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Assessing the psychometric properties of the Internet Addiction Test: A study on a sample of Italian university students



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ABSTRACT

The aim of the study was to assess the psychometric properties of the 20-item Internet Addiction Test (IAT) among a sample of 659 Italian university students enrolled in several degree courses in the same university. The data collected was subjected to exploratory and confirmatory factor analyses by using robust statistical models. Results from exploratory factorial analysis suggested removing items 4 and 7 of the IAT. The final 18-items of the IAT were covered by a two-factor model which demonstrated good psychometric properties, and fits well with the data. Pearson's correlation results indicated that the two-factor model satisfied the criteria of convergent and divergent validity. The present study confirms that the IAT is a valid and reliable instrument for measuring Internet addiction. At the same time, the study suggests that some items of the IAT needs to be improved. Practical implications for further studies are provided as a conclusion.

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1. Introduction

The rapid and pervasive transformation of the Internet in recent years has provided an interactive social platform for millions of people. The popularity of Internet-related services has become a part of modern life, especially through communication via social networking sites, and in the areas involving recreational and academic activities. It has even pervaded everyday activities like playing games, watching movies, surfing for information, posting selfies, and reading the news. On the other hand, scientific evidence shows that overuse of the Internet may be associated with adverse and problematic behaviour and could even lead to addiction (Calvo-Francés, 2016; Kaess et al., 2014; Kuss & Lopez-Fernandez, 2016; Romano, Osborne, Truzoli, & Reed, 2013; Van Rooij & Prause, 2014; Weinstein, Curtiss Feder, Rosenberg, & Dannon, 2014; Wu, Lee, Liao, & Chang, 2015).

The issue of Internet addiction has received increased attention in the last few years, and among the studies related to this topic, the evaluation of its relevance and symptomatology still represents the core of much of the present scientific debate (Griffiths, Kuss, Billieux, & Pontes, 2016; Young, 2015). Recent results show that social isolation, low self-esteem, weak personality traits, interpersonal and intrapersonal problems, as well depression, compulsive

behaviour, pathological gambling, compulsive online shopping, attention deficit and hyperactivity disorder can all be associated with Internet addiction disorder (Koo & Kwon, 2014; Lee et al., 2012; Mittal, Dean, & Pelletier, 2013; Quiñones-García & Korak-Kakabadse, 2014; Romano et al., 2013; Ryan, Chester, Reece, & Xenos, 2014; Servidio, 2014; Zhang, Brook, Leukefeld, & Brook, 2016; Zhang et al., 2015).

Furthermore, given the pervasiveness of the Internet, the risks of addiction is a growing global problem. Results obtained from different screening methods (e.g., self-report questionnaires, neurological analysis, clinical interview, etc.) reveal that adolescents—in particular, university students—are most at-risk for developing Internet addiction (Hsu, Lin, Chang, Tseng, & Chiu, 2015; Li et al., 2016). In relation to this, university students report higher levels of computer ownership, Internet connection per day and time spent per day (Jelenchick, Becker, & Moreno, 2012).

Internet addiction, as a disorder, however, has not yet been clearly and uniformly defined. The concept itself was introduced by Young (1998). Referencing Internet addiction with pathological gambling, Young (2004) described it as an impulse-control disorder not involving an intoxicant but fulfils a set of criteria indicating an excessive or uncontrolled use of the Internet that not only causes behavioural problems but also impairs normal daily functioning. Addicted subjects exhibit symptoms such as preoccupation with Internet use, having lower mood, spending excessive amount of time online, exhibiting lower performance at school or work,

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having conflictual relationship with family and friends and lying about its use (Young, 2015). From this original description, several other conceptualizations have been used to explain this type of problematic human behaviour (Israelashvili, Kim, & Bukobza, 2012; Weinstein et al., 2014).

Moreover, although official diagnostic criteria for Internet addiction has not yet been clearly defined, there is a general consensus in considering it as an impulse control disorder and as a behaviour addiction (Griffiths et al., 2016; Lee et al., 2013). In this regard, the recent Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) underlines the necessity of conducting further research in the field of Internet addiction before it may be considered for inclusion as a formal disorder (Floros, Siomos, Stogiannidou, Giouzevas, & Garyfallos, 2014).

With the need for further research in this area highlighted, it is no surprise that an instrument measuring Internet addiction like the Internet Addiction Test (IAT) has also received a lot of attention. In current literature, for example, the evaluation of the psychometric properties of IAT reveals that its factorial structure is not always clear and stable. To understand fully the effects of technological evolution on human behaviour, it is important to update and revise the psychometric properties of the assessment tools that measure the risk of Internet addiction, including the IAT. This methodological approach assures the application of more reliable instruments for exploring the prevalence of addiction among subjects (Zhang & Xin, 2013), in keeping also with the rapid technological changes that accompany societal challenges (Brunetti & Servidio, 2010). This present study looks to determine the best-fit factorial structure of the IAT to make it more effective and more reliable in assessing the risk of problematic Internet use.

2. The Internet Addiction Test (IAT)

The first version of the IAT was designed and developed by Young (1998) and was based on the DSM-IV criteria for pathological gambling (e.g., tolerance, withdrawal symptoms, mood modification or relapse). According to Young (1998), the IAT measures the subjective risk of using the Internet (e.g., trying to hide the time spent online) and covers the degree to which technological abuse affects daily routine, social life, school and work productivity, and even sleep quality.

