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VALIDATION OF THEORETICAL AND MEASUREMENT MODEL OF THE GENERALIZED PROBLEMATIC INTERNET USE SCALE 2 IN A POLISH SAMPLE

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The Generalized Problematic Internet Use Scale (GPIUS2) was developed to operationalize the theoretical cognitive-behavioral model of GPIU. The aims of the study were to examine the theoretical model of GPIU, analyze the psychometric properties of the GPIUS2 among Polish adolescents, study measurement invariance across gender and method of data collection (offline vs. online). The sample comprised of 1,621 participants (52% men, M_{age} = 20.3). Some participants completed an online version of the GPIUS2 (n = 707, 73% men, M = 17.9), and others filled in a pencil and paper version (n = 914, 35% men, M = 22.1). Reliability was assessed (Cronbach's α; McDonald's ω). The factor structure and nomological, convergent, and discriminant validity were tested. The findings of this study supported the reliability and the factor structure of the GPIUS2. The factor similarity in Polish sample and the original US sample was high (Tucker's congruence coefficients were range: .99–1.00). The structural relationships between the constructs of the model, convergent and discriminant validity were confirmed. The strong measurement invariance of the model across gender and method of data collection was confirmed. The Polish version of the GPIUS2 is a reliable and valid instrument that can be used for Polish adolescent samples. The scale showed measurement invariance across gender and method of data collection. Furthermore, the results support the cognitive-behavioral model of problematic Internet use in adolescents.

Keywords: Generalized Problematic Internet Use (GPIU); the cognitive-behavioral model of GPIU; Caplan GPIUS2; measurement invariance.

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The Generalized Problematic Internet Use Scale 2 (GPIUS2) is a tool for studying nonspecific Internet use from a psychological perspective; the theoretical model which was the basis for the construction of this scale allows a cognitive-behavioral intervention for PIU to be developed.

The Internet has a positive influence on many aspects of social life, becoming its indispensable part. In January 2021, 59.5% (4.66 billion) of people worldwide (7.83 billion) had access to the Internet. Of this total, 92.6% users (4.32 billion) went online via mobile devices (Johnson, 2021). Analysis shows that there were 53.6% of the population (4.20 billion) were actively using social media (Kemp, 2021a). In January 2021, 84.5% of the total Polish population had access to the Internet and 68.5% used social media (Kemp, 2021b). In 2020, 90.4% of Polish households had Internet access, including 89.6% to broadband (Główny Urząd Statystyczny [GUS], 2020).

The widespread use of the Internet in education, work, and leisure raise concerns about the consequences of Internet overuse for the health and social functioning of people. The possibilities offered by Internet use increasingly intensify the problem of Internet addiction (Guitton, 2014; Leo & Wulfert, 2012).

An excessive use of the Internet disrupts family life and leads to problems with studying or working, neglect of duties, and giving up other activities (Derbyshire et al., 2013). It also causes sleep disorders (Kim et al., 2016; Lam, 2014), depression, social anxiety and hyperactivity (Andreou & Svoli, 2013; Caplan, 2007; Chun, 2016; Park et al., 2013; Tokunag & Rains, 2010). It also drives up the number of lonely people who have trouble creating healthy social relationships (Kerkhof et al., 2011). The dynamics of changes in the Internet offer causes undiminished researchers' interest in the consequences of excessive use of the Internet (Kuss & Lopez-Fernandez, 2016; Young et al., 1999), especially by young people (Andreou & Svoli, 2013; Assunçao & Matos, 2017; Chun, 2016; Park et al., 2013).

The reported percentage of people overusing Internet varies between 0.8% and 26.7% and depends on the construct definition, used tools, cut-off, country and age of the participants (Kim et al., 2016; Kuss et al., 2014; Kuss & Lopez-Fernandez, 2016).

After two decades of research, the question remains whether problematic Internet use (PIU) should be treated as an addiction, disorder, or continuum of normal behavior (Dalal & Basu, 2016). Researchers who recognize PIU as Internet addiction classify it as an impulse control disorder and construct tools based on addiction criteria (Fioravanti & Casale, 2015; Kuss & Lopez-Fernandez, 2016; Moon et al., 2018). According to others, PIU is a set of cognitive, emotional, and behavioral symptoms that lead to difficulties in managing offline life (Caplan, 2010).

