# PIUS-a: Problematic Internet Use Scale in adolescents. Development and psychometric validation

## EUPI-a: Escala de Uso Problemático de Internet en adolescentes. Desarrollo y validación psicométrica

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## Abstract

Adolescents' use of the Internet is becoming a matter of great concern for different sectors of society. The psychological and behavioural consequences of problematic Internet use in young people demands quick and effective answers. One of the major challenges in this context is the development of empirically validated tools, which would facilitate early detection and screening for potential risk cases. This is precisely the aim of this paper. Based on a sample of 1,709 secondary-school students from Galicia (a region in northern Spain) aged 11 to 17 ($M$ = 13.74, $SD$ = 1.43), the analysis carried out permitted us to present a brief and simple tool (with just 11 items). It has substantial theoretical support, since both the existing background information and the views of experts from the academic and professional spheres were taken into account in the course of its development. The scale is adapted to the Spanish cultural context and to the language of young people. It has satisfactory psychometric properties in terms of reliability of the scores ($\alpha$ = .82), evidence of its internal structure (tested via a Confirmatory Factorial Analysis), sensitivity (81%), and specificity (82.6%). Moreover, its use enables the gradation of adolescents on a risk or problematic Internet use continuum. In our view, all of this lends it enormous applied potential in both the educational and clinical contexts.

*Key words:* addiction, adolescents, early detection, Internet, problematic use, screening.

## Resumen

El uso que los adolescentes hacen de Internet viene suscitando una enorme preocupación en diferentes sectores de la sociedad. Las consecuencias a nivel psicológico y conductual que el uso problemático de la Red provoca entre los más jóvenes demandan una respuesta tan rápida como eficaz. Uno de los grandes retos en este contexto es el desarrollo de herramientas validadas empíricamente, que permitan hacer un cribado o detección precoz de posibles casos de riesgo. Ese es precisamente el objetivo de este trabajo. A partir de una muestra de 1709 escolares de Enseñanza Secundaria Obligatoria de la comunidad gallega, de edades comprendidas entre los 11 y los 17 años ($M$ = 13,74; $DT$ = 1,43), los análisis realizados permiten presentar una herramienta breve y sencilla (compuesta por solo 11 ítems), que goza de un importante aval teórico, ya que para su elaboración se tuvieron en cuenta tanto los antecedentes existentes en la literatura, como las opiniones de expertos del ámbito académico y profesional. Dicha escala, además de estar adaptada al contexto cultural español y al lenguaje de los adolescentes, presenta unas propiedades psicométricas satisfactorias, tanto en términos de fiabilidad de las puntuaciones ($\alpha$ = ,82) y evidencias de su estructura interna (probada a través de un Análisis Factorial Confimatorio), como de sensibilidad (81%) y especificidad (82,6%), permitiendo "escalar" a los adolescentes en un continuum de riesgo o uso problemático de Internet. Todo ello le confiere, a nuestro modo de ver, un notable potencial a nivel aplicado, tanto en el contexto educativo como clínico.

*Palabras clave:* adicción, adolescentes, cribado, detección precoz, Internet, uso problemático.

One of the defining characteristics 21st-century society is the generalized use of so-called *New Technologies* (NT) or *Information and Communications Technology* (ICT). According to Spain's National Institute of Statistics (Instituto Nacional de Estadística [INE], 2014), in Spain 92% of minors aged 10 to 15 are Internet users. The Web provides access to multiple sources of information, learning, leisure and personal, academic and professional development, as well as to innovative forms of communication, relation and expression. Without questioning its benefits, we should not overlook the fact that its use also involves certain associated risks and dangers (loss of privacy, contact with strangers, isolation), in addition to disconcerting practices such as cyberbullying, grooming or sexting, which are affecting increasing numbers of adolescents, considered one of the most vulnerable groups in this new environment (Castellana, Sánchez-Carbonell, Graner, & Beranuy, 2007; Echeburúa & Corral, 2010; Yang & Tung, 2007).

The use that teenagers make or are able to make of Internet is a topic of concern in Spain and elsewhere (Oliva et al., 2012; Puerta-Cortés & Carbonell, 2014; Ruiz-Olivares, Lucena, Pino, & Herruzo, 2010; Smahel et al., 2012; Tsitsika, Tzavela, Mavromati and EU consortium NET ADB, 2012; Valedor do Pobo, 2011). This general concern has been heightened in recent years by the sometimes sensationalist way in which the subject is treated in the media. This has helped to create some degree of social alarm and no little scepticism among researchers and professionals, who do not consider it appropriate to speak of Internet addiction per se (Estallo, 2001; Grohol, 1999; Matute, 2001). However, others have indeed taken this step, attempting to scientific credibility to the use of this term (Cao & Su, 2007; Young, 1998). Various studies have tried to provide evidence that the behaviour of some individuals in relation to the Web fulfils the general criteria of an addiction (Echeburúa, 1999; Griffiths, 1998), or even proposed diagnostic criteria (Ko, Yen, Chen, Chen, & Yen, 2005; Tao et al., 2010; Young, 1996). And while it is true that neither of the diagnostic manuals of reference (CIE-10 and DSM-5) currently includes such a category, it is interesting to mention two innovations that appear in the DSM-5 (American Psychiatric Association [APA], 2013): on the one hand, *Internet Gaming Disorder* has been included in Section III of the manual, reserved for potential new diagnostic categories that require further research and evidence from clinical contexts; on the other hand, *compulsive gambling* has been classified as a *behavioural addiction,* which leads us to think, in line with other authors (Cía, 2014; Petry & O'Brien, 2013), that other behaviours capable of generating the psychopathology characteristic of addiction could also be fully incorporated into coming editions of the manual.

Despite the enormous amount of scientific work that this area has been generating for almost two decades now, there is still a degree of controversy (García, Beltrán, & Pérez, 2012; Douglas et al., 2008; Rial, Gómez, Braña, & Varela, 2014; Sánchez-Carbonell, Beranuy, Castellana, Chamarro, & Oberst, 2008; Spada, 2014). An example of this is the disparity in the prevalence figures estimated by different studies. In the Spanish context the data range from *0.76% of adolescents and young people with severe level of Internet addiction* to *21.88% with moderate addiction* (Oliva et al., 2012), or *3.3% of problematic users* and *43.3% of risk users* in young people aged 14 to 18 (Estévez, Bayón, de la Cruz, & Fernández-Líria, 2009), to *19.9% of problematic users* among secondary-school students (Gómez, Rial, Braña, Varela, & Barreiro, 2014).