The IAT is a 20-item questionnaire with each item rated on a 5-point Likert-type scale ranging from 0 (not applicable) to 5 (always). The final score, which could range from 0 to 100, is the sum of the score for each subject's answer. A higher score indicates higher severity of Internet disorder that could negatively affect the subject's life. In this regard, Young (1998) suggests an impairment index to assess the subject's Internet behaviour in terms of: a) no problem (0–30 points); b) mild problems because of Internet use (31–49 points); c) moderate problems when the subject experiences occasional or frequent problems due to the Internet (50–79 points); and d) severe problems due to Internet usage which impacts negatively on the subject's life (80–100 points).

Literature aimed at evaluating the risk of Internet addiction reveals that Young's IAT is one of the most popular assessment instruments to screen for problematic Internet usage, and has demonstrated a strong internal reliability across studies (Chang & Man Law, 2008; Laconi, Rodgers, & Chabrol, 2014; Panayides & Walker, 2012).

The IAT has been translated and validated in several European (Barke, Nyenhuis, & Kröner-Herwig, 2012; Faraci, Craparo, Messina, & Severino, 2013; Fernández-Villa et al., 2015; Ferraro, Caci, D'Amico, & Blasi, 2007; Fioravanti & Casale, 2015; Hawi, Blachnio, & Przepiorka, 2015), and non-European languages (Chong Guan, Isa, Hashim, Pillai, & Harbajan Singh, 2015; Karim & Nigar, 2014;

Lai et al., 2013). Furthermore, a German short version of the IAT has been validated and proposed, which in turn, demonstrates the scientific interest towards this instrument (Mirko Pawlikowski, Altstötter-Gleich, & Brand, 2013).

Other studies have attempted to test the dimensionality of the IAT, but the first version, which was in the English language, as well as the Arabic version (Hawi, 2013), the French version (Khazaal et al., 2008), the Indian version (Dhir, Chen, & Nieminen, 2015a), the Finnish version (Korkeila, Kaarlas, Jääskeläinen, Vahlberg, & Taiminen, 2010), the Greek version (Panayides & Walker, 2012), and the Portuguese version (Pontes, Patrão, & Griffiths, 2014) all contained only one factor.

All previous assessments of the IAT's psychometric properties exhibit a common consistent result as regards the different number of the factorial solutions, which have ranged from one-to-six (Laconi et al., 2014; Watters, Keefer, Kloosterman, Summerfeldt, & Parker, 2013, for a review). Moreover, when similar numbers of factors were extracted, differences were observed in the distribution of the items on the factors (Khazaal et al., 2015; Watters et al., 2013). This heterogeneity in the factorial structure of the IAT poses a major concern for studying Internet addiction disorder, not because of the number of factors itself, but because of the different names assigned to the same factors, which could potentially define the concept of Internet addiction in a different way (Dhir, Chen, & Nieminen, 2015b). We may posit several reasons for the difference among the factorial structure, which include mainly theoretical, socio-cultural and methodological reasons. There is a theoretical aspect because Internet addiction is a relatively new construct and so recent studies aim to discover the nature of this disorder (Jelenchick et al., 2012; Widyanto, Griffiths, & Brunson, 2011). On the other hand, socio-cultural background, inasmuch as it may reflect different improvements in the subjects' life-styles and their use of new technologies, could affect not only the translation procedures, but also could impact the factorial structure. All these aspects make it complex to investigate the nature and prevalence of Internet addiction (Hawi et al., 2015; Servidio, 2014; Teo & Kam, 2014). Then, the factorial structure could also depend on the inter- and intra-personal dimensions of the subject's personality as well as other important psychosocial variables, which altogether, can concur to redefine the current combination of the items (Koo & Kwon, 2014). As regards methodological issues, the extreme variability of the sample size, and the statistical techniques used to assess the psychometric properties of the IAT may also affect its factorial structure. Nevertheless, most of the current studies adopt statistical methods based on the idea of following a "me too" approach. This result could affect both the item distribution and the number of factors useful to explain how maladaptive Internet usage can lead to addiction for its users (Van Rooij & Prause, 2014).

A study aimed at examining the psychometric properties of the IAT in Chinese adolescents found satisfactory convergent and divergent validity with the Revised Chen Internet Addiction Scale (CIAS-R), amount of time spent online per day, and academic results (Lai et al., 2013). Another recent research found a good convergent validity of the IAT with depressed subjects (Lee et al., 2013). Other studies reported convergent validity of the IAT with time spent online by the subjects, and specific Internet usage (Ngai, 2007), as well as the subject's frequency of being engaged in online activities (Ha et al., 2007). A previous study has verified the convergent and divergent validity of the IAT and its association with other pathological behaviour like gambling (Northrup, Lapierre, Kirk, & Rae, 2015). Similarly, the IAT has also been used for studying the relationship between Internet misuse and gambling disorder in adolescents (Kuss & Lopez-Fernandez, 2016; Lee et al., 2012; Parker, Summerfeldt, Taylor, Kloosterman, & Keefer, 2013; Parker, Taylor, Eastbrook, Schell, & Wood, 2008; Tonioni et al., 2014).

Presently, in the Italian language, three IAT validations exist which have concluded with different factorial structures and items distribution. In the first Italian study (Ferraro et al., 2007), the IAT validation showed six factors (compromised social quality of life, compromised individual quality of life, compensatory usage of Internet, compromised time control, compromised academic/working careers, and excitatory of Internet). The study was conducted with a sample of 236 Internet chatters (139 males and 97 females) aged between 13 and 50 years old ($M = 23.9$, $SD = 6.5$).

The next two recent Italian IAT validations reported similar results only in terms of factor solutions. One study (Faraci et al., 2013) identified two factors (emotional and cognitive preoccupation with Internet, and loss of control and interference with daily life). In this study, the final IAT factorial structure included 18-items, where item 8 and item 17 were excluded for presenting double loadings. The authors interviewed 485 Italian adult subjects (157 males and 328 females) recruited on a voluntary basis. The mean age of the sample was 24.05 ($SD = 7.3$, range 17–47 years).

