Scale of problematic internet use in university students: evidence of validity and reliability

Escala de uso problemático da internet em universitários: evidências de validade e precisão

Escala de uso problemático de internet en universitarios: evidencias de validez y fiabilidad

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Abstract: The objective of these two studies was to gather evidence of the validity and precision of the Scale of Problematic Internet Use. In Study 01, 240 university students, with an average age of 22.96 years ($SD = 3.45$), answered scale and sociodemographic questions. The results of an exploratory factor analysis indicated a one-dimensional structure, explaining 49.01% of the total variance and comprising eight items, with a Cronbach's alpha of .84. In Study 02, 235 university students, with an average age of 23.95 years ($SD = 6.67$), responded to the same instruments. Using confirmatory factor analysis, the structure can be confirmed and presents excellent fit indicators: CFI = .99, TLI = .99, RMSEA = .03 (90% CI = .00-.07) and Pclose = .72, in addition to a Cronbach's alpha of .82. It was concluded that the instrument presents evidence of validity and precision and can be used to gauge the problematic use of the Internet and investigate its relationships to the study population.

Keywords: Internet dependence, social networks, University students, psychological tests, psychological assessment

Resumo: Objetivou-se, por meio de dois estudos, reunir evidências de validade e precisão da Escala de Uso Problemático da Internet. No Estudo 1, os 240 universitários com média de 22.96 anos ($DP = 3.45$), responderam à escala e a questões sociodemográficas. Os resultados de uma Análise Fatorial Exploratória indicaram uma estrutura unidimensional, explicando 49,01% da variância total, composta por oito itens, com um alfa de *Cronbach* de .84. No Estudo 2, os 235 universitários, com média de 23.95 anos ($DP = 6.67$), responderam os mesmos instrumentos. Por meio de uma Análise Fatorial Confirmatória pode-se confirmar a estrutura encontrada, apresentando excelentes indicadores de ajustes: CFI = .99, TLI = .99, RMSEA = .03, além de um alfa de *Cronbach* de .82. Conclui-se que o instrumento apresenta evidências de validade e precisão e pode ser utilizado para aferição do uso problemático da *internet* e investigação de suas relações para a população estudada.

Palavras-chave: dependência da internet, redes sociais, universitários, testes psicológicos, avaliação psicológica

Resumen: El objetivo de este trabajo fue reunir evidencias de validez y fiabilidad de la Escala de uso problemático de Internet. En el estudio 1 respondieron a la escala y encuesta sociodemográfica, 240 universitarios, cuya media de edad ha sido de 22.96 años ($DP = 3.45$). Los resultados del Analisis Factorial Exploratorio indicaron una estructura unidimensional, explicando 49.01% de la varianza total, compuesta por ocho items, con un alfa de *Cronbach* de .84. En el estudio 2, los 235 universitarios, cuya media de edad ha sido 23.95 años ($DP = 6.67$) respondieron a los mismos instrumentos. A través de un Analisis Factorial Confirmatorio se puede confirmar la estructura, presentando excelentes indicadores de ajustes: CFI = .99, TLI = .99, RMSEA = .03, además de un alfa de *Cronbach* de .82. Se concluye que el instrumento presenta evidencias de validez y fiabilidad y se puede utilizar para la medición del uso problemático de *internet* e investigación de sus relaciones para la población estudiada.

Palabras clave: dependencia de internet, redes sociales, universitarios, pruebas psicológicas, evaluación psicológica

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Introduction

With the advancement of digital technologies, the use of the Internet on mobile devices has contributed to the expansion of access to social networks, which in turn has modified life in society. The phenomena occur in cyberspace and present their own dynamics, depending on the subjectivities of the participants (Lima, Moreira, Stengel, & Maia, 2016).

Access to mobile devices has enabled immediate insertion into social networks, reinforced by the social appeal of using the Internet as an efficient and democratic vehicle of communication. This phenomenon can be seen in the Brazilian Midia Survey (2015), which was conducted by the Social Communication Secretariat of the Presidency of the Republic, in which the majority of respondents stated that they had access to the Internet via computer (71%), followed by cell phones (66%).

