = 380.35$ ,  $df = 82$ ,  $p < .001$ , CFI = .971, TLI = .963, RMSEA = .084, 90% CI [.076, .093], SRMR = .049).

The results of the investigation of measurement invariance of the GPIUS2 are presented in Table 2. The results showed that items’ thresholds, factor loadings, and items’ intercepts of the GPIUS2 are equivalent in the offline group and the online group, which allows the comparison of factor means be-

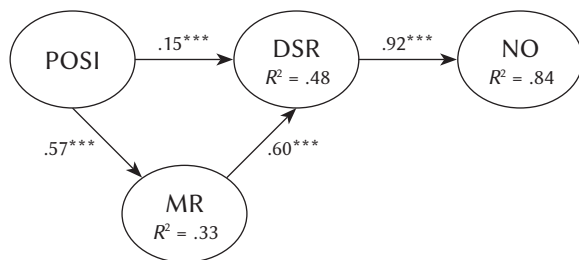
**Table 2***Results of the measurement invariance of the GPIUS2*

	$\chi^2$	<i>df</i>	CFI	RMSEA	SRMR	Model comparison	$\Delta\chi^2$	$\Delta df$	$\Delta CFI$	$\Delta RMSEA$	$\Delta SRMR$
M1: Configural invariance	849.28	164	.973	.085	.048						
M2: Thresholds invariance	983.15	224	.970	.077	.048	M1	94.89	60	-.003	-.008	.000
M3: Thresholds and loadings invariance	951.59	235	.972	.073	.048	M2	15.88	11	.002	-.004	.000
M4: Thresholds, loadings, and intercepts invariance	935.17	246	.973	.070	.048	M3	19.01	11	.001	-.003	.000

Note. GPIUS2 – Generalized Problematic Internet Use Scale 2; CFI – comparative fit index; RMSEA – root mean square error of approximation; SRMR – standardized root mean square residual;  $\Delta$  – the change in the given index with respect to the previous model (e.g., M2–M1).

**Figure 1**

The structural model of generalized problematic internet use ( $N = 1155$ )



Note. POSI – preference for online social interaction; MR – mood regulation; DSR – deficient self-regulation; NO – negative outcomes. \*\*\* $p < .001$ .

tween the offline and online groups. The post hoc power analysis showed that all of the comparisons of the following levels of measurement invariance had power above .99.

#### STRUCTURAL MODEL OF PROBLEMATIC INTERNET USE

The structural model of problematic Internet use in which cognitive preoccupation and compulsive Internet use were combined into a single factor of deficient self-regulation and covariances between these two pairs of items were allowed showed adequate fit to the data in the whole sample:  $\chi^2 = 752.53$ ,  $df = 84$ ,  $p < .001$ , CFI = .974, TLI = .967, RMSEA = .083, 90% CI [.078, .089], SRMR = .046. Standardized regression coefficients of this model are presented in Figure 1.

#### DESCRIPTIVE STATISTICS AND CORRELATION ANALYSIS

Means and standard deviations of the scores of the offline and online groups for the factors of the GPIUS2 are presented in Table 3. The online group had higher scores for POSI, mood regulation, deficient self-regulation, and negative outcomes (see Table 3 for Cohen's  $d$ ; see Table S1 in Supplemental Materials for comparison of the scores of the criterion variables between the offline group and the online group). Comparison of the correlation coefficients between factors of the GPIUS2 and the criterion variables in the offline group and in the online group are presented in Table S2 in Supplemental Materials (none of the differences was significant at  $\alpha$  level set to .001). Means and standard deviations of the criterion variables and correlation coefficients between factors of the GPIUS2 and the criterion variables in the whole sample are presented in Table 4. The post hoc power analysis showed that Cohen's  $d$  of at least .25 and a correlation coefficient of at least .12 were needed to obtain power greater than .80.