On the other hand, the study conducted by Fioravanti and Casale (2015) confirmed the two-factor solution of the IAT (emotional and cognitive preoccupations with Internet and social consequences, and loss of control and interference with daily duties), but the result, compared to the study conducted by Faraci et al. (2013), showed a different item distribution among the factors. The participants were 840 students aged between 14 and 26 years old ($M = 18.65$, $SD = 3.85$; 59% females). According to the authors, 50.5% of the subjects came from a public high school in Florence and the remaining subjects were recruited in the study rooms of the Universities of Florence and Perugia, Italy.

Given all the past IAT validations in the Italian language, to date, no Italian studies or empirical investigations have proposed to analyse the psychometric properties of the IAT by applying robust explorative and confirmatory statistical methods. Moreover, the first study does not report statistical data about the validation as well as the reliability of the IAT (Ferraro et al., 2007). In addition, the latent factors of the recent Italian validations of the IAT (Faraci et al., 2013; Fioravanti & Casale, 2015) were highly correlated to each other, indicating a poor discriminant validity between the factors, thus making it important to identify more parsimonious solutions. Also relevant is the value of the chi-square to test the fit of the model, which tends to increase along with the sample size (Kline, 2016). In a typical confirmatory analysis, a way to reduce this risk is to adopt the Satorra-Bentler adjusted chi-square that is based on a different scaling correction factor (Satorra & Bentler, 2001). Although the study by Fioravanti and Casale (2015) mentioned the Satorra-Bentler index in the description of the CFA's parameters, data about this index was not available.

In light of these previous studies therefore, the current study examined, refined and validated the psychometric properties of the Italian IAT instrument and explored its internal consistency, as well as its convergent and divergent validity in a sample of university students. Thus, in the Italian context, the present study is the first attempt to cover a gap by providing critical information on these aspects. This current study wanted to contribute to developing a more systematic validation of the multidimensional nature of the IAT, focusing exclusively on Italian university students. From the perspective of social psychology, university students are particularly vulnerable to Internet addiction risks since they report universal rates of computer skills, daily Internet access, as well as absence of parental and self-control (Al-Gamal, Alzayyat, & Ahmad, 2016; Chen, 2012; Chong Guan et al., 2015; Jelenchick et al., 2012; Lu & Yeo, 2015; Sung, Shin, & Cho, 2014). In this light, since excessive Internet use could be associated to problematic behaviour, the need to develop a standardized assessment tool cannot be overemphasized.

3. Method

3.1. Participants and procedure

This study employed 659 undergraduate university students (234 males, 35.5% and 425 females, 64.5%) enrolled at University of X (Italy). The mean age was 23.6 years ($DS = 3.75$, range = 18–41). The students attended various academic degree courses identified as follows: 205 students (31.1%) belong to the scientific area; 188 students (28.51%) belong to the humanistic area; and 166 students (25.2%) were in the field of economics. The remaining 15.2% of the sample (100 subjects) did not provide information on their degree courses. All the participants had access to Internet facilities on campus—whether they chose to use them or not—and in their homes. A good number of the subjects (42%) connected to the Internet via their mobile phones.

We recruited all the participants for this study in the university campus during the break periods. The students received an informative talk to explain the study's objectives, after which they were invited to collaborate. After obtaining the students' consent, those interested were given a pencil and paper questionnaire, which took around 20 minutes to complete. We emphasized the voluntary nature of participating in the study so that the students could stop completing the questionnaire at any time. In addition, the participants were guaranteed complete anonymity and were assured that the data would be used only for research purposes. Furthermore, the participants completed the questionnaire under the supervision of the researcher and/or a member of the research team. We collected data following the general research principles and the ethical rules of the Italian Psychological Association (AIP).

3.2. Young Internet Addiction Test

Internet addiction risk was assessed by using the previously translated Italian version of the self-administered Internet Addiction Test (IAT) (Ferraro et al., 2007). The scale consists of 20-items and answers have to be given on a five-point Likert scale ranging from 0 (not applicable) to 5 (always) (Appendix A). Scores were computed by applying the Young (1998) impairment index. The Cronbach's alpha internal reliability of the IAT for the current study was good ($\alpha = 0.89$), indicating a high consistency (Field, 2013; Tavakol & Dennick, 2011).

3.3. Self-Esteem Scale

The Italian Rosenberg Self-Esteem Scale (Prezza, Trombaccia, & Armento, 1997) was used to measure the subjective feelings of self-value and self-acceptance. Participants rated their answers with 10 statements on a scale of 1 (strongly disagree) to 4 (strongly agree). Higher scores indicate higher self-esteem. The internal consistency in the sample of this present study was good ($\alpha = 0.84$).

3.4. South Oaks Gambling Screen

The South Oaks Gambling Screen (SOGS) was used to screen for pathological gambling. The Italian version of SOGS has been validated in the Italian population (Guerreschi, 2000). The SOGS is composed of 20-scoring items, all equally weighted, requiring a "yes" or "no" answer where each "yes" answer obtains one point. The non-scoring items identify the type of gambling, amount of money gambled in a day, and relatives and friends with a gambling problem. For the purpose of this study, respondents' scoring was obtained by applying the questionnaire's procedures, by which it was possible to identify the profile of a gambler: regular gambler (0–2 scores); risk problematic gambler (3–4 scores); and

pathological gambler (5 or more scores). For the current study, the measure demonstrated good reliability ($\alpha = 0.84$).

3.5. Demographic information

The questionnaire asked the participants' demographic information such as gender, age, and educational background. Then we obtained data about their Internet use based on time spent online per day, and type of online activities engaged daily (communication, surfing, and interactive activities) through a multiple-choice modality.