In the case of Europe-wide studies, the data range from *1% of pathological levels of Internet use* found in children aged 11 to 16 (Smahel et al., 2012), or the *1.2% of* adolescents aged 14 to 17 with *Internet addiction behaviours* and *12.7% at risk* (Tsitsika et al., 2012), to *4.4% of pathological Internet users* and *13.5% of maladaptive users* (Durkee et al., 2012)

The figures in studies outside Europe also show disparities: Cao, Sun, Wan, Hao and Tao (2011) report *8.1%* of *problematic users of Internet* among Chinese adolescents, whilst Lam, Peng, Mai and Jing (2009) speak, in relation to Chinese secondary-school students, of *10.2% moderately addicted* and *0.6% severely addicted* to the Web. At the same time, the range of prevalence found in studies with adolescents and university students in the USA is from *0%* to *26.3%* (Moreno, Jelenchick, Cox, Young, & Christakis, 2011).

In sum, although more and more research is being done on this issue, the data are confusing, and at times even contradictory. The "risk" estimated in each case tends to be an excessively diffuse term, given the underlying conceptual controversy that must be resolved first: what do we actually want to assess? It is necessary to clarify what we are talking about: *Internet addiction* (Chou & Hsiao, 2000; Young, 1996), *compulsive use* (Greenfield, 1999; Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009), *pathological use* (Davis, 2001; Morahan-Martin & Schumacher, 2000), *problematic use* (Caplan, 2002; Shapira et al., 2003), *excessive use* (Hansen, 2002), *unregulated use* (LaRose, Lin, & Eastin, 2003) or *Internet dependence* (Anderson, 2001; Scherer, 1997). Do these terms form part of a single *continuum* of risk? And if so, what sequence do they follow? Which of them accounts for the highest level of risk? Where should we set the boundaries between one concept and another? The heterogeneity of terms makes it seriously difficult to compare and integrate results, so that the first task for research teams and the scientific-professional community is to reach a consensus on both the term to use and its defining criteria. Thus,

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although it might be acceptable to speak of *addiction* to Internet, in the name of rigour and orthodoxy (and pending the necessary consensus), a prudent solution would be to employ the term *problematic use*. Authors such as Ceyhan, Ceyhan and Gürcan (2007), Pulido-Rull, Escoto-de la Rosa and Gutiérrez-Valdovinos (2011) or Thatcher and Goolam (2005) advocate the use of this expression.

But beyond this controversy, what is certain is that signs are increasing of the existence of the problem, so that it must be addressed as soon as possible. In this context, one of the greatest challenges for research is the development of screening instruments, permitting early detection or the identification of possible risk cases, which would redound to the benefit of prevention initiatives.

The Appendix to this article includes a list of the principal instruments or tests developed to date. Its length serves only to highlight the enormous degree of heterogeneity there is, from both the conceptual and methodological points of view. Despite the large number of scales available, if our goal is to develop a tool with sound guarantees that permits early detection of cases of problematic Internet use among adolescents, the truth is that many of them present some kind of limitation: (1) they are not adapted to the adolescent population or the items are unsuitable for the specific reality of this age group (Armstrong, Phillips, & Saling, 2000; Nichols & Nicki, 2004); (2) they do not provide sufficient data on their psychometric properties, or they are not as reliable as they should be (Frangos, Frangos, & Sotiropoulos, 2012; García et al., 2008; Orman, 1996); (3) the samples used for their empirical validation are too small (Lam-Figueroa et al., 2011; Morahan-Martin & Schumacher, 2000); (4) their factor structure is unclear (Chang & Law, 2008; Widyanto & McMurran, 2004); (5) they are difficult to use as *screening tools*, given their large numbers of items (Davis, Flett, & Besser, 2002; Li & Yang, 2007) or because they do not provide cut-off points (Beranuy, Chamarro, Graner, & Carbonell, 2009; Meerkerk et al., 2009); (6) there is no suitably adapted version in Spanish (Demetrovics, Szeredi, & Rózsa, 2008); or (7) they were developed in a culture very different from that of Spain (Chen, Weng, Su, Wu, & Yang, 2003; Huang, Wang, Qian, Zhong, & Tao, 2007).

The objective of the present work is precisely to develop a screening scale for *problematic Internet use in* adolescents, with sufficient theoretical and empirical guarantees, and that is both brief and easy to use. Such a scale must integrate the different antecedents from the literature and present acceptable psychometric properties, with regard to score reliability, evidence of validity, sensitivity and specificity. In addition to being brief and simple, its items must be in accordance with the language and cultural context of adolescents.

## Method

### *Participants*

To achieve our objective we used purposive sampling, in an effort to access the largest and most heterogeneous sample possible. Through contact with 11 secondary schools in 7 different municipalities (both urban and rural) of the province of A Coruña (north-western Spain), it was possible to assemble a sample of 1709 adolescents (835 girls and 874 boys) aged 11-17 (*M* = 13.74; *SD* = 1.43). Of these, 30.2% were in the first grade (1º de ESO), 25.2% in the second grade, 23.8% in the third grade and 20.8% in the fourth grade. As regards parents' educational level, 4% of fathers and 3.2% of mothers had no formal education, whilst 36.9% of fathers and 34.5% of mothers had primary education. Those with secondary/high-school education accounted for 48.6% of the fathers and 46.3% of the mothers, and 10.4% of fathers and 15.9% of mothers had a university education.

### *Instruments*

For the construction and development of the scale we followed the phases set down in the American Educational Research Association's *Standards* (American Psychological Association and National Council on Measurement in Education, 1999). First of all, we defined the purpose of the scale, which was to produce a *screening instrument for problematic Internet use in* adolescents, as well as defining the scope of the construct or domain to be measured. We next specified certain aspects of the scale, such as item format, response format and the procedure for calculating the scores obtained by each participant. Specifically, it was decided that the items would be statements in the first person, and that the response format would be based on a Likert-type scale with 5 options, since this maximizes score reliability and improves the chances of obtaining good validity evidence. For calculating the scores we established a range of 0 to 4 in the 5 categories of the agreement scale, 0 signifying *Totally disagree and* 4 signifying *Totally disagree*. Next, we implemented the phase of development, assessment and selection of the items, and finally, we drew up the final version of the scale and carried out its empirical evaluation.

These four phases were developed through three complementary strategies. The first of these involved a review of the extensive literature on the subject, summarized in the Appendix, which lists the main scales previously proposed and their defining characteristics. We also took into account the DSM-5 diagnostic criteria for pathological gambling and Internet Gaming Disorder.

The second strategy was the development of a qualitative study, which involved the creation of a multidisciplinary team of experts consisting of 12 professionals (3 clinical psychologists, 3 psychiatrists, 3 community edu-

cation workers and 3 experts in drug-dependence prevention), with three specific objectives: (1) To carry out a critical review of the existing literature, highlighting the current limitations in this area; (2) To provide evidence of the content validity of the scale and the items making it up; and (3) To establish criteria for analyzing its discriminative capacity, given the absence of consensus-based diagnostic criteria.