Many tools are available to measure PIU (Aboujaoude, 2010). These tools vary in length (from 7 to 72 items), design (research, clinical screening or diagnosis),

and ways of application (self-report, interview; Breslau et al., 2015), as well as the assumptions underlying their construction. The imperfection of the tools used is one of the reasons for the low quality of PIU research (Throuvala et al., 2019). The unidimensional structure of the available tools (Young, 1998) and the lack of theoretical justification (Thatcher & Goolam, 2005) make it difficult to understand the etiology and reasons for the increase of the PIU issue (Vondrácková & Gabrhelík, 2016). Therefore, GPIUS2, constructed on the basis of the cognitive-behavioral model of Davis (2001), should be considered an important research tool. It can be useful both in explaining and in the early diagnosis of GPIU.

In Poland, the Internet Addiction Test is a commonly used tool (IAT; Jarczyńska, 2015). The IAT is criticized for "loosely described" theoretical assumptions and the lack of a stable structure (Fioravanti & Casale, 2015). Adaptation of GPIUS2 will allow testing a model explaining the etiology of GPIU among Polish youth, and will also enable better matching of preventive and therapeutic measures.

Defining and Measuring Generalized Problematic Internet Use

Davis conceptualizes the PIU as a multidimensional construct that consists of cognitive and behavioral symptoms causing negative consequences in the life of the individual. According to the diathesis-stress framework, "abnormal behavior is a result of a predisposed vulnerability (diathesis) and a life event (stress)" (Davis, 2001, p. 189). Psychopathological background, although itself not a cause of PIU symptoms, is a necessary condition in its etiology. Davis distinguishes specific (limited to specific functions or web applications) and generalized (compulsive, undertaken without a clear objective) PIU. In his opinion, a sense of loneliness and lack of social support are the main factors in the creating of GPIU. However, only stress can cause the occurrence of GPIU (Caplan, 2002).

According to Caplan (2003, 2007), social skills and social anxiety are a better predictor of POSI (preference for online social interaction) than loneliness. The PIU model (Caplan, 2010) consists of four main components (Figure 2). First, the cognitive component consists of online social interaction preferences (POSI) instead of personal contacts. POSI increases the use of the Internet to regulate mood, reducing negative states such as social anxiety and stress. Mood regulation is an important cognitive predictor of negative outcomes associated with Internet use (Caplan, 2007). Besides, both POSI and Internet use as mood regulation increase the deficient of self-regulation of Internet use, which includes cognitive preoccupation and compulsive Internet use. Finally, a deficient of the self-regulation of Internet

use increases the likelihood of negative outcomes. The Caplan (2010) concept is the theoretical background of GPIUS2 (Figure 2).

The result of Caplan's research is the GPIUS2 consisting of five first-order factors: POSI, mood regulation, cognitive preoccupation, compulsive use of the Internet, and negative outcomes of Internet use. This structure includes deficient self-regulation as a second-order factor (Figure 1). The GPIUS2 consists of 15 items rated on an 8-point Likert scale and reliability was $\alpha = .91$ (subscales: $\alpha = .82–.87$). The measurement model and theoretical model assuming the relationship between the factors (Figure 2) were confirmed (Caplan, 2010).

GPIUS2 Adaptations

The GPIUS2 has been translated into Portuguese (Assunçao & Matos, 2017; Pontes et al., 2016), Spanish (in Mexico: Gámez-Guadix et al., 2012, and in Spain: Gámez-Guadix et al., 2013), Italian (Fioravanti et al., 2013), German (Barke et al., 2013) and Polish (Ciżkowicz, 2017). Table 1 presents the results of these adaptations and the original GPIUS2 (Caplan, 2010).

The conditions of GPIUS2 adaptation differ from those of Caplan (2010) research, by the size of samples, the age of the respondents, the method of data collection (offline or online) and the related specifics of the sample (see Table 1). There are also significant differences in the response range (from 5 to 8). Despite these differences, the reliability of measurement is mostly high and stable both for the whole scale and for subscales. Slightly decreased reliability (less than .70) was obtained for subscales in German studies. In these studies, the shortest Likert scale (1–5) was used, which could affect the reliability of the measurement. The structure of the measurement model adopted by Caplan (2010) was confirmed in German (Barke et al., 2014) and Mexico studies (Gámez-Guadix et al., 2012) and the Portuguese Facebook user survey (Assunçao & Matos, 2017). It should be emphasized, however, that in the Portuguese research, the researchers changed the content of the scale items using "Facebook" instead of "online". These slightly changes the nature of the tool, causing the scale to explore specific PIU, related to the use of Facebook. The Spanish version of GPIUS2, which was validated on data collected among teenagers, maps the measurement model of Caplan, but with an additional general factor of higher order (Gámez-Guadix et al., 2013).