Finally, two items in the questionnaire asked about their social and personal well-being in the university residence and asked via one self-diagnostic item whether they thought they were addicted to the Internet (Widyanto et al., 2011). The answers had to be given on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). All the above-mentioned variables were identified taking into account the previous studies on Internet addiction (Fioravanti & Casale, 2015; Lu & Yeo, 2015; Wu et al., 2015).

3.6. Data analyses

Due the goal of the current study, we conducted several statistical analyses. First, we randomly split the sample into two subsamples. We performed the split procedure in SPSS version 22.0 via the SAMPLE command to generate two random subsamples of approximately 50% of the cases. We used the first subsample ($n = 332$) to derive the exploratory factor analysis (EFA) and then we selected the second subsample ($n = 327$) to test the fit of the derived EFA factorial solution with a confirmatory factor analysis (CFA).

We performed the EFA with the support of the FACTOR software program (Lorenzo-Seva & Ferrando, 2006). Then, we used the EQS 6.1 statistical software to perform the CFA (Byrne, 2006). This software supports the function of examining the data for univariate and multivariate normality assumptions by obtaining univariate skewness and univariate kurtosis values and the Mardia's normalized multivariate kurtosis coefficient (Mardia, 1970). This analysis was necessary in view of the nature of the questionnaire, as well as the ordinal nature of the scale in measuring the subject's answer. The Mardia coefficient for the current data indicated the violation of normality, and then robust statistical methods were applied (García-Fernández, Inglés, & Marzo, 2014; Li, 2015). In this regard, Finney and DiStefano (2013) have underlined that univariate skewness and kurtosis values that are closer to 0.0 indicate a normal distribution.

Although the data of the current study showed acceptable values of skewness, the result of Mardia's normalized multivariate kurtosis for the IAT items was 38.75 ($p < 0.05$). This value indicates the presence of multivariate non-normality in the distribution of the IAT scores for the current sample.

Taking into account the ordinal nature of the variables involved in the current study, we adopted a Robust Maximum Likelihood (RML) estimation method (Finney & DiStefano, 2013). In relation to this, a recent study also underlines the appropriateness of using RML when the normality assumption is violated (Li, 2015). Likewise, we accepted the recommendation provided by Hu and Bentler (1999) which underlined the importance of combining different fit indices and cut-off values, respectively: the ratio of chi-square to its degree of freedom (χ^2/df) was applied the Satorra and Bentler (2001) scaled chi-square (S-B χ^2) method to standard error estimates; the Comparative Fit Index (CFI) with recommended values of >0.90 ; the Root Mean Square Error of Approximation (RMSEA) with values of cut-off < 0.008 ; the Standardized Root Mean Square Residual (SRMR) < 0.05 ; and the Non-Normed Fit

Index (NNFI) with expected values > 0.90 . To this end, the chi-square scaling correction is a valid approach to reduce the risk for obtaining inaccurate results (Dimitrov, 2010). Next, we compared the fit of the current factorial structure with other studies aimed at verifying the psychometric properties of the IAT.

Finally, we computed descriptive statistics. We used the Cronbach's alpha (α) coefficient to assess the internal consistency of the IAT's factorial structure. We examined gender differences through t -test. We evaluated the IAT's convergent and divergent validity using Pearson's product moment coefficient on the entire sample. Correlation between gender and the two-factor models was point-biserial. Then, we performed a one-way ANOVA to explore differences between SOGS gamblers' profile and IAT scores.

4. Results

4.1. Internet use, self-esteem and gambling

Using Young's (1998) IAT cut-off criteria on the severity impairment risk-index, the results show that 20.2% of subjects used Internet correctly (scores 0–30). On the other hand, 57.5% of the subjects surfed the web longer than was usually called for, although they still retained control over their online sessions (scores 31–49). The remaining 21.9% of the subjects showed a moderate risk of experiencing occasional or frequent problems due to Internet usage, the extent of which should warn these subjects of the Internet's negative impact on their life (scores 50–79). Finally, only 0.5% of the subjects showed a severe Internet addiction to an extent that causes significant problems in the subject's life (scores 80–100). Overall, the results of the present study on Internet addiction risk are comparable with previous studies even if the present one includes different sample categories (Ng Chong Guan et al., 2015; Servidio, 2014).

The t -test for independent sample showed a significant difference between males ($M = 44.53$, $SD = 12.84$) and females ($M = 39.55$, $SD = 11.08$) in relation to Internet addiction scores ($t(657) = 4.98$, $p < 0.001$, $d = 0.41$); however, it represented a medium sized effect. The majority of the participants used Internet between 1 and 5 h per day (35.2%), whereas 27.2% of the subjects used Internet between 3 and 5 h per day, while only the remaining 7.1% used Internet between 5 and 10 h per day. Males spent more time online daily ($M = 2.20$, $SD = 1.04$) than females ($M = 1.90$; $SD = 1.10$). A significant difference in the results between genders was found ($t(657) = -3.47$, $p < 0.001$, $d = 0.28$), and represented a smaller sized effect. Results also indicated a significant difference in the self-esteem level ($t(657) = 2.55$, $p < 0.01$, $d = 0.21$) between males ($M = 31.36$, $SD = 5.19$) and females ($M = 30.26$, $SD = 5.13$), but the sized effect was smaller. The results of the one-way ANOVA showed a significant effect of IAT scores ($M_{0-2} = 37.49$, $SD = 12.12$; $M_{3-4} = 52.5049$, $SD = 8.62$; $M_5 = 61.14$, $SD = 6.18$) on the SOGS gambler profile, $F(3,655) = 16.84$, $p < 0.001$, $d = 0.43$), and represented a medium sized effect.