For the work with the experts we used the Delphi technique, structured in three phases: the initial meeting was for discussing the state of the issue and the possible criteria indicating the problem; the experts then individually presented their reflections on the problem and their considered proposals for the items to be included in the scale and the response format to be used; finally, they agreed on the indicators or reference criteria for considering an

adolescent's behaviour as "risk", as well as other, more technical elements such as the order of presentation of the items.

Furthermore, we took into account the results of the preliminary study by Gómez et al. (2014), which presented an 8-item scale that can be considered the starting point of the scale used in the present study. Nevertheless, it should be noted that, given its additional contributions, the present scale can be considered a priori a more comprehensive and rigorous instrument, with greater theoretical support (thanks to the extensive literature review and the work carried out with the experts).

As a result of the four phases mentioned above and the three complementary strategies used, we drew up an initial version of the 14-item scale, as shown in Table1.

Table 1
*Items of the scale and sources*

| ITEMS OF THE SCALE | SOURCES |
|---|---|
| 1. When I'm online I feel that time flies and hours pass without me realizing it | - Beranuy et al., 2009<br>- Huang et al., 2007<br>- Preliminary study<br>- Expert group |
| 2. I've sometimes tried to control or reduce my Internet use, but I couldn't | - Echeburúa, 1999<br>- Young, 1996<br>- Internet Gaming Disorder<br>- Gambling Disorder |
| 3. I sometimes prefer to be online than to be with people (family or friends) | - Chen et al., 2003<br>- García et al., 2008<br>- Young, 1998<br>- Preliminary study<br>- Expert group |
| 4. I've sometimes even managed to neglect certain tasks or perform below par (in exams, sport, etc.) because I put connecting to Internet first | - De García et al., 2008<br>- Internet Gaming Disorder<br>- Preliminary study |
| 5. I'm starting to like more and more spending hours connected to Internet | - Chen et al., 2003<br>- Greenfield, 1999<br>- Internet Gaming Disorder<br>- Gambling Disorder |
| 6. I sometimes get irritated or in a bad mood because I can't connect to Internet or because I have to disconnect | - Demetrovics et al., 2008<br>- Young, 1998<br>- Internet Gaming Disorder<br>- Gambling Disorder<br>- Preliminary study |
| 7. I prefer that my parents don't know how long I spend online because they would think it was too much | - Huang et al., 2007<br>- Morahan-Martin & Schumacher, 2000<br>- Internet Gaming Disorder<br>- Gambling Disorder<br>- Expert group |
| 8. I've stopped going to places or doing things that interested me before so as to connect to the Internet | - Armstrong et al., 2000<br>- Internet Gaming Disorder<br>- Preliminary study<br>- Expert group |
| 9. Connecting to the Internet helps me to not think about problems and to relax | - Beranuy et al., 2009<br>- Huang et al., 2007<br>- Internet Gaming Disorder<br>- Gambling Disorder |
| 10. I've even put relationships or important things at risk because of the Internet | - Beranuy et al., 2009<br>- De Gracia et al., 2002<br>- Internet Gaming Disorder<br>- Gambling Disorder<br>- Preliminary study |
| 11. I've sometimes got into trouble because of the Internet | - Caplan, 2002<br>- Morahan-Martin & Schumacher, 2000<br>- Expert group |

*(Continued from previous page)*

| | |
|---|---|
| 12. It annoys me to spend hours without connecting to Internet | - Young, 1998 <br> - Internet Gaming Disorder <br> - Gambling Disorder <br> - Preliminary study <br> - Expert group |
| 13. When I can't connect I can't stop thinking that I might be missing something important | - Caplan, 2002 <br> - Labrador, Becoña& Villadangos, 2008 <br> - Internet Gaming Disorder <br> - Gambling Disorder |
| 14. I say or do things on Internet that I wouldn't be capable of saying/doing in person | - Caplan, 2002 <br> - Carbonell et al., 2012 <br> - Expert group |

### Procedure

Data were collected in the classrooms of the schools participating in the study, in small groups (20 or less), after the corresponding instructions had been given. Collection of the information was carried out by the experts in drug-dependence prevention who developed the education for health programmes at the different schools, as an extra activity of the same programme, within the module on responsible use of New Technologies. A training session was held with technicians who assisted with data collection in order to standardize the procedure as much as possible and resolve any doubts at the technical level. Special emphasis was placed on the confidentiality of information and anonymity of responses was guaranteed, since at no time were the adolescents asked about their names or personal information. The cooperation and consent of both the schools' head teachers and parents' associations were obtained. Participation in the study was completely voluntary and unpaid. Rate of refusal to participate in the study was 1.2%. Finally, it should also be pointed out that the study was approved by the Bioethics Committee of the University of Santiago de Compostela.

### Data analysis

First of all we carried out a missing values analysis. Once confirmed the low percentage of missing values for each of the variables (ranging between 0% and 1.8%), and the randomness of such values, we decided to remove from the analysis those participants with missing values in any of their answers. Thus, an initial sample of 1772 adolescents became a final sample of 1709 adolescents for the analysis. We then calculated the descriptives (M, SD, skewness and kurtosis) for each scale item, as well their corrected homogeneity indices (HIc). The multivariate normal distribution was evaluated by means of the Mardia coefficient and the internal consistency with Cronbach's alpha. To study the dimensionality or factor structure of the scale we carried out first of all an Exploratory Factor Analysis (EFA), followed by a first-order Confirmatory Factor Analysis (CFA). Given the absence of consensus-based diagnostic criteria with which to define problematic Internet use among adolescents, in order to explore the scale's capacity for screening, we first divided the total

sample into two groups: (a) a first group whose use of Internet could be considered moderate, and (b) a second group whose use could be considered problematic (they go online every day, usually for more than 5 hours a day, and report frequent arguments with their parents for this reason). Next, based on this categorization as moderate or problematic users, we calculated the sensitivity and specificity values for different cut-off points, and complementary to this, we carried out a ROC curve analysis. Finally, in addition to providing the descriptive statistics of the final scale for the total sample, we made comparisons of means by the adolescents' sex (through application of the Student *t test*) and age (through a one-factor ANOVA and a Tukey *post-hoc* comparison). All the analyses were carried out using IBM SPSS Statistics 20.0 (IBM Corp. Released, 2011) and IBM SPSS AMOS 21.0 (Arbuckle, 2012).

A large part of the decisions made on a methodological level took as a reference studies such as those of Cuenca-Royo, Torrens, Sánchez-Niubó, Suelves and Domingo-Salvany (2013) or Muñiz and Fonseca-Pedrero (2008).