Table 1

GPIUS2: Original Version and Adaptations

Baseline characteristic	Country								
	US	Spain	Italy	Germany		Portugal		Poland	Mexico
Collecting data	offline	offline	offline	online	offline	online[1]	Facebook[2]	offline	offline
Sample (*n*)	785	1021	371	1041	841	641	761	798	1491
M_{age} (*SD*)	33.1 (15.3)	15.0 (1.7)	18.1 (5.6)	24.2 (7.2)	23.5 (3.0)	25.2 (9.6)	15.9 (1.1)	19.5 (2.8)	14.5 (1.6)
$Age_{min\text{-}max}$	18–70	adoles-cents	14–33	–	stu-dents	10–74	14–18	18–24	12–18
Likert	1–8	1–6	1–8	1–5	1–7	1–7	1–7	1–6	
SEM	yes	yes	no	no	no	yes	yes	yes	
Scale/ subscale	Cronbach's α								
GPIUS2	.91	.91	.89	.91	.86	.90	.91	.90	.90
PIU1	.82	.85	.78	.89	.72	.80	.84	.79	.79
PIU2	.86	.83	.78	.80	.77	.84	.83	.79	.78
PIU3	.86	.81	.89	.67	.62	.86	.80	.80	.81
PIU4	.87	.84		.83	.76		.83	.88	.80
PIU5	.83	.78	.78	.76	.64	.78	.65	.72	.74

Note. [1] GPIUS2 (Pontes et al., 2016); [2] GPIUS2 adapted for Facebook (Assunçao & Matos, 2017); PIU1 = POSI; PIU2 = Mood Regulation; PIU3 = Cognitive Preoccupation; PIU4 = Compulsive Internet Use; PIU5 = Negative Outcomes; SEM = nomological validity.

In the Italian and Portuguese versions, there were 4-factor measurement models with correlated factors (Fioravanti et al., 2013; Pontes et al., 2016), in which the deficient self-regulation was the first-order factor with eight items. In these models, the cognitive preoccupation and compulsive use factors were not distinguished. In addition, in order to better fit the models to the data, errors were additionally correlated. However, it is worth noting that neither the number of pairs of correlated errors nor the pairs were identical. In the Italian version two error pairs were correlated (P3 ↔ P8, P4 ↔ P9), and three in the Portuguese version.

(P1 ↔ P11, P4 ↔ P9, P13 ↔ P14). Only the correlation between P4 and P9 errors was included in both versions of the GPIUS2. The decision to correlate errors was made after research (suggested by modification indices). It should be emphasized that the correlation of errors introduced after the conducted research (post-hoc) only on the basis of modification indices is criticized (Hermida, 2015).

The theoretical model was tested only in a few studies. The German, Portuguese, and Italian adaptation of GPIUS2 lacked information on the results of nomological validity testing (SEM, Table1).

Aims and Hypotheses

Based on the cognitive-behavioral model, the GPIUS2 assessed the cognitive and behavioral aspects of GPIU and the negative outcomes of Internet use. It was one of the few scales designed to measure GPIU, whose subsequent adaptations had good and stable psychometric properties (see Table 1).

The present study, which was a continuation of an earlier one (Ciżkowicz, 2017), aimed to re-analyse the GPIUS2 structure, to test convergent-discriminant validity and to evaluate measurement invariance (MI) across gender and methods of data collection (offline vs. online). In the previous Polish version of the GPIUS2, the factor "compulsive use" had only two items (P4, P9), and "cognitive preoccupation"—four items (P3, P8, P13, P14) and item P2 showed a high cross-loading (Ciżkowicz, 2017). This distinguished the Polish GPIUS2 from the original version (Caplan, 2010). The wording of items P2 and P14 was changed in order to better relate the content of the item to the factor to which the item belonged.