The percentage of responses of the items on online activities is shown in Table 1. The findings indicate that the current sample of students are most frequently involved in the following online activities: surfing generic websites (62.4%); using Facebook (51.9%); sending email (30.7%); eLearning (23.1%) and online gaming (18.4%).

4.2. Item analyses

The IAT inter-item correlation (Table 2) ranged between $r_{iic} = 0.09$ and $r_{iic} = 0.52$, which demonstrates that the majority of the selected items measure similar phenomena (Hawi, 2013). Whereas, the mean of the inter-item correlation was $r_{iic} = 0.30$. The

Table 1
Percentage rates of responses to items on specific online activities (N = 659).

Item	Frequency	Percentage (%)
<i>Communication</i>		
Email	202	30.7
Chat	94	14.3
Forum	13	2.0
Facebook	342	51.9
Twitter	8	1.2
<i>Surfing</i>		
Generic websites	411	62.4
Specific websites	158	24.0
Blog	74	11.2
File sharing	16	2.4
<i>Interactive activities</i>		
Online gaming	121	18.4
Online shopping	115	17.5
eLearning	152	23.1
Nothing	271	41.1

overall Cronbach's alpha estimate for the full IAT scale obtained a good internal consistency ($\alpha = 0.89$).

Although the corrected item-total correlation values for the IAT (Table 3) varied from $r_{itc} = 0.34$ (item 7) to $r_{itc} = 0.63$ (item 11), indicating that the items measured the same theoretical construct, items 3, 4, and 7 exhibited lower values. Similarly, the squared multiple correlation, which explains the item's contribution to internal consistency, was good for all items except for items 3, 4 and 7, which were smaller. After this preliminary evaluation, we decided to perform an exploratory factor analysis including all the items of the questionnaire. Given the objectives of the current study and based on the results of the previous analyses, we chose to perform a Parallel Analysis (PA) with polychoric correlations as a more accurate statistical method for performing exploratory factor analysis (Timmerman & Lorenzo-Seva, 2011).

4.3. The exploratory factor analysis (EFA)

To examine the dimensionality of the IAT scale, the first subsample ($n = 332$) was submitted to the EFA. FACTOR software (Lorenzo-Seva & Ferrando, 2006) recommends the use of polychoric correlations, rather than Pearson correlation, when either the skewness or kurtosis indexes are higher than 1 in terms of absolute value (Mardia, 1970). Table 4 shows the univariate descriptive statistics of the IAT derived from the EFA. For the current study, the test of skewness was not statistically significant ($p > 0.001$). However, there was evidence of excessive kurtosis ($p < 0.05$). In this regard, the Mardia's result supported the decision to use polychoric correlations matrix for this study.

With the support of FACTOR, we ran a Parallel Analysis (PA) with a polychoric correlations and we used the Principal Components Analysis (PCA) with rotation Promin (Timmerman & Lorenzo-Seva, 2011) for components extraction. These methods were selected because previous studies have shown the efficiency of the PA as the most accurate method of determining the number of factors (Cho, Li, & Bandalos, 2009; Garrido, Abad, & Ponsoda, 2013; Horn, 1965). Additionally, the performance of PA-PCA increases the accuracy in identifying the number of underlying factors (Crawford et al., 2010).

Once the result of the PA recommended the extraction of two factors, we applied the Hull method for selecting the number of common factors (Lorenzo-Seva, Timmerman, & Kiers, 2011). The dispersion matrix was polychoric correlations and the method for factor extraction was Minimum Rank Factor Analysis (MRFA) (ten Berge & Kiers, 1991) and as rotation, we used Weighted Oblimin (Lorenzo-Seva, 2000) because we considered the inter-correlation

Table 2
Inter-item correlations of the IAT (N = 659).

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	—																			
2	0.47**	—																		
3	0.09*	0.15**	—																	
4	0.16**	0.15**	0.28**	—																
5	0.34**	0.39**	0.17**	0.24**	—															
6	0.29**	0.41**	0.21**	0.21**	0.43**	—														
7	0.13**	0.22**	0.16**	0.22**	0.24**	0.17**	—													
8	0.25**	0.37**	0.25**	0.20**	0.31**	0.58**	0.20**	—												
9	0.22**	0.29**	0.26**	0.24**	0.37**	0.37**	0.25**	0.36**	—											
10	0.16**	0.22**	0.16**	0.22**	0.25**	0.22**	0.23**	0.40**	0.30**	—										
11	0.22**	0.28**	0.30**	0.20**	0.33**	0.35**	0.24**	0.40**	0.39**	0.40**	—									
12	0.18**	0.25**	0.28**	0.18**	0.28**	0.23**	0.19**	0.26**	0.33**	0.34**	0.44**	—								
13	0.25**	0.32**	0.25**	0.25**	0.38**	0.36**	0.23**	0.34**	0.37**	0.32**	0.49**	0.42**	—							
14	0.32**	0.37**	0.17**	0.30**	0.35**	0.35**	0.19**	0.36**	0.30**	0.28**	0.31**	0.25**	0.37**	—						
15	0.23**	0.27**	0.33**	0.31**	0.21**	0.26**	0.19**	0.38**	0.39**	0.33**	0.52**	0.43**	0.45**	0.32**	—					
16	0.37**	0.39**	0.09*	0.21**	0.42**	0.37**	0.16**	0.27**	0.28**	0.28**	0.34**	0.25**	0.34**	0.42**	0.27**	—				
17	0.23**	0.27**	0.18**	0.13**	0.32**	0.31**	0.15**	0.33**	0.22**	0.24**	0.34**	0.24**	0.20**	0.20**	0.35**	0.30**	—			
18	0.15**	0.24**	0.31**	0.16**	0.32**	0.30**	0.20**	0.33**	0.37**	0.36**	0.45**	0.30**	0.35**	0.30**	0.51**	0.28**	0.42**	—		
19	0.22**	0.27**	0.30**	0.23**	0.28**	0.17**	0.28**	0.33**	0.26**	0.30**	0.39**	0.34**	0.38**	0.37**	0.46**	0.25**	0.30**	0.35**	—	
20	0.17**	0.20**	0.38**	0.19**	0.26**	0.22**	0.21**	0.35**	0.33**	0.33**	0.51**	0.44**	0.45**	0.30**	0.55**	0.19**	0.31**	0.52**	0.43**	—

Note: * $p < 0.05$, ** $p < 0.001$.

