Factorial validity of the Problematic Facebook Use Scale for adolescents and young adults

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Background and aims: Recent research on problematic Facebook use has highlighted the need to develop a specific theory-driven measure to assess this potential behavioral addiction. The aim of the present study was to examine the factorial validity of the Problematic Facebook Use Scale (PFUS) adapted from Caplan's Generalized Problematic Internet Scale model. *Methods:* A total of 1,460 Italian adolescents and young adults (aged 14–29 years) participated in the study. Confirmatory factor analyses were performed in order to assess the factorial validity of the scale. *Results:* Results revealed that the factor structure of the PFUS provided a good fit to the data. Furthermore, results of the multiple group analyses supported the invariance of the model across age and gender groups. *Discussion and conclusions:* This study provides evidence supporting the factorial validity of the PFUS. This new scale provides a theory-driven tool to assess problematic use of Facebook among male and female adolescents and young adults.

Keywords: adolescents, problematic Facebook use, factorial validation, Internet, young adults

INTRODUCTION

In recent years research on Facebook use has been growing, indicating a likely association between Facebook misuse and psychological problems such as anxiety, depressive symptoms, and school/academic and work problems (Satici & Uysal, 2015). Thus, concerns about the negative effect of Facebook on users' well-being have led researchers to posit that Facebook misuse can be considered as potentially addictive (Koc & Gulyagci, 2013). Indeed, even though Facebook addiction (FA) is not recognized as a diagnosable disorder, there is increasing research supporting the view that Facebook use can become problematic (Ryan, Reece, Chester, & Xenos, 2016). As an application on the Internet, FA has been often studied within an Internet addiction (IA) framework, which suffers itself a lack of consensus in definition and diagnostic criteria (for a review see Griffiths, 2013; Spada, 2014). The fact that there is no accepted theory of either IA or FA directly impacts also on the consensus about the terminology to be used (e.g., "addiction," "problematic use," and "compulsive use") and, in turn, on the validity of instruments used to assess these phenomena (Pontes, Kuss, & Griffiths, 2015).

In a recent review (Ryan, Chester, Reece, & Xenos, 2014) it has been highlighted that a number of different measures related to FA may lack construct validity. This is because many of these measures have been developed, in the first instance, by creating *ad hoc* measures or by adapting existing measures of IA which, in turn, were originally designed to assess other addictive behaviors (e.g., pathological gambling, substance misuse) (for a review

on this topic see Ryan et al., 2014). For example, the widely used Bergen Facebook Addiction Scale (BFAS; Andreassen, Torsheim, Brunborg, & Pallesen, 2012) assesses FA through six items representing the six core elements of behavioral addiction designed to assess gambling and gaming addiction (i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse). Such scale possesses very good psychometric properties and represents the first important attempt to assess FA through a valid measure. However, the fact that it is based on criteria associated with other behavioral addictions can constitute a possible weakness because it is possible to argue that addiction to social networking sites differs from problematic gaming or gambling addiction (Ryan et al., 2014). If this is the case, then a theory specifically developed for IA should provide the basis for the development of a relevant measure to assess problematic Facebook use (PFU). Ryan et al. (2014) identified Caplan's (2010) model of Generalized Problematic Internet Use (GPIU) and the relative measure "Generalized Problematic Internet Use Scale 2" (GPIUS2) as the best option for conceptualizing and measuring FA. In accordance with this model, the term "problematic Facebook use" (PFU) will be used in the present study. Even though both BFAS and GPIUS2 include mood-related and negative consequences factors, the GPIUS2 adds the preference for an online social

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interaction factor, particularly appropriate for the Facebook context, given the predominantly "social" functions offered by this social network (Lee, Cheung, & Thadani, 2012).