Todavia, Marques, Pinto and Alvarez (2016) called attention not only to the opportunities but also to the risks inherent in the use of social networks, and Gálvez-Nieto, Vera-Bachman, Cerda and Díaz (2016) brought cyberbullying behaviors in adolescents to people's attention. Abreu, Costa and Góes (2013) emphasized the negative effects of excessive use of the Internet on psychological health, resulting in pathologies such as *nomophobia (*excessive anxiety and stress because of not having a mobile device nearby).

Each day, the Internet becomes more present in daily life, primarily through tools of socialization and social sharing. According to Kuss and Griffiths (2011), social networks are perceived as a "global consumer phenomenon," exponentially increasing in use in recent years. Certainly, the use of the Internet presents several positive aspects, such as rapid access to information, cooperation and solidarity (Castells, 2013). However, it also has negative effects when it is used to excess, causing personal, academic and professional losses to users (Oliveira & Pasqualini, 2014).

Based on this scenario, for years, Caplan (2002) recorded the growing interest of researchers in establishing links between the intensive use of the Internet and psychosocial well-being. However, he highlighted that the studies were limited by the lack of a measuring instrument that adequately explained the problematic use of the Internet. Thus, considering the importance of having tools to measure the problematic use of the Internet in the Brazilian context, this study seeks to gather evidence of the validity and reliability of the scale proposed by Salgado, Boubeta, Tobío, Mallou and Couto (2014) – the Scale of Problematic Internet Use (SPIU).

Studies and evaluation of the problematic use of the Internet

During the twentieth century, the Internet revolutionized the daily lives of the population and became an essential component of people's routines. The Internet is effectively one of the most widely used technologies, with over one billion users worldwide (Picon, Karam, Breda, Restano, Silveira, & Spritzer, 2015). It is important to understand the relevance of the Internet in people's daily lives. There are many reasons for young people and, in the case of this study, university students to use the online network, even after the identification of benefits and risks (Marques, Pinto, & Alvarez, 2016).

Studies specifically regarding the problematic use of the Internet are relatively recent in the literature. Dependence on the Internet, for example, was first presented in 1986 by the American psychiatrist Ivan K. Goldberg, who coined the term "Internet addiction disorder," which is characterized by the inability to control one's own use of the Internet, leading to suffering of the user and significant impairment of daily activities and social relationships (Abreu & Góes, 2011).

According to Abreu, Eisenstein and Estefenon (2013), the uncontrolled use of the Internet can become a behavioral and health problem,

causing malnutrition, poor school performance, low self-esteem, antisocial behavior, drug use, habit disorders (particularly eating and sleeping disorders), violence and confusion between the real and virtual worlds. In addition, Internet use may present with comorbidities such as obsessive-compulsive disorder (OCD) and social anxiety disorder (SAD) (Hong et al., 2013).

Tsitsika, Critselis, Janikian, Kormas and Kafetzis (2010), in a study that correlated the practice of gambling by adolescents with the problematic use of the Internet, affirmed that this population is prone to higher rates of risk behavior. Therefore, when their use exceeds what is considered healthy, users may experience social, physical, psychological and academic damage.

Exemplifying the effects on people's social relationships, Sasmaz et al. (2014) determined that users - so-called "addicts" - spend a good portion of their lives isolated from face-to-face relationships. With regard to physical impairment, Lam (2014) observed a relation to sleep problems (poor sleep quality, insomnia). From a psychological perspective, Ceyhan and Ceyhan (2008) verified levels of solitude and depression as significant predictors of the level of problematic use of the Internet by university students. In addition, academic losses were noted by Kirschner and Karpinski (2010), demonstrating that social network users had lower scores than nonusers.

Considering the importance of the theme and the relevance of having instruments that evaluate this phenomenon, instruments were developed as psychometric tools to measure the problem. The literature describes approximately 45 instruments in 23 languages developed between 1995 and 2013 to investigate behaviors related to Internet addiction (Laconi, Rodgers, & Chabrol, 2014).