## Results

Table 2 shows the descriptive statistics for each one of the 14 items in the initial version. The highest averages correspond to items 1 (When I'm online I feel that time flies and hours pass without me realizing it) with a mean of 2.62, followed by item 9 (Connecting to the Internet helps me to not think about problems and to relax), with an average of 1.69. The lowest average corresponds to item 8 (I've stopped going to places or doing things that interested me before so as to connect to the Internet), with a mean of 0.27, and item 10 (I've even put relationships or important things at risk because of the Internet), with 0.39. As regards the variability of responses, the item that presents the most heterogeneous responses (with a standard deviation of 1.45) is item 9, while item 8 is the most homogeneous, with a standard deviation of 0.71. As regards the standardized skewness values, we can observe a marked positive skewness in all the items, except in the case of the first one, which presents marked negative skewness. Regarding the kurtosis, many of the items show a leptokurtic distribution (items

2, 3, 6, 7, 8, 10, 11, 12 and 14), though some have a platykurtic distribution (items 1, 5, 9 and 13). However, only four of the items have a value above 10, the rest falling within reasonable limits (Kline, 2005). The Mardia multivariate normality coefficient is 77.97, which leads to rejection of the multivariate normality hypothesis. The corrected homogeneity index (HIc) of the items ranges from .37 to .59 and the internal consistency of the initial scale is in general highly acceptable, with a Cronbach's alpha coefficient of .83. As Pardo and Ruíz (2001) state, "values of over .80 are generally considered sound, and those of over .90, excellent" (p. 598).

To study the factor structure of the scale we began by dividing the aggregate sample into two random halves of the same size. With the first we carried out an Exploratory Factor Analysis (EFA), and with the second, a Confirmatory Factor Analysis (CFA), in an effort to confirm or validate the structure found. It was also found that there

Table 2
*Descriptive Statistics for the Elements of the Initial Scale*

| Ítem | M | SD | Skewness | Kurtosis | HIc |
|---|---|---|---|---|---|
| 1 | 2,62 | 1,27 | -6,983 | -5,694 | 0,39 |
| 2 | 0,81 | 1,13 | 18,378 | 5,584 | 0,43 |
| 3 | 0,53 | 0,94 | 26,332 | 21,018 | 0,42 |
| 4 | 1,00 | 1,21 | 14,567 | ,138 | 0,49 |
| 5 | 1,22 | 1,24 | 10,801 | -2,533 | 0,56 |
| 6 | 0,88 | 1,20 | 17,896 | 4,108 | 0,57 |
| 7 | 0,91 | 1,33 | 17,708 | 1,808 | 0,51 |
| 8 | 0,27 | 0,71 | 44,471 | 74,563 | 0,40 |
| 9 | 1,69 | 1,45 | 4,210 | -8,748 | 0,37 |
| 10 | 0,39 | 0,91 | 35,935 | 41,721 | 0,42 |
| 11 | 0,48 | 1,01 | 31,099 | 28,493 | 0,38 |
| 12 | 0,96 | 1,20 | 15,854 | 1,807 | 0,57 |
| 13 | 1,11 | 1,35 | 13,674 | -2,362 | 0,59 |
| 14 | 0,93 | 1,29 | 16,994 | 1,629 | 0,42 |

were no significant differences in the composition of the two subsamples, or by sex ($\chi^2 = 0.02$; p = .88), or age (t = 1.27; p = .20).

For carrying out the EFA we used the Principal Components Method. The KMO index value was .88, and that of the Bartlett Sphericity Test, 2539.47 (p <.01). The analysis provided three factors, which together accounted for 49.40% of the variance of the data, even though the first one explained 32.90%, the other two factors showing a much more residual character, which fits at a theoretical level with the unidimensional nature of the Gomez et al. (2014) scale that was used as a basis. Following this first analysis we conducted a CFA, starting out from a theoretical model with a single dimension. Despite the absence of normality, for parameter estimation we used the Maximum Likelihood (ML) method, since works such as those of Curran, West and Finch (1996) or Thomas and Oliver (1998) have indicated that this method is sufficiently robust against non-fulfilment of this assumption when sam-

ples are large, as in this case (n = 1709). In any case, and in accordance with Levy, Martin and Norman (2006), we used complementarily other methods, such as Generalized Least Squares (GLS), Unweighted Least Squares (ULS) and Asymptotically Distribution Free (ADF), obtaining very similar results. The estimated parameters were statistically significant (p <.01) and the factor loadings greater than .40, except in the case of item 9 (see Figure 1).

Goodness of fit of the model was assessed by means of different indices, as recommended by Byrne (2009) or Kline (2005): $\chi^2$, $\chi^2/df$, *Goodness of Fit Index* (GFI), *Adjusted Goodness of Fit Index* (AGFI), *Comparative Fit Index* (CFI), *Normed Fit Index* (NFI), *Tucker Lewis Index* (TLI) and *Root Mean Square Error of Approximation* (RMSEA). Following the recommendations of Steiger (1998), we also included the 90% confidence intervals in the case of RMSEA. The
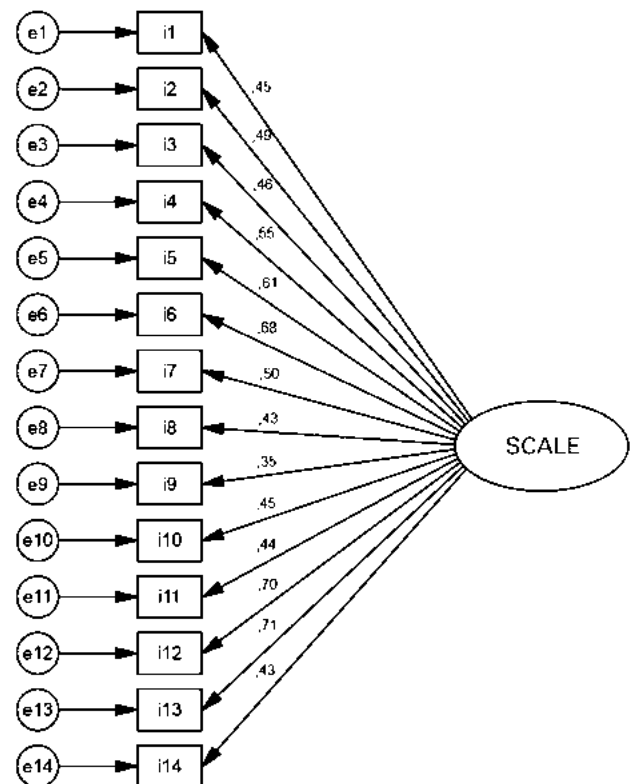


*Figure 1.* Estimated standardized parameters of the Initial CFA Model

different indices show that the scale fits only moderately with the unidimensional theoretical model (see Table 3). Although the GFI and AGFI values were over .90, those of the NFI, TLI and CFI were around .85, and the RMSEA value was .074. The low HIc values of some items (3, 9 and 10) and their low factor loadings (.46, .35, and .45, respectively), together with the modification indices provided by the program, advised a respecification of the initial model, deleting the 3 items mentioned.