From this viewpoint, the GPIU model appears to offer a good base for investigating PFU because it focuses on elements that are specifically implicated in this potential behavioral addiction; that is preference for online social interactions (POSI), Internet use for cognitive and emotional regulation, and negative consequences of maladaptive use of the Internet. The GPIU model states that individuals preferring online social interactions to a face-to-face context use the Internet to regulate their moods and they are more likely to engage in cognitive preoccupation and compulsive use of the Internet (indicators of deficient self-regulation) which, in turn, predict negative outcomes of Internet use (Caplan, 2010). To assess these dimensions, Caplan (2010) developed and validated the 15-item GPIUS2. This scale can be used to obtain both an overall GPIU score and a set of five separate subscales scores, including the second order factor "deficient self-regulation" comprised of cognitive preoccupation and compulsive use subscales. Moreover, this scale has been widely used and validated in several languages including: Portuguese, German, Spanish, and Italian (Barke, Nyenhuis, & Kröner-Herwig, 2014; Fioravanti, Primi, & Casale, 2013; Gámez-Guadix, Orue, & Calvete, 2013; Pontes, Caplan, & Griffiths, 2016).

Given the supporting literature about the use of Facebook for mood regulation (Hong, Huang, Lin, & Chiu, 2014), self-regulation problems (Błachnio & Przepiorka, 2015) and negative outcomes concerning Facebook use, the goal of the present study was to present an adaptation of the GPIUS2 to Facebook use and to validate the factor structure of the PFU Scale (PFUS) in Italian adolescents and young adults. This population was specifically chosen because it appears to be at great risk of engaging in PFU because of the relevant role played by Facebook in facing developmental tasks and challenges. For example, some research has recently argued that Facebook is used by adolescents to shape their relationships with peers (Doornwaard, Moreno, van den Eijnden, Vanwesenbeeck, & Ter Bogt, 2014) and by young adults to satisfy specific psychological needs, such as self-presentation, socializing, and escapism (Papacharissi & Mendelsohn, 2011).

METHODS

Participants

A convenience sample of 1,650 Italian adolescents and young adults (842 boys, 808 girls, M_{age} 18.55 years, $SD = 2.70$, range: 14–29 years) participated in this study and was used to test the factorial validity of a scale. Moreover, a second separate sample ($N = 807$) of Italian young adults ($M_{age} = 21.06$ years, $SD = 1.89$, range: 18–29 years) was used to test the convergent validity of the PFUS.

Procedure

The first sample was recruited from a variety of secondary public schools in southern and northern Italy, and at the University of Padova (Italy). Only participants with a Facebook account were included in the study and the final sample included 1,460 Italian adolescents and young adults (718 boys, 742 girls, $M_{age} = 18.71$ years, $SD = 2.67$, range: 14–29 years). Anonymous questionnaires (including demographics and Facebook related questions) were filled in during regularly scheduled classes or university classes and participation was voluntary. The second sample was recruited with the same procedure used for the first sample of young adults.

Measures

At the beginning of the questionnaire, participants were asked to provide information about their Facebook affiliation (i.e., if they have a Facebook account) and problematic use, while their demographic information was only requested at the very end of the questionnaire (e.g., age and gender).

PFUS. The PFUS comprised 15 items slightly adapted from the scale developed and validated by Caplan (2010), the GPIUS2. In our adaptation, we replaced the word "Internet" with the word "Facebook" where necessary. Participants (from both the first and second samples) were asked to rate the extent to which they agreed with each of the 15 items on a 8-point scale [from (1) "definitely disagree" to (8) "definitely agree"]. The scale included five subscales, of three items each: (a) POSI (e.g., "I prefer online social interaction over face-to-face communication"); (b) mood regulation (three items, e.g., "I have used Facebook to make myself feel better when I was down"); (c) cognitive preoccupation (three items, e.g., "I would feel lost if I was unable to access Facebook"); (d) compulsive use (three items, e.g., "I have difficulty controlling the amount of time I spend on Facebook"); and (e) negative outcomes (three items, e.g., "My Facebook use has created problems for me in my life"). Caplan's original model also included the higher-order factor "deficient self-regulation" comprised of cognitive preoccupation and compulsive Internet use. Preliminary analysis using our sample did not support that structure, thus we decided to test for the five-factor structure of the scale. Taken together, these factors give an overall index score for the construct of PFU. Higher scores on the scale indicate higher levels of PFU. The full list of items is reported in Table 1.