These studies of evaluation and measurement of problematic behaviors related to Internet use include the Generalized Problematic Internet Use Scale [(GPIUS) (Caplan, 2002), the Internet Consequences Scale [(ICS), Clark & Frith, 2005], and the Chinese Internet Addiction Inventory [(CIAI), Huang, Wang, Qian, Zhong, & Tao, 2007]. In addition, the Internet Addiction Test [(IAT), Widyanto & McMurran, 2004], one of the most internationally used tests, was translated into Portuguese (Brazil) by Conti et al. (2012). The Online Cognition Scale [(OCS), Davis, Flett, & Besser, 2002] also has a Brazilian Portuguese version (Silva et al., 2014).

This variety of instruments reflects problematic use of the Internet at rates ranging from 0.3% to 37.9%, justified by sampling characteristics, psychometric fragilities and different theories (Pezoa-Zares, Espinoza-Luna, & Vasquez-Medina, 2012). Although several instruments were applied to the evaluation, including the instruments translated into Brazilian Portuguese to evaluate this type of problem, they are widely criticized due to fragile evidence, items considered vague and a lack of a solid theoretical perspective in the construction and validity (Gámez-Guadxi, Villa-George, & Calvete, 2012; Pontes, Patrão, & Griffiths, 2014; Wallace, 2014).

Faced with such evidence, it is emphasized that Caplan (2002) conducted a study to develop and test a measure for problematic use of the Internet based on behavioral cognitive theory. Based on this study and the specialized literature, Salgado et al. (2014) presented a new instrument to measure the problematic use of the Internet for early diagnosis of adverse health effects: the Scale of Problematic Internet Use (SPIU). This scale was developed in the Spanish context in a population of adolescents; it is a short instrument, comprising eight items, is quite concise and has excellent psychometric properties.

Given the above, the relevance of the present research lies in the contribution to the context of a scale to be used in Brazilian Portuguese to evaluate the problematic use of the Internet, particularly for the university population. To accomplish its creation, two studies were developed, which are presented next, that sought to gather evidence of the validity and precision of the SPIU.

Study 01- Initial evidence of the validity and accuracy of the SPIU

Method

Participants

The sample was non-probabilistic, for convenience, and comprised 240 university students from public and private institutions, equally distributed, from the city of João Pessoa-PB, Brazil. The participants had a mean age of 22.06 years old ($SD = 3.45$, ranging from 18 to 35 years), with 50.42% female. They were mostly single (91.3%). Financially, the majority (29.2%) reported having a family income ranging from

BRL 2862.00 to BRL 5724.00, followed by 22.5% declaring an income between BRL 1909.00 and BRL 2862,00 and 14.7% declaring an income between BRL 954.00 and BRL 1,908.00 As a criterion for inclusion in the sample, participants needed to have access to the Internet.

Instruments

The participants answered questions in a booklet containing the following instruments:

- *The Scale of Problematic Internet Use* (SPIU), originally constructed in the Spanish language by Salgado et al. (2014), is a measure tracking the problematic use of the Internet that comprises 8 items (e.g., Item 8, *I have stopped doing important things to stay connected,* and Item 2, *On some occasions I have lost hours of sleep to use the Internet*), answered on a Likert-type scale with five response options, ranging from 0 "strongly disagree" to 4 "strongly agree." Notably, the original study in Galicia, an autonomous Spanish community, presented an index of accuracy considered satisfactory (Cronbach's alpha = .84).

- *Sociodemographic questionnaire*: To characterize the participants, the questions refer to age, gender, marital status, the nature of the university institution and family income.

Procedure

Initially, the translation of the measure was accomplished using the technique of backtranslation (Sousa & Rojjanasrirat, 2010), assisted by bilingual professionals (Portuguese-Spanish). The scale was translated into Portuguese and then retranslated into Spanish, with the collaboration of two teachers who were not familiar with the instrument (blind translation). Subsequently, the versions were compared in terms of their equivalence, demonstrating that the translation into Portuguese adequately reflected the meaning of the measure in Spanish.