Additionally, the cognitive-behavioral theoretical model of PIU was tested (Caplan, 2010). In accordance with the structural relationships between the factors in the model (Figure 2), the following hypotheses were tested:

• POSI is a positive, direct predictor of two factors: mood regulation and deficient self-regulation; mood regulation is a positive, direct predictor of deficient self-regulation; deficient self-regulation is a positive, direct predictor of negative outcomes.

• There is a positive, indirect relationship between POSI and deficient self-regulation in which the mood regulation acts as a mediator; there is a mediating role of deficient self-regulation in the positive, indirect relationship between POSI and negative outcomes as well as in the role of the Internet as mood regulation and negative outcomes.

METHOD

Participants and Procedure

The offline study was conducted in March 2018 among full-time students (N = 914, 65.1% women, aged 18–31; M = 22.1, SD = 1.7) from various faculties of two Polish universities. Each student had their own computer with Internet access. The online study was conducted among computer game players (N = 707, 26.7% women, aged 12–40; M = 17.9, SD = 3.1). Data were collected in April 2018.

To check whether the modified items P2 and P14 improved the psychometric properties of the scale (Caplan, 2010), the analysis was conducted twice: with P2 and P14 and with modified versions of these items. Both versions of items P2 and P14 were given in the appendix. Only the GPIUS2 analysis with the changed item P14 (see the appendix) was presented below, because the modification of P2 did not improve the psychometric properties of the scale.

Measures

The Polish version of the GPIUS2 contains 15 Likert-type items rated on a 7-point scale (from 1 = *definitely disagree* to 7 = *definitely agree*). The scale consists of five subscales: POSI, mood regulation, cognitive preoccupation, compulsive use of the Internet, and negative outcomes. However, in the previous Polish version, compulsive use had only two items, and cognitive preoccupation—four items and item P2 showed high cross-loading (Ciżkowicz, 2017).

Data Analysis

SPSS v.21 was used for the descriptive analyses. CFA, SEM and MI were tested using the R packages lavaan and semTools (Rossell, 2012). Data were screened for missing values, multivariate outliers, and normality (skewness < 3 and kurtosis < 8; Kline, 2015).

Internal consistency was examined by Cronbach's α and McDonald's ω_t (α and $\omega_t > .7$ are acceptable; McDonald, 1999). McDonald's ω was used because of the multidimensional GPIUS2 model and because finding the multidimensionality does not guarantee that the subscales can provide meaningful and reliable information about subdomains that is unique to the overall structure (Deng & Chan, 2017). Both ω_t (total reliability) and ω_h (hierarchical) were calculated according to the bifactor

model with five first-order factors (CFA was conducted with R-package psych; Revelle, 2019). The bifactor model allows, better than other models, to separate the variance of general and group factors. For scale, ω_h above .7 indicates the essential unidimensionality of the scale, ω_h close to .5 and higher indicate the substantive meaning of the subscales (Reise et al., 2013a). The GPIUS2 measurement model was verified using confirmatory factor analysis (CFA). Nomological validity was tested using structural equation modeling (SEM). Indirect effects were examined using bootstrap analyses (5,000 bootstrap samples, 95% CI).

MLM estimation with the Satorra-Bentler scaled χ^2(S–B χ^2) was used because of significant positive kurtosis in the distribution of values (Mardia's kurtosis 42.70). Goodness-of-fit was assessed using χ^2, standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker–Lewis index (TLI). When SRMR and RMSEA < .05 or .08 and RMSEA 90% CI with its the upper limit below .10 and CFI and TLI > .95 or .90 model fit was good or acceptable, respectively (Hu & Bentler, 1999). In model comparison, a change of .010 in CFI, supplemented by a change of .015 in RMSEA, indicates significant differences (Chen, 2007). Local fit was estimated by standardized factor loading, factor reliabilities, average variance extracted (*AVE*), standardized residual covariances and modification indices. Tucker's congruence coefficient was used to compare the factor similarity of the GPIUS2 model for the Polish and US samples. The Tucker's congruence coefficient range of .85–0.94 indicates fair similarity, and a range of .90–1.00 means high similarity (Lorenzo-Seva & ten Berge, 2006).

Convergent and discriminant validity were assessed using factor loadings (.5 or more) and *AVE* (*AVE* should be at least .5 and exceed the squared correlations with the other factors; Fornell & Larcker, 1981). MI was assessed by studying configural, metric and scalar invariance (Brown, 2015). The nested models were compared based on the Satorra–Bentler scaled χ^2 difference test.