Table 3

Mean, standard deviation, corrected item-total correlation, squared multiple correlation, and Cronbach's alpha of the IAT (N = 659).

Item	Mean	Standard deviation	Item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
1	3.34	1.09	0.42	0.29	0.89
2	2.64	1.13	0.52	0.37	0.88
3	1.32	0.72	0.38	0.25	0.89
4	2.36	1.12	0.36	0.20	0.89
5	2.33	1.17	0.56	0.36	0.88
6	2.21	1.11	0.55	0.46	0.88
7	2.75	1.26	0.34	0.14	0.89
8	1.85	1.01	0.56	0.44	0.88
9	2.14	1.13	0.54	0.32	0.88
10	2.11	1.09	0.47	0.27	0.89
11	1.75	1.00	0.63	0.47	0.88
12	1.87	1.07	0.50	0.33	0.88
13	1.84	0.98	0.61	0.41	0.88
14	2.19	1.25	0.54	0.35	0.88
15	1.50	0.86	0.61	0.49	0.88
16	2.69	1.22	0.52	0.36	0.88
17	1.88	1.10	0.46	0.28	0.89
18	1.54	0.94	0.56	0.44	0.88
19	1.63	0.90	0.53	0.34	0.88
20	1.39	0.77	0.56	0.49	0.88

Table 4

Univariate descriptive statistics of the IAT based on the EFA (N = 332).

Item	Mean	SD	Skewness	Kurtosis
1	3.40	1.04	-0.51	-0.14
2	2.68	1.12	0.00	-0.73
3	1.28	0.66	2.74	8.51
4	2.34	1.11	0.45	-0.55
5	2.39	1.18	0.33	-0.89
6	2.26	1.12	0.57	-0.44
7	2.77	1.24	0.14	-0.93
8	1.82	0.97	0.99	0.24
9	2.16	1.15	0.70	-0.35
10	2.12	1.11	0.63	-0.53
11	1.75	0.98	1.26	1.02
12	1.87	1.08	1.15	0.57
13	1.82	0.95	1.16	1.06
14	2.20	1.24	0.64	-0.75
15	1.50	0.86	1.94	3.67
16	2.73	1.25	0.28	-0.88
17	1.89	1.09	1.06	0.24
18	1.56	0.96	1.76	2.55
19	1.56	0.86	1.55	2.04
20	1.36	0.69	2.05	4.39

between the two factors.

The result of the polychoric correlation matrix for evidence of non-zero showed a significant Bartlett's statistic test of sphericity ($\chi^2 = 2.002$, $df = 190$, $p < 0.001$), and the Kaiser-Meyer-Olkin (KMO = 0.90) measure of adequacy indicated evidence of a good correlation between the items. The final factorial solution resulted in 18-items (Table 5). The two extracted factors explain 41% of the total variance (Table 5). All items loaded 0.30 or higher except for items 4 and 7, which were excluded for the next confirmatory factor analysis.

Based on the extracted two-factor model, the first factor (F1) included 11 items and described the subject's motivation for using the Internet in terms of "interpersonal, emotional and obsessive conflict as a result of Internet use." On the other hand, the second factor (F2) covered 7 items and explained the role of "online time management and compromised personal wellbeing." All the communalities were above the minimum of 0.41 (Table 5).

The results from the current data returned good values of the Cronbach's alpha, corresponding to ($\alpha = 0.86$) for the first factor, and ($\alpha = 0.81$) for the second factor, which both show high internal

consistency and reliability (Field, 2013; Tavakol & Dennick, 2011). Whereas the overall internal reliability of the IAT was $\alpha = 0.89$, the two extracted factors (F1: M = 18.97, SD = 6.80; F2: M = 17.24, SD = 5.42) showed an acceptable correlation value ($r = 0.63$, $p < 0.001$, two-tailed), which supports the proposed construct of the IAT questionnaire. According to Tavakol and Dennick (2011), the index to measure the variance of error is calculated using the standard formula: $1 - [\text{Square of } \alpha]$. For the current version of the IAT, the variance of error was small (F1 = 0.26; F2 = 0.34).

4.4. The confirmatory factor analysis (CFA)

To verify the factor structure identified through EFA, we performed CFA on the second sample of subjects ($n = 327$) using ESQ 6.1 software. Then we analysed the 18-IAT items as reflective indicators of the extracted factors.

The goodness-of-fit indices for this CFA model are shown in Table 6. After the analysis, the modification fit indices suggested the inclusion of the error of covariance for both the extracted factors. For the first factor, the error of covariance was added between items 17 and 18. We chose to let the errors of these two items covariate because both are related to time spent online (Fioravanti & Casale, 2015; Lai et al., 2013). For the second factor, the error of covariance was added between items 6 and 8. According to the previous studies, these two items can covary because their content is very similar (Barke et al., 2012; Fioravanti & Casale, 2015; Khazaal et al., 2008; Pontes et al., 2014).