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Table 3
*Goodness of fit indicators of the CFA Model for the Screening Tool*

|  | $\chi^2$ | df | p | $\chi^2$/df | GFI | AGFI | NFI | TLI | CFI | RMSEA [CI]* |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial model | 325.38 | 77 | ←.001 | 4.22 | .93 | .90 | .84 | .85 | .87 | .074 [.066-.083] |
| Respecified model | 118.39 | 44 | ←.001 | 2.69 | .96 | .95 | .92 | .94 | .95 | .054 [.042-.065] |

Note: * 90% Confidence Interval for the RMSEA statistic

Next, on the re-specified model with only 11 elements, a new CFA was conducted, giving a better overall fit of the scale, with a GFI value of .96, AGFI, NFI, TLI and CFI values of between .92 and .95, and an RMSEA value of under .06, as recommended by Hu and Bentler (1999). It should be borne in mind that even differences below 0.1 in the GFI or AGFI can be considered as relevant (Levy, Martin, & Norman, 2006). All estimated parameters were statistically significant (p <.01) (Figure 2). Finally, the internal consistency of the final scale was analyzed, yielding a Cronbach's alpha of .82. Additionally, since the response format used was an ordered categorical scale, the ordinal alpha index (Elosúa & Zumbo, 2008) was calculated, yielding a slightly higher value (83).

As regards the total descriptive statistics for the final 11-item scale, for a theoretical minimum score of 0 and a maximum of 44, the average score attained for the whole sample was 11.18, and the standard deviation was 7.70. As shown in Table 4, no significant differences were found by sex, but there were differences according to age group (F = 10.32; p <.001), with a higher average on the scale in the older age groups.
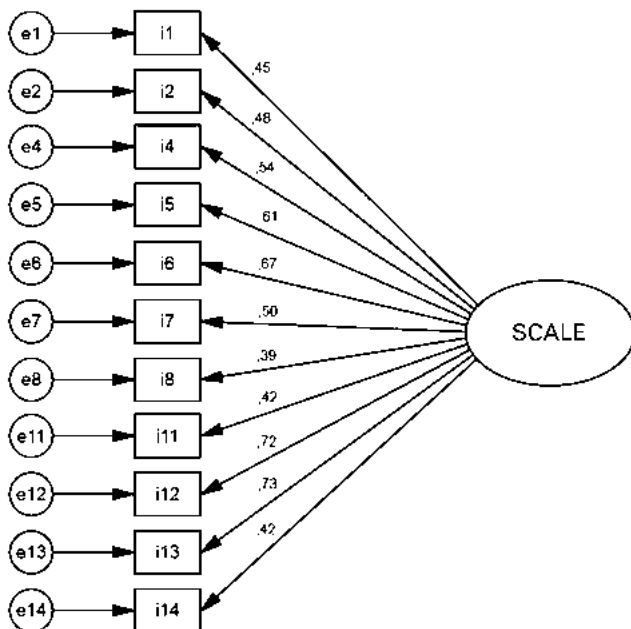


*Figure 2.* Estimated standardized parameters of the Final CFA Model

To study the scale's capacity for screening, in the absence of consensus-based diagnostic which could enable us to have a clinical sample, the total sample was divided into two groups: (a) a first group whose Internet use could be considered moderate, and (b) a second group whose use could be considered problematic. This second group would be made up those adolescents who: 1) connect the Internet every day, 2) are usually online for more than 5 hours a day, and 3) report frequent arguments with their parents for this reason. The sensitivity and specificity values obtained for different cut-off points are shown in Figure 3. As it can be seen, values 15 and 16 permit the attainment of a balance between these two indicators. Specifically, if we use as a cut-off point a score of 16, we obtain a sensitivity of 81% and a specificity of 82.6%. In other words, the screening instrument is capable of detecting true positives in 81% of cases and of rejecting true

Table 4
*Comparison of total scores on the scale by sex and age*

|  |  | M | SD | t | p |
|---|---|---|---|---|---|
| Sex | Men | 10,76 | 7,24 | -1,87 | ,062 |
|  | Women | 11,60 | 8,13 |  |  |
|  |  | M | SD | t | p |
| Age group | 11 – 13 years | 10,18 | 7,43 | 10,321 | < ,001 |
|  | 14 – 15 years | 11,78 | 7,92 |  |  |
|  | 16 – 17 years | 13,18 | 7,61 |  |  |

negatives in 82.6% of cases, both results being highly acceptable. By way of a complement, we carried out a ROC curve (Receiver Operating Characteristic) analysis, obtaining an area under the curve of 0.88.

Finally, participants' response pattern was analyzed by comparing the profile of adolescents who make moderate use of the Internet with those who use is problematic. As can be seen in Table 5, at both the global score level and that of each of the items individually, the two groups showed statistically significant differences (p <.01). This confirms the capacity of each of the items for detecting problematic Internet use and justifies their presence in the final version of the scale.

## Discussion

One the main concerns among professionals and researchers in the field of addictions today is adolescents' problematic use of the Internet. In this context, various authors have highlighted the need to reach a consensus, from both the conceptually and methodological points of view, on the denomination, definition and evaluation of
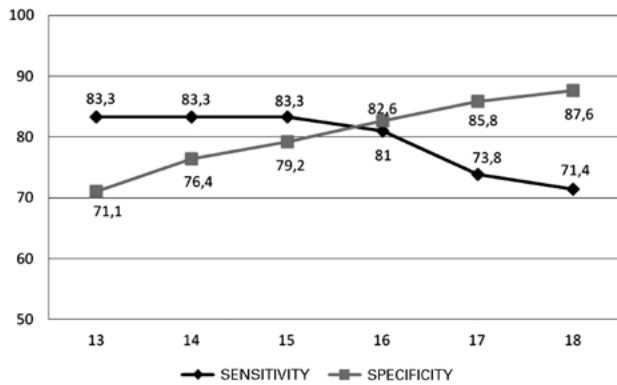
*Figure 3.* Sensitivity and Specificity values for the different cut-off points