RESULTS

Descriptive Statistics and Reliability

Descriptive statistics and reliability of the GPIUS2 were calculated (Table 2). For a bifactor model, the explained common variance (*ECV*) was in the range .49–.62, and the percentage of uncontaminated correlations (*PUC*) was .86 (Reise et al., 2013b).

Table 2

Descriptive Statistics and Reliability Analysis of GPIUS2 and Subscales

Scale/ subscale	OFF (914) ON (707)	*M*	*SD*	*As*	*K*	$r_{item\text{-}total}$	Cron-bach's α	McDonald's ω_t	McDonald's ω_h
GPIUS2	OFF	39.51	16.02	.75	.41	.52–.67	.92	.95	.85
	ON	47.48	15.39	.23	–.08	.37–.60	.87	.92	.77
PIU1	OFF	6.45	3.74	1.32	1.33	.69–.78	.85	.85	.45
	ON	9.10	4.71	.51	–.41	.67–.74	.84	.84	.32
PIU2	OFF	9.37	4.60	.38	.77	.59–.80	.85	.87	.51
	ON	11.92	4.54	–.26	–.59	.41–.72	.77	.83	.32
PIU3	OFF	7.97	3.86	.83	.23	.57–.65	.77	.79	.64
	ON	8.22	3.89	.71	.15	.56–.61	.75	.77	.58
PIU4	OFF	10.13	4.95	.34	–.89	.72–.83	.89	.89	.49
	ON	11.21	4.89	.13	–.89	.61–.79	.85	.86	.43
PIU5	OFF	5.58	3.24	1.72	3.22	.57–.60	.76	.76	.54
	ON	7.02	3.61	.95	.60	.45–.49	.66	.68	.39

Note. PIU1 = POSI; PIU2 = Mood Regulation; PIU3 = Cognitive Preoccupation; PIU4 = Compulsive Internet Use; PIU5 = Negative Outcomes; $r_{item\text{-}total}$ = item–total correlation; OFF = sample offline; ON = sample online.

Almost all item–total correlations were fully satisfactory (> .40). The only item with a slightly lower item-total correlations was P15 (.37). The GPIUS2 was highly internally reliable (GPIUS2: α and ω_t > .85; subscales: .75–.89; Table 2). Only Cronbach's α and ω_t PIU5 in the ON sample was < .70, but > .65, which is considered an acceptable value (Hair et al., 2014). Coefficients ω_h > .70 indicate high saturation of the scores with a general factor. Coefficients ω_h for subscales (close to .5) proves the essential meaning of the subscale regardless of the general factor. Definitely lower values of ω_h occurred mainly in sample online for PIU1 and PIU2, where P2 had cross-loading (Figure 1).

Structural Validity

Two measurement models were tested: M1—the original GPIUS2 model with modified P14 (Appendix), M2cP2—M1 with item P2 (POSI) cross-loadings (Table 3, Figure 1). The models were tested on an offline, online, and a combined sample.

Table 3

Goodness-of-Fit Indices for Measurement and Structural Models of GPIUS2

Model[a]	S–Bχ^2	*df*	CFI	ΔCFI	TLI	SRMR	RMSEA (90% CI)	ΔRMSEA
Offline + Online (N = 1621)								
M1	552.91***	82	.954		.940	.052	.060(.055–.064)	
M2cP2	415.23***	81	.967	.013	.957	.036	.050(.046–.055)	.010
Offline (n_1 = 914)								
M1	316.53***	82	.956		.944	.044	.056(.050–.062)	
M2cP2	258.24***	81	.967	.011	.957	.033	.049(.041–.055)	.007
Online (n_2 = 707)								
M1	341.84***	82	.935		.916	.070	.067(.060–.074)	
M2cP2	252.39***	81	.957	.022	.944	.049	.055(.048–.062)	.012
SEM (N = 1621)								
M2cP2	465.70***	83	.962		.952	.042	.053(.049–.058)	