Finally, the version went through the semantic validation stage, following the procedures established by Pasquali (2010), in which a sample of 20 participants from the target population of the study, distributed equally between men and women, identified possible reading difficulties and interpretation problems with the items. At this stage, no problems were identified regarding comprehension or the orientation of the items. Thus, collection of data was conducted.

Ethical procedures

The project was submitted to the Ethics Research Committee of the University Center (Prot. No. 0689/16. CAAE: 61341516.5.0000.5188). Upon approval of the project, based on Resolutions 466/10 and 510/2016 of the National Health Council, data collection occurred in public and private institutions after the consent of the participants through the Informed Consent Form and a letter of agreement from the institutions were obtained; on average, the participants took 10 minutes to finalize their answers.

Data analysis

Descriptive statistics were calculated using SPSS version 21 to characterize the sample, and using the software Factor 9.2 (Lorenzo-Seva & Ferrando, 2013), the dimensionality of CPD-S was investigated with the Hull comparative fit index (CFI) method (Lorenzo-Seva, Timmerman, & Kiers, 2011), one of the best methods available (Lorenzo-Seva et al., 2011), through an unweighted least squares (ULS) categorical exploratory factor analysis with polychoric correlations. In addition, the Cronbach's alpha was calculated based on the polychoric correlations and McDonald's omega to check the internal consistency of the instrument. These analyses were conducted considering that the scale cannot be considered to be continuous because it is a Likert-type scale comprising ordered categories (Holgado-Tello, Chacón-Moscoso, Barbero-García, & Vila-Abad, 2010; Lara, 2014).

Results

Initially, we attempted to verify the adequacy of the polychoric correlation matrix for the ULS ordinal exploratory factorial analysis. It was deemed relevant by satisfactory Kaiser-Meyer-Olkin (KMO) indices = 0.85 and the Bartlett sphericity test = 648.8(28); $p < 0.01$. The exploratory factor analysis using the Hull dimensionality method suggested a unifactorial solution, resulting in a global fit index (GFI) = .99. The results are shown in table 1.

The retained factor (eigenvalue = 3.40) explained 49.01% of the total variance of the

Table 1
Factorial Structure of the Scale of Problematic Internet Use (SPIU)

Itens	Factorial Load	h^2
07. I have neglected my tasks by connecting to the Internet.	0.78*	0.47
08. I have stopped doing important things to stay connected.	0.77*	0.37
02. On some occasions, I have lost hours of sleep to use the Internet.	0.73*	0.35
03. Sometimes I connect more than I should.	0.73*	0.32
06. When I am connected, I feel that time is passing fast, and when I realize it, I have spent hours on the Internet.	0.65*	0.29
05. There are times when I'm in a bad mood because I cannot connect.	0.54*	0.26
04. There are occasions when I prefer to stay connected to the Internet rather than being with my family or friends.	0.52*	0.24
01. It is important to me to connect daily to Facebook, Twitter, Instagram, etc.	0.38*	0.16
Quantity of items	8	
Explained variance (%)	49.01	
Eigenvalue	3.40	
Cronbach's alpha	0.84	
McDonald's Ω	0.85	

Note: * load factor considered satisfactory, i.e., > |0.30|. h^2 = commonality. α = Cronbach 's alpha based on polychoric correlations. Ω = omega.

items and gathered all eight items of the scale, with factorial loads varying from 0.38 (*Item 1, It is important to me to connect daily to Facebook, Twitter, Instagram, etc.*) to 0.78 (*Item 7, I have neglected my tasks after connecting to the Internet*). All items saturated above 0.37 in the factor were deemed problematic Internet use.

The internal consistency, evaluated by the Cronbach 's alpha (based on polychoric correlations) and the McDonald's omega, presented values of .84 and .85, respectively. Thus, the results observed thus far seem to suggest evidence of the validity and accuracy of the SPIU. Nevertheless, it should be considered that the analyses conducted were characterized as purely exploratory, requiring that the structure observed be tested in a different sample. This motivated the conducting of a second study through the accomplishment of a confirmatory factor analysis, which is described next.