Table 5
*Comparison between adolescents with moderate use and problematic use*

| Item | Moderate use | Problematic use | t | p |
|---|---|---|---|---|
| 1 When I'm online I feel that time flies and hours pass without me realizing it | 2,50 | 3,25 | -4,59 | < ,001 |
| 2 I've sometimes tried to control or reduce my Internet use, but I couldn't | 0,72 | 1,43 | -3,22 | < ,01 |
| 3 I've sometimes even managed to neglect certain tasks or perform below par (in exams, sport, etc.) because I put connecting to Internet first | 0,86 | 2,09 | -5,67 | < ,001 |
| 4 I'm starting to like more and more spending hours connected to Internet | 1,12 | 2,32 | -4,99 | < ,001 |
| 5 I sometimes get irritated or in a bad mood because I can't connect to Internet or because I have to disconnect | 0,69 | 2,16 | -6,13 | < ,001 |
| 6 I prefer that my parents don't know how long I spend online because they would think it was too much | 0,72 | 2,32 | -6,37 | < ,001 |
| 7 I've stopped going to places or doing things that interested me before so as to connect to the Internet | 0,19 | 0,67 | -2,88 | < ,01 |
| 8 I've sometimes got into trouble because of the Internet | 0,36 | 1,28 | -3,66 | < ,001 |
| 9 It annoys me to spend hours without connecting to Internet | 0,82 | 1,89 | -4,56 | < ,001 |
| 10 When I can't connect I can't stop thinking that I might be missing something important | 0,97 | 2,41 | -6,32 | < ,001 |
| 11 I say or do things on Internet that I wouldn't be capable of saying/doing in person | 0,81 | 1,84 | -4,09 | < ,001 |
| TOTAL | 9,67 | 21,62 | -9,70 | < ,001 |

the development and validation of a new screening tool, backed up by the knowledge accumulated over the past two decades and with proven psychometric properties.

Despite the existence of numerous previous scales, a large part of them have certain shortcomings or limitations, especially if our aim is to have available a tool with guarantees that would permit early detection of problematic Internet use among Spanish adolescents. Many of the scales developed previously have not been validated in our country, are not adapted to the adolescent population, or fail to provide data on their psychometric properties. Sometimes the samples used for their validation are too small, their factor structure is unclear, they are too long, or they or simply do not provide the cut-off points needed for their used as screening instruments.

Analyses carried out with a sample of 1709 schoolchildren in the Spanish region of Galicia made it possible to present a new scale (PIUS-a) that may prove extremely useful for practitioners and researchers in this field. This scale was developed on the basis of a thorough review of the literature and enriched by the contributions from a multidisciplinary team of experts; moreover, it has highly acceptable psychometric properties, in terms of both internal consistency (α = .81), and evidence of internal structure and content, attaining an interesting balance between levels of sensitivity (81%) and specificity (82.6%), as far as screening capacity is concerned. In short, the work carried out has made available to researchers, clinicians and community education workers a brief and simple scale (with just 11 items), adapted to the cultural context of our country and the language of young people – qualities that lend it great potential for everyday practice.

Although in this paper we have been prudent and chosen to use the term problematic Internet use, it would not be unreasonable, as various authors have proposed, to employ terms such as pathological Internet use or Internet addiction (Durkee et al., 2012; Tsitsika et al., 2012; Young, 1996). The facts that the selection of scale items was made on the basis of previous work along these lines, that we took into account the judgements of experts in the clinical and educational spheres, and that we used as references the criteria for diagnostic categories of a similar nature, makes the use of these terms quite plausible. Official recognition of a pathology associated with the use of Internet and the availability of clinical samples, as is the case in the Asian context (Huang et al., 2007; Ko, Yen, Yen et al., 2005), would help resolve these types of controversy.

Moreover, despite the unidimensionality of the scale developed, we cannot discard the possibility of a multidimensional approach, given the complexity of the pro-

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blem at hand. However, many of the works that adopt a multidimensional approach (Günüç & Kayri, 2010; Widyanto & McMurran, 2004) provide a global α, which implicitly entails some unidimensionality. Furthermore, the fact that the calculation of an overall score and the setting of a cut-off point are necessary to enable screening for possible cases of risk makes it preferable to opt initially for the existence of a single factor.

However, this study does have some limitations. First, all the variables are self-reported, so it is impossible to know the extent to which the adolescents may have underestimated or overestimated their Internet use. On the other hand, self-report questionnaires on the use of alcohol and other drugs have shown themselves to be reliable and even comparatively better than other detection methods in the field of substance use (Babor, Kranzler, & Lauerman, 1989; Winters, Stinchfield, Henly, & Schwartz, 1990), so that self-report measures may well be relevant in this context also. It is also true that the use of a social desirability scale or an instrument for the detection of random response patterns could of great use. Moreover, given the still-unresolved conceptual controversy and lack of consensus on the defining criteria of the problem, the sensitivity and specificity values were calculated based on criteria established by the authors, even though it must be said that they have been used in works and endorsed by the group of experts. The availability in the future of duly consensus-based criteria will be what finally permits the validation of the instruments developed, which from a purely psychometric perspective is not currently possible.

It is important to note, finally, that the scale presented constitutes a tool for screening, and never for diagnosis, as the latter must be based on the clinical act itself. Such instruments would play a complementary role, facilitating the early detection of adolescents whose use of the Internet could constitute a problem, on interfering in a crucial way in their everyday life. The scale is specifically designed for use by counsellors, community education workers and drug-prevention experts in the school context, in which it has been validated empirically. Future research would need to test its behaviour in clinical settings, linked in (as occurs in other countries) to primary care services.

## Acknowledgements

## Conflicts of interests

The authors declare that there are no conflicts of interests.

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Appendix. Table A1
*Compilation of the most relevant assessment tools or screening instruments published*