#### DISCUSSION

##### PSYCHOMETRIC PROPERTIES OF THE GPIUS 2

The results reveal that the original five-factor model of the GPIUS2 (Caplan, 2010) has poor fit to the data. To improve model fit, we proposed the four-factor model of the GPIUS2 in which cognitive preoccupation and compulsive Internet use were combined into a single factor of deficient self-regulation. Further, the covariances between the fourth and the ninth and between

**Table 3***Comparison of the offline group and the online group in terms of scores on the GPIUS2 factors*

Variable	Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
POSI	Offline	642	6.86	4.11	1153	-3.32	< .001	-.20
	Online	513	7.69	4.39				
MR	Offline	642	9.97	4.76	1153	-6.47	< .001	-.38
	Online	513	11.81	4.85				
DSR	Offline	642	15.40	7.59	1153	-4.22	< .001	-.25
	Online	513	17.27	7.39				
NO	Offline	642	6.48	3.49	1049.5	-2.91	.004	-.17
	Online	513	7.11	3.82				

Note. GPIUS2 – Generalized Problematic Internet Use Scale 2; POSI – preference for online social interaction; MR – mood regulation; DSR – deficient self-regulation; NO – negative outcomes.

**Table 4***Means and standard deviations of the criterion variables and correlation coefficients between the factors of the GPIUS2 and the criterion variables in the whole sample (N = 1155)*

	<i>M</i>	<i>SD</i>	<i>n</i>	POSI	MR	DSR	NO
Gender <sup>a</sup>	–	–	1147	.02	-.06*	-.03	.05
Age	21.41	2.82	1147	.00	-.07*	-.09**	-.07*
Facebook addiction <sup>b</sup>	12.81	4.78	1141	.21***	.38***	.60***	.47***
Social networking sites addiction <sup>c</sup>	14.71	4.70	1145	.19***	.44***	.60***	.47***
Problematic pornography consumption <sup>d</sup>	29.57	15.27	604	.09*	.13**	.25***	.33***
Anxious attachment	27.98	11.01	1120	.30***	.41***	.30***	.31***
Avoidant attachment	21.28	9.48	1120	.27***	.12***	.11***	.17***
Loneliness	4.96	1.76	1150	.29***	.39***	.25***	.31***
Social anxiety	10.90	3.53	1151	.40***	.33***	.34***	.34***

Note. GPIUS2 – Generalized Problematic Internet Use Scale 2; POSI – preference for online social interaction; MR – mood regulation; DSR – deficient self-regulation; NO – negative outcomes. <sup>a</sup>Point-biserial correlation coefficient (0 – females, 1 – males). <sup>b</sup>Only individuals who use Facebook are included. <sup>c</sup>Only individuals who use social networking sites are included. <sup>d</sup>Only individuals who watch pornography are included. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

the thirteenth and the fourteenth items were relaxed. The final model of the GPIUS2 with four related factors (POSI, mood regulation, deficient self-regulation, and negative outcomes), and with the correlations between those two pairs of items, has an adequate fit to the data. The final version presents good reliability coefficients of all the subscales. Although the modified model did not strictly reflect the original structure of the scale, those results are similar to other research investigating the psychometric properties of the GPIUS2 across various countries and studied groups (Casale et al., 2015; Fioravanti et al., 2013; Gámez-Guadix et al., 2012, 2013; Laconi et al., 2018; Pontes et al., 2016). Further, the scale structure reflects

the four core theoretical components of the generalized problematic Internet use (Caplan, 2010). Lastly, the lack of acceptable fit of the five-factor model of the GPIUS2 might be related to the strong interplay between obsessive thoughts about the Internet and compulsive Internet use. It could reflect the unique manifestation of diminished self-regulation associated with the combination of both cognitive and behavioral aspects of compulsive Internet use (Fioravanti et al., 2013; Pontes et al., 2016).

The results showed that items' thresholds, factor loadings, and items' intercepts of the GPIUS2 are equivalent in the offline and online groups (i.e., scalar invariance), which allows factor means to be

compared between different data collecting contexts. Our findings broaden the results of the previous psychometric validations, showing that results obtained using GPIUS2 could be analyzed across various measuring contexts (offline vs. online) and groups (different age groups and men vs. women; Gámez-Guadix et al., 2012; Marino et al., 2017). The offline group had higher scores on all components of problematic Internet use. Therefore, it might be better to collect data online when investigating the population of problematic Internet users, as there is a higher probability of recruiting more individuals that manifest problematic use.