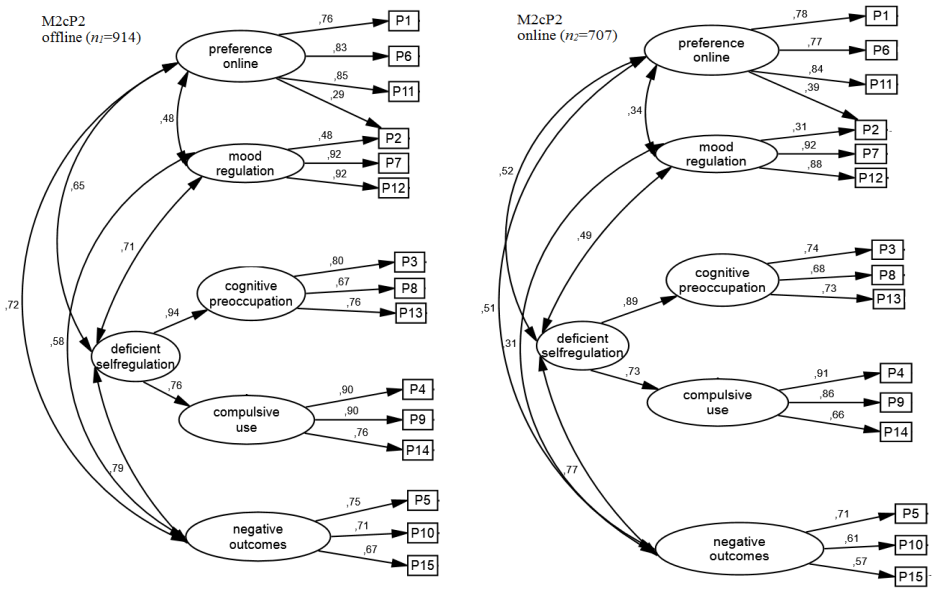
Note. M1 = Caplan's model (2010); M2cP2 = M1 with P2 cross-loading (Figure 1).
[a] All fit indices are robust fit indices.

M1 model fit was acceptable (Table 3). The M2cP2 model fit was significantly better than M1 (ΔCFI > .01). The inclusion of the P2 cross-loading has improved the fit indices (M2cP2).

In conclusion, the M2cP2 model was well fitted (Table 3), and all factor loadings and correlations between factors were highly significant (Figure 1). It was the reason why the M2cP2 was adopted. The M2cP2 local fit suggested little local misfit. All indicators (except P2) had standardized loadings > .57 (p < .001). *AVE* for four out of five constructs was greater than 0.5. Twenty-seven percent standardized residual covariances were bigger than |2.58|, which indicated local misfit "but this test is sensitive to sample size, which means that covariance residuals close to zero could be statistically significant in a very large sample" (Kline, 2015, p. 171).

Figure 1

Confirmatory Factor Analysis of GPIUS2



Note. Standardized factor loadings and correlations. All are significant at $p < .001$.

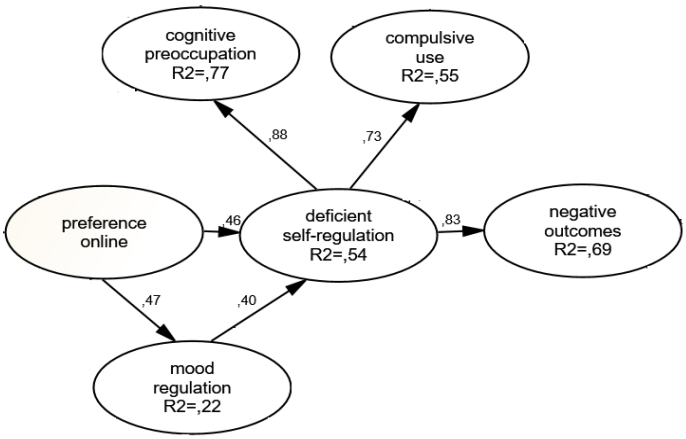
Analysis of the Theoretical Model

Figure 2 showed the structural model GPIUS2. Sixty-nine percent of the variance of negative outcomes was explained by the direct and indirect effects of other factors. The analysis results supported predictions of direct effects. POSI was a positive, significant predictor of mood regulation and deficient self-regulation. The mood regulation was a positive, significant predictor of deficient self-regulation, and deficient self-regulation was a positive, significant predictor of negative outcomes.

The hypotheses assuming the mediating role of mood regulation and deficient self-regulation were also confirmed. There was a significant, positive role of mood regulation as a mediator of the relationship between POSI and deficient self-regulation (β = .19, CI [.17, .22], $p < .001$). Furthermore, deficient self-regulation mediated the relationship between POSI and negative outcomes (β = .54, CI [.49, .59], $p < .001$) and between mood regulation and negative outcomes (β = .34, CI [.30, .38], $p < .001$).