| YEAR | AUTHORS | INSTRUMENTS | COUNTRY | VALIDATION SAMPLE | CONSTRUCT | Nº ITEMS | Nº FACTORS |
|---|---|---|---|---|---|---|---|
| 1995 | Goldberg | Internet Addiction Disorder scale – Qualitative scale | USA | - | Internet addiction | 7 criteria | - |
| 1996 | Orman | Internet Stress Scale (ISS) | USA | - | Internet addiction | 9 YES/NO items | - |
| 1996 | Young | Young's Diagnostic Questionnaire (YDQ) | USA | 496 participants online (Adult population) | Internet addiction | 8 YES/NO items | 1 |
| 1997 | Brenner | Internet-Related Addictive Behavior Inventory (IRABI) | USA | 563 users (Mean age: 34 years) | Internet addiction | 32 TRUE/FALSE items | 1 |
| 1997 | Scherer | Clinical symptoms of Internet dependency (CSID) | USA | 531 university students | Internet dependence | 10 clinical symptoms | - |
| 1998 | Chou, Chou & Tyan | Chinese Internet-Related Addictive Behavior Inventory version I (C- IRABI- I) | Taiwan | 104 participants online (Mean age: 22,3 years; $SD$= 3.13) | Internet addiction | 32 TRUE/FALSE items | 1 |
| 1998 | Griffiths | Addiction Core components criteria | UK | 5 case studies (ages 15 to 35 years) | Addiction | 6 principal components of addiction | - |
| 1998 | Young | Internet Addiction Test (IAT) | USA | - | Internet addiction | 20 items (Likert 5-point scale) | - |
| 1999 | Pratarelli, Browne & Johnson | Computer Use Survey | USA | 341 university students (Mean age: 22.8 years; $SD$= 5.88) | Internet addiction | 55 items | 4 |
| 1999 | Greenfield | Virtual Addiction Survey (VAS) | USA & Canada | 17251 participants online | Compulsive Internet use | 36 YES/NO items | - |
| 1999 | Echeburúa | Test de Adicción a Internet | Spain | - | Internet addiction | 9 YES/NO items | - |
| 2000 | Chou & Hsiao | Chinese Internet-Related Addictive Behavior Inventory version II (C- IRABI- II) | Taiwan | 910 university students (Mean age: 21.11 years; $SD$= 210) | Internet addiction | 37 items (Likert 4-point agreement scale) | 6 |
| 2000 | Morahan-Martin & Schumacher | Pathological Internet Use Scale (PIUs) | USA | 277 university students (Mean age: 20.72 years; $SD$ = 2.35) | Pathological Internet use | 13 TRUE/FALSE items | - |
| 2000 | Armstrong et al. | Internet Related Problem Scale (IRPS) | Australia | 50 participants (75% aged 25 to 30 years) | Internet addiction | 20 questions (Likert 10-point agreement scale) | - |
| 2001 | Tsai & Lin | Internet Addiction Scale for Taiwan high school students (IAST) | Taiwan | 753 secondary-school students (Age range: 16-17 years) | Internet addiction | 29 items (Likert 4-point scale) | 4 |
| 2001 | Anderson | Sin nombre | USA | 1302 university students | Internet dependence | 7 YES/NO items | - |
| 2001 | Del Miglio, Gamba & Cantelmi | Use, Abuse and Dependence on the Internet inventory (UADI scale) | Italy | 244 participants (Age range: 13-57 years; Mean age: 28.7 years) | Internet dependence | 75 items (Likert 5-point scale) | 5 |
| 2002 | Caplan | Generalized Problematic Internet Use Scale (GPIUS) | USA | 386 university students (Age range: 18-57 years; Mean age: 20 years; $SD$= 2.22) | Generalized problematic Internet use | 29 items (Likert 5-point agreement scale) | 7 |

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| YEAR | AUTHORS | INSTRUMENTS | COUNTRY | VALIDATION SAMPLE | CONSTRUCT | Nº ITEMS | Nº FACTORS |
|---|---|---|---|---|---|---|---|
| 2002 | Davis et al. | Online Cognition Scale (OCS) | Canadá | 211 Psychology students (Mean age: 21.73 years; SD= 4.4) | Problematic Internet use | 36 items (Likert 7-point agreement scale) | 4 |
| 2002 | De Gracia, Vigo, Fernández & Marcó | Problemas Relacionados con Internet (PRI) | Spain | 1664 Self-selected internauts (Age range: 15- 54 years) | Problematic Internet use | 19 items (Likert frequency scale) | - |
| 2003 | LaRose et al. | Deficient Internet self-regulation | USA | 465 university students | Unregulated Internet use | 7 items (Likert 7-point scale) | - |
| 2003 | Rotunda, Kass, Sutton & Leon | Internet Use Survey (IUS) | USA | 393 university students (Age range: 18-81 years; Mean age: 276 years) | Abuse of Internet | Impairment index of the IUS: 32 items (Likert 5-point frequency scale) | 4 |
| 2003 | Chen et al. | Chinese Internet Addiction Scale (CIAS) | Taiwan | - | Internet addiction | 26 items (Likert 4-point scale) | 5 |
| 2004 | Yuen & Lavin | No name | USA | 283 university students (adults) | Internet dependence | 7 items adapted from the DSM- IV criteria for substance dependence (Likert 5-point agreement scale) | - |
| 2004 | Nichols & Nicki | Internet Addiction Scale (IAS) | Canada | 233 university students | Internet addiction | 31 items (Likert 5-point frequency scale) | 1 |
| 2004 | Widyanto & McMurran | Internet Addiction Test (IAT) | UK | 86 participants online (Age range: 13-67 years; Mean age men: 25.45 years (SD = 8.91); Mean age women: 31.44 years (SD = 10.34)) | Internet addiction | 20 items (Likert 5-point scale) | 6 |
| 2005 | Beard | Screening Interview Assessing Problematic Internet Use | USA | - | Problematic Internet use | 72 questions | - |
| 2005 | Thatcher & Goolam | Problematic Internet Use Questionnaire (T- PIUQ) | South Africa | Pilot study: 279 participants; Validation: 1795 participants | Problematic Internet use | 20 items (Likert 5-point scale) | 3 |
| 2007 | Fortson, Scotti, Chen, Malone & Del Ben | Reported Behaviors Related to Internet Abuse and Dependence | USA | 411 university students (Age range: 18-56 years; Mean age: 20.4 years; SD= 3.2) | Internet abuse and/or dependence | 9 items (Likert scale) | - |
| 2007 | Li & Yang | Adolescent Pathological Internet Use Scale | China | 1331 secondary-school students and 30 Adolescents diagnosed as pathological users | Pathological Internet use | 38 items (Likert 5-point scale) | 6 |
| 2007 | Ceyhan et al. | Problematic Internet Usage Scale (PIUS) | Turkey | 1658 university students | Problematic Internet use | 33 items (Likert 5-point scale) | 3 |
| 2007 | Huang et al. | Chinese Internet Addiction Inventory (CIAI) | China | Study 1: 516 university students (Age range: 17-24 years; mean age: 20.5 years; SD= 1.47); Study 2: 513 university students (Age range: 17-24 years; Mean age: 20.7 years; SD= 1.51); Study 3: 54 participants (27 clinical sample) | Internet addiction | 31 items (Likert 5-point frequency scale) | 3 |