Our results replicated the original structural model of problematic Internet use (Caplan, 2010). Mood regulation mediated the relationship between POSI and deficient self-regulation. Furthermore, deficient self-regulation predicted a higher probability of occurrence of the negative outcomes. Those results suggest that when behavior becomes compulsive and individuals no longer control their use, they might experience negative consequences of the maladaptive Internet use. Further, those results correspond to previous studies on the relationship between problematic Internet use and social, occupational problems (e.g., Koo et al., 2021; Tokunaga, 2017; Tomaszek et al., 2022), as well as diminished well-being and mental health (e.g., Machimbarrena et al., 2019; Stevens et al., 2020).

#### RELATIONSHIP BETWEEN PROBLEMATIC INTERNET USE AND SPECIFIC INTERNET-RELATED DISORDERS

The results showed that all components of problematic Internet use were positively related to specific Internet-related disorders. The two highest correlation coefficient values were .60 (36% common variance), while all other correlation coefficient values were below .50 (25% common variance). On the one hand, these results support good convergent validity of the scale as deficient self-regulation, defined as diminished self-control over Internet use (Caplan, 2010), reflects the core of the problems associated with addictions such as Facebook addiction and SNS addiction (Andreassen et al., 2016; Sun & Zhang, 2021). On the other hand, they also support good discriminant validity of the scale, showing that even though the problematic Internet use components share some variance with specific Internet disorders, they are different phenomena. Furthermore, components of problematic Internet use, similar to addiction components (i.e., mood regulation, deficient self-regulation, and negative outcomes), were more strongly related to SNS addiction, Facebook addiction, and problematic pornography consumption than POSI, which is more specific for problematic Internet use. Moreover, although related to all specific Internet-related dis-

orders, POSI was more strongly associated with SNS addiction and Facebook addiction than with problematic pornography consumption. Those results are congruent with previous studies and reveal that using the Internet for socializing and social interactions is more specific for generalized Internet use and SNS use than pornography consumption (Montag et al., 2015). Furthermore, SNS could be treated like small equivalences of the World Wide Web. Activities are remarkably similar to what Internet users could generally do (e.g., instant messaging, information searching, posting pictures and comments, gaming). SNS as such do not exist without the Internet. Thus, this specific Internet-related disorder has a stronger relationship with problematic Internet use than problematic pornography consumption, which individuals could also watch offline (Montag et al., 2015).

#### RELATIONSHIP BETWEEN PROBLEMATIC INTERNET USE AND PSYCHOSOCIAL FUNCTIONING

Poor social functioning, namely loneliness, social anxiety, anxious attachment, and avoidant attachment, was positively related to all components of problematic Internet use. Those results are congruent with the theory of problematic Internet use and previous studies (Marci et al., 2021; Prizant-Passal et al., 2016). Individuals with poor social skills might be more prone to problematic Internet use as they tend to decrease the risk of social judgment and want to control their self-presentation (Brailovskaia et al., 2020a; Caplan, 2006; Balcerowska et al., 2019). It might be then strengthened by the maladaptive thought about the Internet, reflected by the POSI and the tendency to enhance mood by using the Internet (Brailovskaia et al., 2020b; Kavaklı & Ünal, 2021). The results also showed a positive relationship between all problematic Internet use components and insecure attachment dimensions (i.e., anxiety and avoidance). Previous studies showed that individuals with a higher risk for the problematic behaviors of substance and non-substance abuse are present in cases of avoidant and anxious attachment styles (Valizadeh et al., 2017). Stronger parental attachment is related to less motivation to use the Internet to escape everyday problems (Soh et al., 2014). Moreover, anxious and avoidant individuals might compensate for difficulties in establishing and maintaining interpersonal relationships, and they search for compensation via online engagement (D'Arienzo et al., 2019), resulting in problematic Internet use.