BFAS. The BFAS (Andreassen et al., 2012) contains six items reflecting the six core behavioral addiction elements (Griffiths, 2005), which are salience, mood modification, tolerance, withdrawal, conflict, and relapse. Participants were asked to answer each of them on a 5-point scale [from (1) "very rarely" to (5) "very often"]. The Cronbach's α for the BFAS was 0.81 in the second sample of this study.

Statistical analysis

First, a confirmatory factor analysis (CFA) using the Lavaan package (Rosseel, 2012) of software R (R Development Core Team, 2012) was implemented. Weighted least estimation with robust standard errors and mean and variance estimator for ordinal items was adopted. The following indices were used to assess the fit of the model: (a) Chi

Table 1. Standardized factor loadings for the Problematic Facebook Use Scale [response format = from (1) "definitely disagree" to (8) "definitely agree"]; $N = 1,460$

Items	POSI	Mood regulation	Cognitive preoccupation	Compulsive use	Negative outcomes
1. I prefer online social interaction over face-to-face communication	0.63				
2. Online social interaction is more comfortable for me than face-to-face interaction	0.81				
3. I prefer communicating with people online rather than face-to-face	0.78				
4. I have used Facebook to talk with others when I was feeling isolated		0.51			
5. I have used Facebook to make myself feel better when I was down		0.78			
6. I have used Facebook to make myself feel better when I've felt upset		0.77			
7. When I haven't been on Facebook for some time, I become preoccupied with the thought of going on Facebook			0.79		
8. I would fell lost if I was unable to go on Facebook			0.69		
9. I think obsessively about going on Facebook when I am offline			0.71		
10. I have difficulty controlling the amount of time I spend on Facebook				0.77	
11. I find it difficult to control my Facebook use				0.75	
12. When offline, I have a hard time trying to resist the urge to go on Facebook				0.79	
13. My Facebook use has made it difficult for me to manage my life					0.74
14. I have missed social engagements or activities because of my Facebook use					0.58
15. My Facebook use has created problems for me in my life					0.58
PFU	0.46	0.77	0.92	0.81	0.74
Internal consistency (Cronbach's α)	0.79	0.70	0.73	0.81	0.67

square (χ^2); (b) comparative fit index (CFI; acceptable fit ≥ 0.90); (c) goodness-of-fit index (GFI; acceptable fit ≥ 0.90); and (d) root mean square error of approximation (RMSEA; acceptable fit ≤ 0.08) (Browne & Cudeck, 1993). Cronbach's α was employed to assess internal consistencies of the scale and its dimensions.

Second, the model was tested independently for both genders (males vs. females) and both age groups (i.e., the age groups 14–18 years and 19–29 years, named adolescents and young adults group, respectively) to establish configural invariance (Van de Schoot, Lugtig, & Hox, 2012). After this, two multigroup CFAs were also performed to examine measurement invariance of the PFUS across gender and age. A hierarchical approach was adopted by successively constraining model parameters and comparing changes in model fit (Steenkamp & Baumgartner, 1998). Configural, metric, and scalar models were also estimated. Measurement invariance was established when: (a) the change in values for fit indices (e.g., ΔCFI, ΔRMSEA) was negligible (i.e., a ΔCFI larger than 0.01 and a change larger than 0.015 in RMSEA as indicative of non-invariance; Cheung & Rensvold, 2002; Gilson et al., 2013); and (b) the multigroup model fit indexes indicated a good fit (Beaujean, Freeman, Youngstrom, & Carlson, 2012).