| YEAR | AUTHORS | INSTRUMENTS | COUNTRY | VALIDATION SAMPLE | CONSTRUCT | Nº ITEMS | Nº FACTORS |
|---|---|---|---|---|---|---|---|
| 2007 | Ferraro, Caci, D'amico & Di Blasi | Internet Addiction Test (IAT) | Iltaly | 236 participants online (Age range: 13-50 years; Mean age: 23.9 years; SD = 6.5) | Internet addiction | 20 items (Likert 5-point scale) | 6 |
| 2007 | Jenaro, Flores, Gómez-Vela, Gonzá-lez-Gil & Caballo | Internet Over-use scale (IOS) | Spain | 377 university students | Pathological Internet use | 23 items (Likert 6-point scale) | - |
| 2008 | Demetrovics et al. | Problematic Internet Use Questionnaire (D- PIUQ) | Hungary | 1037 participants online (Mean age: 23.3 years; SD= 9.1) | Problematic Internet use | 18 items (Likert 5-point scale) | 3 |
| 2008 | Labrador, Becoña & Villadangos | Cuestionario de Detección de Nuevas Adicciones (DENA) | Spain | Pilot study: 140 secondary-school students; Study 2: 1710 minors (Age range: 12-17 years) | Internet addiction | 50 items. Block of 12 items referring to Internet use | - |
| 2008 | García et al. | Cuestionario de Uso y Abuso de Internet | Spain | 391 university students (Age range: 18-47 years; Mean age: 19.59 years; SD= 2.83) | Internet abuse | 47 items (Likert 5-point scale) | - |
| 2008 | Chang & Law | Internet Addiction Test (IAT) | China | 410 university students | Internet addiction | 20 items (Likert 5-point scale) | 3 |
| 2009 | Chow, Leung, Ng & Yu | Internet-user Assessment Screen | China | Phase 1: 378 adolescents (Mean age: 12.84 years; SD= 1.53); Phase 2: 3523 adolescents (Mean age men: 12.33 years; SD= 1.66. Mean age women: 12.5 years; SD= 1.6) | Maladaptive Internet use | 26 items (20 items with Likert 5-point agreement scale) | 9 |
| 2009 | Meerkerk et al. | The Compulsive Internet Use Scale (CIUS) | Holland | Study 1: 447 intensive Internet users (Mean age: 38.5 years; SD=12.5); Study 2: 229 participants from the previous study; Study 3: 16,925 participants online (Age range: 11-80 years; Mean age: 25.3; SD= 10.0) | Compulsive Internet use | 14 items (Likert 5-point frequency scale) | 1 |
| 2009 | Beranuy et al. | Cuestionario de Experiencias Relacionadas con Internet (CERI) | Spain | 1879 secondary-school and university students (Mean age: 15.52; SD=2.434) | Internet addiction | 10 items (Likert 4-point scale) | 2 |
| 2009 | Mitchell, Sabina, Finkelhor & Wells | Index of Problematic Online Experiences (I-POE) | USA | 563 university students (Mean age: 19.86 years) | Problematic Internet use | 26 YES/NO items | - |
| 2010 | Caplan | Generalized Problematic Internet Use Scale 2 (GPIUS2) | USA | 785 participants (Age range: 18-70 years. Mean age: 33.14 years; SD= 15.25) | Generalized problematic Internet use | 15 items (Likert 8-point agreement scale) | 5 first-order factors (2 of them form a 2nd-order factor) |
| 2010 | Günüç & Kayri | Tukish Internet Addiction Scale | Turkey | 754 secondary-school students | Internet addiction | 35 items (Likert 5-point scale) | 4 |
| 2011 | Frangos, Frangos & Sotiropoulos | Problematic Internet Use Diagnostic Test (PIUDT) | Greece | 2293 university students (adults) | Problematic Internet use | 38 items | 4 |
| 2011 | Lam- Figueroa et. al. | Escala de la Adicción a Internet de Lima (EAIL) | Peru | 248 secondary-school students | Internet addiction | 11 items (Likert 4-point frequency scale) | 2 |

| YEAR | AUTHORS | INSTRUMENTS | COUNTRY | VALIDATION SAMPLE | CONSTRUCT | N° ITEMS | N° FACTORS |
|---|---|---|---|---|---|---|---|
| 2011 | Pulido-Rull et al. | Cuestionario de Uso Problemático de Internet (CUPI) | Mexico | 697 university students (Mean age: 22.68 years; SD= 4) | Problematic Internet use | 18 items (Likert 5-point scale) | 5 |
| 2013 | Lopez-Fernandez, Freixa-Blanxart & Honrubia-Serrano | Problematic Internet Entertainment Use Scale for Adolescents (PIEUSA) | Spain | 1131 adolescents (Age range: 12-18 years. Mean age: 14.55 years; SD= 1.816) | Problematic Internet use | 30 items (Likert 7-point agreement scale) | 5 |
| 2013 | Labrador, Villadangos, Crespo & Becoña | Cuestionario de Uso Problemático de Nuevas Tecnologías (UPNT) | Spain | 2747 students (from 5th-grade Primary to 5th-year degree) | Problematic Internet use | 26 items (Internet subscale: 7 items) | 7 |
| 2013 | Watters, Keefer, Kloosterman, Summerfeldt & Parker | Internet Addiction Test (IAT) | Canada | 1948 secondary-school students (Age range: 16-18 years; Mean age: 17.07 years; SD = 0.84) | Internet addiction | 20 items (Likert 5-point scale) | 2 |
| 2013 | Puerta-Cortés, Carbonell & Chamarro | Internet Addiction Test (IAT) | Colombia | 1117 participants online (Age range: 14-67 years; Mean age = 20.93 years; SD = 4.84) | Internet addiction | 20 items (Likert 5-point scale) | 3 |
| 2013 | Hawi | Internet Addiction Test (IAT) | Republic of Lebanon | 817 middle and secondary school students (Age range: 10-22 years; Mean age: 15 years; SD = 2.12) | Internet addiction | 20 items (Likert 5-point scale) | 1 |
| 2013 | Lee, Lee, Gyeong, Yu, Song & Kim | Korean version of the Internet Addiction Test (KIAT) | Republic of Korea | 279 university students (Mean age: 19.9 years; SD = 2.7) | Internet addiction | 20 items (Likert 5-point scale) | 4 |
| 2014 | Gómez et al. | Screening Scale of Problematic Internet Use in adolescents | Spain | 2339 secondary-school students (Age range: 11-18 years. Mean age: 13.77; SD= 1.34) | Problematic Internet use | 8 items (Likert 5-point agreement scale) | 1 |
| 2014 | Cho et al. | Internet Addiction Scale (IAS) based on the Internet Gaming Disorder Criteria (DSM-5) | Republic of Korea | 1082 secondary-school students (Age range: 13-14 years) | Internet addiction | 26 items | 7 |
| 2014 | Jelenchick et al. | Problematic and Risky Internet Use Screening Scale (PRIUSS) | USA | 714 university students (Age range: 18-25 years; Mean age: 19.7 years; SD = 1.4) | Problematic Internet use | 18 items (Likert 5-point frequency scale) | 3 |