#### LIMITATIONS AND FUTURE DIRECTIONS

The most important limitation of this study is that it lacked an investigation of measurement invariance



between the Polish version and the original version (Caplan, 2010) of the scale. Consequently, we cannot be sure that Poles understand and interpret the items of the GPIUS2 identically to the users of other languages. Thus, further studies examining the psychometric properties of the GPIUS2 across different cultural contexts and the measurement equivalency across different groups are needed. The sample mainly consisted of students 18 and 25 years old and 70.6% of participants were female. Thus it was not representative of the general population of Internet users, which restricts the generalizability to other populations. Moreover, the narrowed variability of age and gender also limited the possibilities to perform a statistically and theoretically sound investigation of the impact of these variables on the measurement of the GPIUS2. Future studies might also consider adding different age cohorts and gender specificity in the context of problematic Internet use and specific online activities. Furthermore, the investigation of other specific Internet-related disorders such as online gaming disorder and its relation to the whole spectrum of generalized and specific problematic Internet use is needed.

## CONCLUSIONS

The present study proposed the Polish version of the widely used GPIUS2, built on the cognitive-behavioral framework relevant for many Internet-related disorders. The results support a four-factor internal structure of the GPIUS2, similar to that initially proposed (Caplan, 2010) and the results of the previous studies (Casale et al., 2015; Fioravanti et al., 2013; Gámez-Guadix et al., 2012, 2013; Laconi et al., 2018; Pontes et al., 2016). To the authors' knowledge, the current study is the first to investigate the equivalency of the measurement by GPIUS2 in the different data collecting contexts (i.e., online and offline). Our findings also prove the theoretical assumption that problematic Internet use is a multidimensional construct rather than a one-dimensional construct. Furthermore, problematic Internet use has strong but not overlapping positive relations with the other specific Internet-related disorders. Those relationships are especially strong among problematic activities related to the relational context of Internet use and satisfying social needs online. Our results are in line with theoretical conceptualizations, as well as previous research findings showing that those phenomena are similar yet distinct constructs (Montag et al., 2015; Starcevic & Billieux, 2017). Furthermore, our findings prove the theoretical assumptions that psychosocial problems and poor social skills are related to problematic Internet use.

To summarize, the present study broadens the knowledge about the nature of those relationships

and proposes a reliable scale to measure problematic Internet use. The researchers could use GPIUS2 to assess problematic Internet use for screening the potential maladaptive use. However, when it comes to the specific relations and conceptualization of particular Internet-related disorders, it is recommended to use more specific tools considering the unique aspects of those phenomena.

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## ENDNOTE

1 This sample was previously used by Balcerowska et al. (2022). However, the scopes of the two papers barely overlap as different variables were used.

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## SUPPLEMENTAL MATERIALS

## 1. THE ORIGINAL AND POLISH VERSIONS OF THE GENERALIZED PROBLEMATIC INTERNET USE SCALE 2 (GPIUS2)

Item	Wording
1	I prefer online social interaction over face-to-face communication. [Wolę kontakt z ludźmi przez Internet niż twarzą w twarz.]
2	I have used the Internet to talk with others when I was feeling isolated. [Korzystałem(-am) z Internetu, żeby porozmawiać z innymi, gdy czułem(-am) się osamotniony(-a).]
3	When I haven't been online for some time, I become preoccupied with the thought of going online. [Kiedy nie korzystam z Internetu przez jakiś czas, zaczynam być pochłonięty(-a) myślami o tym, by z niego skorzystać.]
4	I have difficulty controlling the amount of time I spend online. [Mam trudności z kontrolowaniem ilości czasu spędzanego w Internecie.]
5	My Internet use has made it difficult for me to manage my life. [Korzystanie z Internetu utrudniło mi zarządzanie własnym życiem.]
6	Online social interaction is more comfortable for me than face-to-face interaction. [Kontakt z ludźmi przez Internet jest dla mnie bardziej komfortowy niż kontakt twarzą w twarz.]
7	I have used the Internet to make myself feel better when I was down. [Korzystałem(-am) z Internetu, żeby poczuć się lepiej, kiedy byłem przygnębiony(-a).]
8	I would feel lost if I was unable to go online. [Czułbym(-abym) się zagubiony(-a), gdybym nie mógł(-a) korzystać z Internetu.]
9	I find it difficult to control my Internet use. [Jest mi trudno kontrolować korzystanie z Internetu.]
10	I have missed social engagements or activities because of my Internet use. [Zaniedbywałem(-am) obowiązki lub spotkania towarzyskie z powodu korzystania z Internetu.]
11	I prefer communicating with people online rather than face-to-face. [Wolę komunikować się z ludźmi przez Internet niż twarzą w twarz.]
12	I have used the Internet to make myself feel better when I've felt upset. [Korzystałem(-am) z Internetu, żeby poczuć się lepiej, gdy byłem(-am) zaniepokojony(-a) lub zdenerwowany(-a).]
13	I think obsessively about going online when I am offline. [Obsesyjnie myślę o korzystaniu z Internetu, kiedy z niego nie korzystam.]
14	When offline, I have a hard time trying to resist the urge to go online. [Gdy jestem poza siecią, mam trudności, aby oprzeć się pragnieniu korzystania z Internetu.]
15	My Internet use has created problems for me in my life. [Korzystanie z Internetu przysporzyło mi problemów w życiu.]