Study 02- Proof of the SPIU's factorial structure

Method

Participants

A nonprobabilistic sample, by convenience, of 235 university students from the city of João Pessoa-PB, Brazil was obtained. The students had a mean age of 23.95 years ($SD = 6.67$, ranging from 18 to 56 years), of whom 56.6% were female and 54% were from public institutions. The majority declared themselves as single (82.6%), with a family income varying from BRL 2641.00 to BRL 5520.00 (25.5%), followed by the group that declared an income between BRL 881.00 and BRL 1760.00 (23.8%) and between BRL 1761.00 and BRL 2640.00 (22.1%). The same inclusion criterion as for the sample in the previous study was used.

Instruments

The participants answered questions from a booklet containing the same instruments described in Study 01.

Procedure

The procedures adopted here follow the guidelines of Resolutions 466/12 and 510/16 of the National Health Council and are similar to those of the first study.

Data analysis

Using the R software, descriptive analyses were performed to describe the participants. With the Lavaan package (Rossel, 2012), a weighted least squares mean and variance-adjusted (ordinal) categorical confirmatory factor analysis was conducted (WLSMV) (Muthén & Muthén, 2014), which, considering the ordinal nature of the data, was implemented on an array of polychoric correlations.

To evaluate the adequacy of the model, the following indicators were used (Byrne, 2010;

Tabachnick & Fidell, 2013): (1) The comparative fit index (CFI) is a comparative index, and generally, values from 0.90 are indicative of a fitted model. (2) The Tucker-Lewis index (TLI) presents a measure of parsimony between the indices of the proposed model and the null model and ranges from zero to one, with values above 0.90 as acceptable. (3) For the root-mean-square error of approximation (RMSEA) and its 90% confidence interval (90% CI), values between 0.05 and 0.08 are recommended and values up to 0.10 accepted. (4) Pclose is a more criterious indicator, testing the null hypothesis of RMSEA < .05; thus, Pclose> .05 is recommended as indicative of the adjusted model. In addition, the measure reliability was calculated with the semTools package (semTools Contributors, 2016).

Results

Considering the original version of the instrument used in Study 01, the researchers conducted the testing using the AFC. These items were then evaluated using the WLSMV categorical confirmatory factor analysis with the purpose of determining the fit of this factorial structure to the empirical data. The results support the unidimensionality of the scale, presenting excellent adjustment indicators: CFI = .99, TLI = 0.99, RMSEA = .03 (90% CI = .00-0.07) and Pclose = .72.

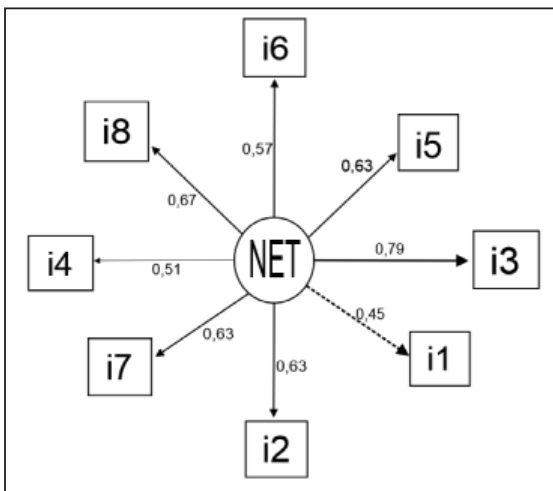*Figure 1*
Factorial Structure of the Scale of Problematic Internet Use

The factor weights (Lambdas - λ) were all positive and different from zero ($λ ≠ 0$, z > 1.96, p <.001), which suggests that the factor satisfactorily predicts answers to these items. The factor loads (λ)

of items ranged from 0.45 (*Item 1, It is important to me to connect daily to Facebook, Twitter, Instagram, etc.*) to 0.79 (*Item 3, Sometimes I connect more than I should*). It was observed that the precision of the measurement presented equally favorable results, being evaluated by Cronbach's alpha (polychoric correlations) and McDonald's omega at 0.82 and 0.83, respectively. Therefore, such psychometric indices reinforce the evidence of the validity and internal consistency demonstrated in Study 01.