To test the convergent validity of PFUS scores, we also administered the BFAS. The association between PFUS scores and the BFAS was investigated in the second sample of young adults ($N = 807$).

Ethics

The current research received formal approval from the Ethics Committee for Psychological Research at the University of Padova, Italy. All participants were informed about the study and all provided informed written consent. Parental consent was sought for those younger than 18 years of age. This study did not involve human and/or animal experimentation.

RESULTS

Results of the CFA for the global model (run on the entire sample) showed an adequate fit to the data: $\chi^2_{(85)} = 170.50$, $p < .001$, CFI = 0.983, GFI = 0.997, RMSEA = 0.026 [0.021–0.032]. Standardized loadings ranged between 0.46 and 0.92 (see Table 1). The internal consistency of the overall scale's scores was 0.86. Before testing for

Table 2. Fit indices for measurement invariance tests on the PFUS

Model	N	χ^2	df	CFI	ΔCFI	RMSEA	ΔRMSEA
Gender							
Boys	712	82.54*	85	1.00	–	0.000	–
Girls	740	104.43*	85	0.994	–	0.018	–
Configural invariance	1,452	186.96*	170	0.997	–	0.012	
Metric invariance	1,452	213.44*	184	0.994	0.002	0.015	0.003
Scalar invariance	1,452	238.44*	193	0.991	0.003	0.018	0.003
Age							
Adolescents (14–19 years)	713	86.03*	85	0.999	–	0.004	–
Young adults (19–29 years)	739	114.50*	85	0.991	–	0.022	–
Configural invariance	1,452	200.53*	170	0.994	–	0.016	–
Metric invariance	1,452	257.31*	184	0.986	0.008	0.023	0.008
Scalar invariance	1,452	271.46*	193	0.985	0.001	0.024	0.000

*$p < .001$.

measurement invariance, the PFUS model was estimated separately in both male and female and in both adolescents and young adults. Results (see Table 2) demonstrated that the model fit was adequate to excellent for both gender groups (boys: $\chi^2_{(85)} = 82.539$, $p < .001$, CFI = 1.00, GFI = 0.995, RMSEA = 0.000 [0.000–0.019]; and girls: $\chi^2_{(85)} = 104.425$, $p < .001$, CFI = 0.994, GFI = 0.996, RMSEA = 0.018 [0.000–0.028]), and for age groups (adolescents: $\chi^2_{(85)} = 86.03$, $p < .001$, CFI = 0.999, GFI = 0.996, RMSEA = 0.004 [0.000–0.021]; and young adults: $\chi^2_{(85)} = 114.50$, $p < .001$, CFI = 0.991, GFI = 0.996, RMSEA = 0.022 [0.009–0.031]). Then, measurement invariance of the model was tested on gender groups and age groups through separate multi-group analyses (Van de Schoot et al., 2012). The fit indices of the unconstrained multigroup models demonstrated the configural invariance of the model across gender ($\chi^2_{(170)} = 186.964$, $p < .001$, CFI = 0.997, RMSEA = 0.012 [0.000–0.021]) and age groups ($\chi^2_{(170)} = 200.53$, $p < .001$, CFI = 0.994, RMSEA = 0.016 [0.000–0.024]) suggesting that the factor structure is similar across gender and age groups. A subsequent metric model testing for invariance of all factor loadings was established. All item loadings were constrained to equality and this did not lead to a significant reduction in model fit (ΔCFI = 0.008, ΔRMSEA = 0.008), suggesting that the PFUS assesses similar underlying factors across both males and females and both adolescents and young adults. Finally, all the item intercepts were constrained across groups to test for scalar invariance. Results demonstrated that total scalar invariance across both gender and age groups was confirmed (ΔCFI = 0.001, ΔRMSEA = 0.000).