Figure 2

Standardized Estimates for Structural Model GPIUS2



Note. N = 1,621. All are significant at $p < .001$.

Convergent and Discriminant Validity

The convergent and discriminant validity were evaluated for the M2cP2. For each factor, *AVE* and Pearson correlation coefficients between factors were calculated (Table 4). Square roots of *AVE* were shown on the diagonal (in bold). Almost all *AVE* (> .50, except PIU5) and factor loadings (≥ .65, except P2) were high, which confirmed the convergence validity. Discriminant validity was confirmed. For each factor, the square root *AVE* was high and higher than their correlation with other factors.

Table 4

AVE, Square Root of AVE and Matrix of Correlations Between Factors

Subscale	*AVE*	PIU1	PIU2	PIU3	PIU4	PIU5
Offline (N = 1,621)						
PIU1	.53	**.73**				
PIU2	.61	.49	**.78**			
PIU3	.54	.45	.52	**.73**		
PIU4	.71	.34	.44	.57	**.84**	
PIU5	.44	.50	.44	.49	.51	**.66**

Note. AVE = average variance extracted; the diagonal values (in bold) are the square root of *AVE* of the construct; PIU1 = POSI, PIU2 = Mood Regulation, PIU3 = Cognitive Preoccupation, PIU4 = Compulsive Internet Use, PIU5 = Negative Outcomes. All Pearson's correlation coefficients are significant at $p < .001$.

Measurement Invariance

Three of the five dimensions of the model M2cP2 (Figure 1) were tested: construct, metric, and scalar equivalence (Bauer, 2017).

Table 5

Testing for Measurement Invariance Across Gender and Method of Data Collection (N = 1,621)

Model[a]	S–Bχ^2	*df*	S–B$\Delta\chi^2$	Δdf	*p*	CFI	ΔCFI	RMSEA	ΔRMSEA
Gender (women vs. Men)									
Configural	621.19	162				.967		.056	
Weak (+loading)	633.40	174	11.61	12	.478	.967	.000	.054	.002
Strong (+intercepts)	676.37	183	41.76	9	<.001	.965	.003	.055	.001
Method of data collection (offline vs. online)									
Configural	635.95	162				.965		.058	
Weak (+loading)	668.71	174	31.46	12	.002	.964	.002	.057	.001
Strong (+intercepts)	806.19	183	159.07	9	<.001	.953	.010	.063	.006

Note. [a] All fit indices are robust fit indices.

The assumption of factor loadings equivalence for both genders and both methods of data collection yielded no significant differences ($\Delta\chi^2$, *p*; Table 5), which confirmed the weak invariance. The establishment of intercept equivalence gave significant values of $\Delta\chi^2$ in both groups. However, the high sensitivity of χ^2 to the sample size should be taken into account.

But in both cases, differences of fit indices (ΔCFI and ΔRMSEA) were smaller than the assumed cut-offs (respectively .01 and .015) and this confirmed the equivalence of the models.

The strong MI of the model across gender and methods of data collection were confirmed.

CONCLUSIONS

The current study was a continuation of the work on the GPIUS2 validation on the sample of Polish youth. Previous studies confirmed a high reliability of measurement, criterion validity, and a measurement model with a good fit that was slightly different from the original structure GPIUS2 (Ciżkowicz, 2017). The difficulties with fitting measurement model in Polish and other cultural adaptations (Table 1) have become a direct reason for undertaking further research.

In the current study, GPIUS2 extended by two modified items (P2 and P14) was used. But only the modification of P14 improved the psychometric properties of the scale.

Internal consistency was assessed using Cronbach's α and McDonald's ω coefficients. The general factor saturation for the GPIUS2 was calculated using bifactor measurement model with five first-order factors. This allowed to calculate not only the saturation of the general factor for the GPIUS2 but also of the other five first-order factors (Deng & Chan, 2017). These values were close to 0.5 which allowed also to infer about their substantive meaning (Table 2).

In the current study changing P14 improved model fit (M2cP2, Figure 1). The GPIUS2 was reliable (Table 2) and valid (Table 3). For the M2cP2 model, the direct and indirect relationships between factors were confirmed, and this provided support for the nomological validity of the GPIUS2. The negative outcomes variance was explained in 69% by this model (Figure 2). The convergent and discriminant validity were confirmed based on the average variance extracted (Table 4).