Note. Response options were: (1) *definitely disagree*, (2) *disagree*, (3) *slightly disagree*, (4) *neutral*, (5) *slightly agree*, (6) *agree*, (5) *definitely agree*.

**Scoring:** Item for each subscale (either sum or average the items listed to obtain a score for the subscale).

Preference for online social interaction: 1, 6, 11; Mood regulation: 2, 7, 12; Cognitive preoccupation: 3, 8, 13; Compulsive Internet use: 4, 9, 14; Negative outcomes: 5, 10, 15.

## 2. THE THREE CANDIDATE MODELS FOR THE CONFIGURAL MODEL

The original five-factor model of the GPIUS2 (Caplan, 2010) showed poor fit to the data based on RMSEA (offline group:  $\chi^2 = 643.12$ ,  $df = 82$ ,  $p < .001$ , CFI = .963, TLI = .952, RMSEA = .103, 90% CI [.096, .111], SRMR = .051; online group  $\chi^2 = 533.57$ ,  $df = 82$ ,  $p < .001$ , CFI = .957, TLI = .944, RMSEA = .104, 90% CI [.095, .112], SRMR = .055). As the results indicated that cognitive preoccupation and compulsive Internet use were empirically indistinguishable ( $r_{\text{offline}} = .93$  and  $r_{\text{online}} = .95$ ) we decided to use the four-factor model of the GPIUS2 in future analyses. The four-factor model of the GPIUS2 in which cognitive preoccupation and compulsive Internet use were combined into a single factor of deficient self-regulation showed equally poor fit to the data (the offline group:  $\chi^2 = 653.28$ ,  $df = 84$ ,  $p < .001$ , CFI = .962, TLI = .953, RMSEA = .103, 90% CI [.096, .110], SRMR = .052; the online group:  $\chi^2 = 533.16$ ,  $df = 84$ ,  $p < .001$ , CFI = .957, TLI = .946, RMSEA = .102, 90% CI [.094, .111], SRMR = .055). Inspection of modification indices indicated that there were substantial covariances between residuals of the fourth item and the ninth item and between residuals of the thirteenth item and the fourteenth item, which were also reported in previous studies (Casale et al., 2015; Pontes et al., 2016). The four-factor model of the GPIUS2 in which cognitive preoccupation and compulsive Internet use were combined into a single factor of deficient self-regulation and covariances between these two pairs of items were allowed showed adequate fit to the data (offline group:  $\chi^2 = 468.28$ ,  $df = 82$ ,  $p < .001$ , CFI = .974, TLI = .967, RMSEA = .086, 90% CI [.078, .093], SRMR = .047; online group:  $\chi^2 = 380.35$ ,  $df = 82$ ,  $p < .001$ , CFI = .971, TLI = .963, RMSEA = .084, 90% CI [.076, .093], SRMR = .049). Based on these results, the four-factor model of the GPIUS2 in which cognitive preoccupation and compulsive Internet use were combined into a single factor of deficient self-regulation and covariances between these two pairs of items were allowed was used as a configural model when testing measurement invariance of the GPIUS2.