Discussion

The objective of gathering evidence of the SPIU psychometric adequacy was satisfactorily achieved, taking into account adequate factorial validity (exploratory and confirmatory) and internal consistency (Cronbach 's alpha and McDonald's omega). Achieving that objective fulfilled one of the purposes of the factor analysis, i.e., identifying a causal connection between the hypothetical latent factor and the set of measurement items (Markus & Borsboom, 2013).

It should be noted that the SPIU, originally constructed in Spanish by Salgado et al., (2014), is a tracking measure of the problematic use of the Internet, and similar to its original structure, the Brazilian version comprised all eight items and had a unifactorial structure. It was possible to obtain these findings from the analyses of the two studies executed, considering the ordinal nature of the data, that were implemented with polychoric correlations in order to be considered consistent and recommended in a research situation that aims to identify the linear relationship between variables (Asún, Rdz-Navarro, & Alvarado, 2015; Holgado-Tello et al., 2010).

The unweighted least squares estimator (ULS or non-weighted least squares) was used in Study 01, gathering evidence for factor validity, with all the factor loads saturating above the cutoff point recommended in the literature (|0.30|, Pasquali, 2010). In Study 02, using the weighted least squares mean- and-variance-adjusted (WLSMV or robust weighted least squares) method, it was possible to check the unifactorial structure of the measure, which presented satisfactory fit indicators according to the literature (e.g., CFI and TLI > 0.90 and RMSEA < 0.08; Tabachnick & Fidell, 2013). In addition, it was observed that the internal consistency indices of the measure presented adequate and equally satisfactory parameters

(Cohen, Swerdlik, & Sturman, 2014; Nunnally, 1978).

Clearly, the psychometric properties of the measure were ensured, and it is estimated that these findings contribute to researchers interested in the subject, considering the importance of having instruments that demonstrate solid evidence favoring an understanding of the antecedents and consequences of a given phenomenon (Clark & Watson, 1995). Specifically, studies about the use of the Internet are justified by the need to reach a conceptual and methodological consensus that helps to evaluate its problematic use, characterized by the neglect of other areas of life (Salgado et al., 2014). According to Sasmaz et al. (2014), users who spend the majority of their hours connected are isolated from face-to-face relationships.

Consequently, allowing oneself to be swayed by the attractiveness of the Internet, not perceiving time passing, may engender a decrease in an individual's friendships and social circle. In addition, excessive use creates feelings of anxiety or irritation and causes people to go for long periods of time without eating or sleeping to spend more time connected (Picon et al., 2015).

Thus, the SPIU is a useful tool in the Brazilian Portuguese language to investigate whether there are educational, labor, and sleep decreases and a decline in the quality of interpersonal relationships (e.g., partner, family and friends). Thus, the SPIU allows a coherent investigation regarding the possibilities and risks of access to online networks (Marques et al., 2016). It also creates an understanding of possible variables related to or predictors of problematic Internet use (e.g., personality, substance use and solitude), thus helping in the understanding and prevention of this phenomenon.

Nevertheless, the present study has limitations, such as sampling by convenience bias (Cozby, 2003), which restricts the results to the sample used and impedes the generalization of the findings. However, this was not one of objectives of these studies, which, for the moment, present meritorious evidence. There was also a lack of external validity of the measurement, and two studies that provided only internal validity of the measurement were presented.

It is necessary for future studies to consider larger and heterogenous samples from different regions of Brazil and to seek to associate the SPIU with other instruments that measure the problematic use of the Internet and with different variables (e.g., anxiety, depression and social isolation). More

robust analysis will also refine the use of the scale. In this manner, it will be possible to incorporate the evidence presented here regarding the psychometric properties of the SPIU, giving greater confidence to the researchers and professionals who opt for its use.

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