The results also confirmed the strong measurement invariance of the GPIUS2 both across gender and methods of data collection (Table 5). It allows the GPIUS2 to be used to compare the results for men and women as well as the data collected both offline and online.

To sum up, although scientists pay a lot of attention to PIU research, there are still terminological ambiguities and a lack of coherent theoretical models to understand the underlying mechanisms of these addictions (Caplan, 2002, 2010; Davis, 2001; Kim & Davis, 2009; Zajac et al., 2017). This is also the reason why there is no formal consensus on diagnostic criteria of Internet addiction. Most studies so far have dealt with risk factors for developing Internet addiction (Prasad et al., 2017). Therefore, it is important that the theoretical GPIU model and its operationalization direct research towards the etiology of GPIU (Caplan, 2002, 2010).

The Polish version of the GPIUS2 has good and stable psychometric properties and the factor similarity in Polish sample and the original US sample (Caplan, 2010) was high (Tucker's congruence coefficients ranged .99–1.00). The cognitive-behavioral model of GPIU among Polish adolescents was confirmed. Empirical support for this model provides a general framework for cognitive-behavioral therapy for excessive use of the Internet. It is its unquestionable advantage. Well-defined, reliable subscales results (Table 2) can help determine the factor that plays a leading role in Internet overuse for any given person and, consequently, to adapt the therapy better (Barke et al., 2014).

The GPIUS2 is a very useful tool. It enables the measurement of generalized PIU, which is important especially when the Internet brings changes so quickly. The GPIUS2 is a relatively short tool to complete and can be used in school settings,

where it can be used in assessing the level and changes of GPIU. The GENIUS 2 can also be used as a screening tool in clinical settings to identify cases of PIU and to indicate of areas of therapy.

LIMITATIONS AND FUTURE RESEARCH

The current studies have several limitations. One of them is that the studies were conducted mostly among young people (M = 19.8, SD = 3.2) and on a non-random sample, which limits the possibility of result generalization. Another limitation is a lack of research on the functioning of the GPIUS2 among people addicted to the Internet (in therapeutic outpatient clinics). Such studies would show what diagnostic properties the GPIUS2 have and allow cut-off values to be determined. Such research would be necessary if the scale was to be used for diagnosing PIU risk. The tested theoretical model assumed causal relationships (Figure 2). Therefore, another limitation was the use of a cross-sectional study for this purpose. Future studies should use a longitudinal study to analyze more precisely these relationships.

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APPENDIX

The Generalized Problematic Internet Use Scale 2 (Polish version)

No.	Item wording
1	Wolę kontakty z innymi w Sieci od porozumiewania się twarzą w twarz.
2	Kiedy czuję się osamotniony, używam Internetu, aby porozmawiać z innymi.
3	Jeżeli od jakiegoś czasu nie przebywam w Internecie, myśl o znalezieniu się tam zaprząta mi głowę.
4	Mam problemy z kontrolowaniem ilości czasu spędzanego w Internecie.
5	Przebywanie w Internecie utrudnia mi radzenie sobie z moim życiem.
6	Kontakty społeczne w Sieci są dla mnie bardziej komfortowe niż kontakty bezpośrednie.
7	Będąc przygnębionym, korzystam z Internetu, aby poczuć się lepiej.
8	Czułbym się zagubiony, gdybym nie miał dostępu od Internetu.
9	Trudno mi kontrolować czas spędzany w Internecie.
10	Zdarza mi się nie uczestniczyć w życiu towarzyskim lub w zajęciach z powodu korzystania z Internetu.
11	Preferuję komunikację w Internecie nad komunikację w świecie realnym.
12	Kiedy czuję się zdenerwowany, korzystam z Internetu w celu poprawy samopoczucia.
13	Myślę obsesyjnie o Internecie, kiedy nie mam do niego dostępu.
14	Używam Internetu dłużej niż powinienem.
15	Korzystanie z Internetu spowodowało problemy w moim życiu.

Note. The modified wording of item 2 that was not accepted: “Kiedy czuję się wyobcowany, używam Internetu, aby poczuć bliskość innych osób”. The wording of item 14 that was used in an earlier version GPIUS2: “Kiedy jestem w trybie offline, trudno mi przezwyciężyć pokusę przejścia do trybu online”.