Fig. 1 shows the final factorial graphical solution of the 18-IAT items. The standardized factor loadings (which ranged from 0.48 to 0.85, based on robust statistics), as well as the estimated correlation among the errors between the items, were significant at the 0.001 level (Fig. 1). The CFA results supported the correlated two-factor model of the IAT ($r = 0.72$, $p < 0.05$) that was identified by the EFA, also in terms of reliability coefficient ($\alpha = 0.91$).

Table 7 shows the standardized solution of the confirmatory model obtained by using RML estimation method. Also, we reported the R^2 value (squared multiple correlation) representing the proportion of variance accounted for by its factor (Byrne, 2006). We compared the factorial structure of this study with the results derived from previous investigations. The comparison of the one-factor model (Dhir et al., 2015b), the two-factor model (Faraci et al., 2013; Fioravanti & Casale, 2015), the three-factor solution

Table 5
Rotated loading matrix of the EFA (selected items in bold character) (N = 332).

Item	F1 - Loading	F2 - Loading	Question: How often ...	Communality
20	0.84	−0.02	do you feel depressed, moody, or nervous when you are offline, which goes away once you are back online?	0.79
15	0.76	0.06	do you feel preoccupied with the Internet when off-line or fantasise about being online?	0.74
18	0.69	0.16	do you try to hide how long you've been online?	0.86
11	0.60	0.22	do you find yourself anticipating when you go online again?	0.67
19	0.57	0.06	do you choose to spend more time online over going out with others?	0.60
3	0.48	−0.01	do you prefer excitement of the Internet to intimacy with your partner?	0.43
12	0.43	0.20	do you feel that life without the Internet would be boring, empty and joyless?	0.42
13	0.43	0.36	do you snap, yell, or act annoyed if someone bothers you while you are online?	0.52
9	0.41	0.32	do you become defensive or secretive when anyone asks what you do online?	0.54
10	0.39	0.21	do you block disturbing thoughts about your life with soothing thoughts of the Internet?	0.41
17	0.37	0.21	do you try to cut down the amount of time you spend online and fail?	0.52
2	−0.01	0.68	do you neglect household chores to spend more time online?	0.77
6	0.07	0.68	does your work suffer because of the amount of time you spend online?	0.76
16	−0.03	0.64	do you find yourself saying "just a few more minutes" when online?	0.58
1	−0.03	0.53	do you feel that you stay online longer than you intend?	0.48
14	0.14	0.53	do you lose sleep due to late night log-ins?	0.56
8	0.24	0.53	does your job performance or productivity suffer because of the internet?	0.81
5	0.15	0.52	do others in your life complain to you about the amount of time you spend online?	0.54
$\alpha = 0.86$		$\alpha = 0.81$	Reliability index (only for the 18-item)	
0.33		0.08	Explained variance (total 41%)	

Table 6
Summary of the CFA and model fit indices IAT (N = 327).

Model	Item	χ^2	df	χ^2/df	S-B χ^2	NNFI	CFI	RMSEA (90% CI)	SRMR
2Factors	18 ^a	410.68	132	3.11	1617.79	0.990	0.992	0.034 (0.021, 0.046)	0.066
1Factor ¹	20	860.90	170	5.06	1792.90	0.911	0.920	0.112 (0.104, 0.119)	0.073
2Factors ²	20	507.91	165	3.07	1919.78	0.954	0.960	0.080 (0.072, 0.088)	0.063
2Factors ³	18 ^b	475.65	134	3.55	1504.76	0.945	0.952	0.088 (0.080, 0.097)	0.069
3Factors ⁴	20	622.96	132	4.71	1736.76	0.919	0.930	0.107 (0.098, 0.115)	0.072
4Factors ⁵	20	334.04	129	2.58	580.47	0.870	0.890	0.070 (0.061, 0.079)	0.057
6Factors ⁶	20	703.35	155	4.53	3433.88	0.922	0.937	0.104 (0.096, 0.112)	0.068

Note. Comparison of our IAT two-factor model with some factor structures suggested in the literature. χ^2 = chi-square; df = degrees of freedom; S-B χ^2 = Satorra-Bentler scaled chi-square; NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval for RMSEA; SRMR = standardized root mean square residual.

^aExcluding items 4 and 7.

^bExcluding items 8 and 17.

Models are listed in the following order:

¹Dhir et al. (2015b).

²Fioravanti and Casale (2015).

³Faraci et al. (2013).

⁴Chang and Man Law (2008).

⁵Karim and Nigar (2014).

⁶Ferraro et al. (2007).

(Chang & Man Law, 2008), the four-factor solution (Karim & Nigar, 2014) and the six-factor solution (Ferraro et al., 2007), with our two-factor solution showed that based on RML estimation, our result obtained the best-fit indexes.

4.5. Convergent and divergent validity

Table 8 summarizes the results of convergent and divergent validity of the two-factor model of the IAT based on 18-item scores. The current study assessed the convergent and divergent validity since the two factors together showed significant correlation levels with other variables used to measure the risk of Internet addiction.

The two IAT factors correlated weakly with sex (F1: $r_{pb} = 0.17$, $p < 0.001$, two-tailed; F2: $r_{pb} = 0.15$, $p < 0.001$, two-tailed), and age (F1: $r = -0.14$, $p < 0.001$, two-tailed; F2: $r = -0.14$, $p < 0.001$, two-tailed). We found a significant relationship between time spent online per day by the subjects and the two factors (F1: $r = 0.29$, $p < 0.001$, two-tailed; F2: $r = 0.43$, $p < 0.001$, two-tailed). This appeared as a good result because the second factor covered items about the subjects' online sessions and their time management.

There was, as well, a moderate association with the subjects' preferred time to establish Internet connection (F1: $r = 0.17$, $p < 0.001$, two-tailed; F2: $r = 0.24$, $p < 0.001$, two-tailed).