**Table S1**

*Comparison of the offline group and the online group in terms of scores on the criterion variables*

Variable	Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
Gender	Offline	634	1.29	0.46	1145	0.40	.691	.02
	Online	513	1.28	0.45				
Age	Offline	634	21.06	2.58	1009.4	-4.65	< .001	-.28
	Online	513	21.84	3.03				
Facebook addiction	Offline	629	13.07	4.85	1139	1.98	.048	.12
	Online	512	12.50	4.68				
Social networking sites addiction	Offline	634	15.03	4.79	1143	2.51	.012	.15
	Online	511	14.33	4.55				
Problematic pornography consumption	Offline	295	29.60	15.46	603	0.02	.985	.00
	Online	310	29.58	15.10				
Anxious attachment	Offline	624	27.26	10.85	1129	-2.35	.019	-.14
	Online	507	28.80	11.09				
Avoidant attachment	Offline	632	20.84	9.29	1138	-1.78	.075	-.11
	Online	508	21.84	9.70				
Loneliness	Offline	638	4.71	1.66	1042.7	-5.28	< .001	-.32
	Online	512	5.26	1.84				
Social anxiety	Offline	640	10.55	3.39	1149	-3.87	< .001	-.23
	Online	511	11.35	3.66				

**Table S2**

*Comparison of the correlation coefficients between factors of the GPIUS2 and the criterion variables in the offline group and in the online group*

GPIUS Factor	Variable	$n_{\text{offline}}$	$r_{\text{offline}}$	$n_{\text{online}}$	$r_{\text{online}}$	$Z$	$p$
Gender <sup>a</sup>	POSI	634	.08	513	-.06	2.43	.015
	MR	634	-.01	513	-.11	1.67	.096
	DSR	634	.03	513	-.10	2.05	.040
	NO	634	.10	513	.01	1.50	.135
Age	POSI	634	.01	513	-.04	0.81	.415
	MR	634	-.12	513	-.08	-0.71	.475
	DSR	634	-.13	513	-.08	-0.83	.404
	NO	634	-.11	513	-.06	-0.71	.474
Facebook addiction <sup>b</sup>	POSI	629	.20	512	.22	-0.36	.719
	MR	629	.39	512	.41	-0.39	.695
	DSR	629	.60	512	.64	-0.98	.327
	NO	629	.46	512	.50	-1.00	.319
Social networking sites addiction <sup>c</sup>	POSI	634	.17	511	.24	-1.20	.231
	MR	634	.44	511	.49	-1.08	.282
	DSR	634	.59	511	.65	-1.71	.088
	NO	634	.43	511	.53	-2.17	.029
Problematic pornography consumption <sup>d</sup>	POSI	294	.08	310	.09	-0.17	.869
	MR	294	.18	310	.09	1.13	.258
	DSR	294	.27	310	.24	0.42	.673
	NO	294	.34	310	.33	0.18	.854
Anxious attachment	POSI	615	.28	505	.31	-0.55	.579
	MR	615	.41	505	.39	0.53	.597
	DSR	615	.26	505	.33	-1.15	.248
	NO	615	.30	505	.32	-0.50	.618
Avoidant attachment	POSI	615	.29	505	.23	1.11	.268
	MR	615	.13	505	.09	0.57	.568
	DSR	615	.10	505	.11	-0.09	.932
	NO	615	.14	505	.19	-0.77	.442
Loneliness	POSI	638	.26	512	.30	-0.77	.439
	MR	638	.35	512	.41	-1.12	.264
	DSR	638	.20	512	.27	-1.28	.201
	NO	638	.31	512	.29	0.39	.694
Social anxiety	POSI	640	.39	511	.40	-0.34	.734
	MR	640	.38	511	.24	2.61	.009
	DSR	640	.35	511	.30	0.83	.406
	NO	640	.35	511	.33	0.39	.696

*Note.* GPIUS2 – Generalized Problematic Internet Use Scale 2; POSI – preference for online social interaction; MR – mood regulation; DSR – deficient self-regulation; NO – negative outcomes. <sup>a</sup>Point-biserial correlation coefficient (0 – females, 1 – males). <sup>b</sup>Only individuals who use Facebook are included. <sup>c</sup>Only individuals who use social networking sites are included. <sup>d</sup>Only individuals who watch pornography are included.