Moreover, we tested the convergent validity in a different sample of young adults. First, we checked the factorial validity also in this sample ($\chi^2_{(85)} = 75.22$, $p < .001$, CFI = 1.000, GFI = 0.996, RMSEA = 0.000 [0.000–0.014]). Age, gender, and BFAS were added in the model as covariates indicating a high association between the latter and the PFUS latent variable, thus demonstrating acceptable convergent validity (Table 3). Overall, associations between BFAS and PFUS subscales were substantially high, whereas a lower correlation was observed between BFAS and POSI. The nonsignificant associations between PFUS and its subscales and both age and gender are in line with invariance across age and gender found in the first sample.

Table 3. Associations between Problematic Facebook Use, Bergen Facebook Addiction Scale, age, and gender in a sample of 807 young adults

PFUS	BFAS	Age	Gender
POSI	0.39*	0.02	−0.04
Mood regulation	0.66*	0.03	0.08
Cognitive preoccupation	0.77*	0.01	0.03
Compulsive use	0.76*	−0.002	0.02
Negative outcomes	0.70*	0.01	−0.04
PFU (total)	0.79*	0.01	0.01

Note. PFUS = Problematic Facebook Use Scale; POSI = preference for online social interactions; BFAS = Bergen Facebook Addiction Scale; $N = 807$.
*$p < .001$.

DISCUSSION AND CONCLUSIONS

The aim of the present study was to present the factor structure validation of the PFUS, the adapted version of Caplan's GPIUS2 (Caplan, 2010), in adolescents and young adults. Specifically, this study provided measurement properties [model fit, internal consistencies, and measurement invariance of the PFUS across gender (males vs. females), and age (i.e., adolescents vs. young adults)] using robust statistical analyses. Results indicated that the five-factor structure of the PFUS provided a good fit to the data. Furthermore, results of the multiple group analyses supported the invariance of the model across age and gender groups.

From a practical point of view, this study presents a new measure that could be used by researchers and practitioners to gain an in-depth understanding of both users' overall levels of PFU and its specific dimensions by drawing different information concerning the preference for online interactions, cognitive and emotional self-regulation skills, and negative consequences due to the maladaptive use of Facebook (Pontes et al., 2016). Specifically, the relatively moderate association between BFAS and the POSI factor of PFSU indicated that POSI could be considered as a new valuable "symptom" implicated in the definition of PFU. Indeed, while previous measures of FA did not include this

crucial social aspect of Facebook, it could be argued that it can constitute an important predictor of FA. This study also contributes to advance research on FA and on the cognitive-behavioral model of problematic Internet use (Caplan, 2002, 2003, 2010), suggesting that it may be usefully applied to the Facebook context. Indeed, the current results further support the literature considering Internet use and, in turn, Facebook use, as potentially problematic behaviors (Pontes et al., 2016; Tokunaga, 2015).

The PFUS has some limitations that need highlighting. For example, it does not provide any cut-off for distinguishing problematic from non-problematic users, and it is not informative about the potential addictive tendencies to each Facebook application (e.g., wall activities, gaming engagement, news feed, etc.). However, it does offer an additional step toward identifying specific symptoms involved in PFU. Moreover, we only tested the factorial structure of the PFUS and its internal consistency. Further research should examine other psychometric properties of this scale, including its test–retest stability, and the cross-cultural invariance of the factorial structure using randomly selected samples. Furthermore, research is needed to confirm the validity of the PFUS in older adults and in different cultures. Additionally, it is important to investigate the predictive validity of the scale, for example, by exploring the relationships between the scale's scores and different patterns of psychological distress, such as psychopathological personality and mood disorders (Rosen, Whaling, Rab, Carrier, & Cheever, 2013). Finally, we did not identify the second-order factor "deficient self-regulation" in our sample and future studies should investigate this aspect more in-depth.

These limitations notwithstanding, the PFUS is a theory-driven scale based on an Internet specific framework that has the potential to assess PFU among at risk population of users, be they male or female adolescents and young adults.

Conflict of interest: The authors declared that they have no conflict of interest.

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