There was also a significant correlation between the two factors and the self-diagnostic item relating to subjects defining themselves as Internet addicts (F1: $r = 0.38$, $p < 0.001$, two-tailed; F2: $r = 0.35$, $p < 0.001$, two-tailed). A small association was also found between the subjects' perception of their own social wellbeing and the two IAT factors (F1: $r = -0.10$, $p < 0.05$, two-tailed; F2: $r = -0.13$, $p < 0.001$, two-tailed).

We explored the divergent validity by correlating the two-factor model of the IAT with the self-esteem score (F1: $r = -0.27$, $p < 0.001$, two-tailed; F2: $r = -0.25$, $p < 0.001$, two-tailed). This significant association supports the validity of the current two-factor model of the IAT. Additional evidence of divergent validity was provided by correlating scores of the SOGS with the two-factor model of the IAT (F1: $r = 0.45$, $p < 0.001$, two-tailed; F2: $r = 0.30$, $p < 0.001$, two-tailed). These findings supported the association between the SOGS and the two factors, and in particular with the first factor related to the obsessive conflict of Internet use.

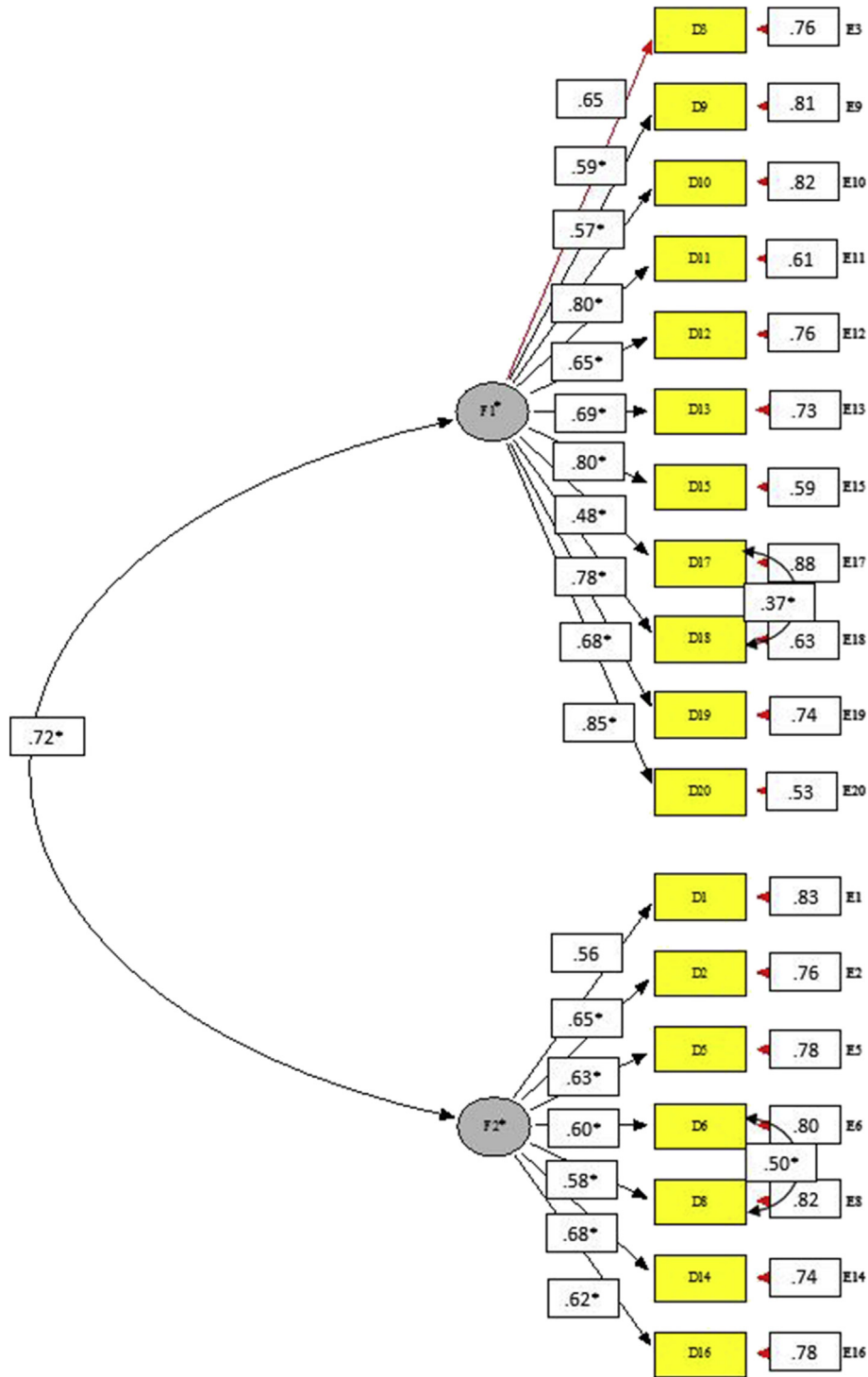


Fig. 1. Path diagram with standardized solution of the Italian 18-IAT items (N = 327).

5. Discussion

The current study aimed to contribute to the further assessment of the psychometric properties of the Italian version of the IAT in a sample of university students. While the current international literature on Internet addiction shows a variety of the IAT factorial structures, the present study showed similar results to those found in two of the most recent Italian investigations (Faraci et al., 2013; Fioravanti & Casale, 2015). On the other hand, in contrast with

these two studies, the results of the current research found differences for the EFA and the CFA fit indexes of the IAT, as well as the item distribution among the factorial structure.

The IAT was shown to have a good reliability, as well as high internal consistency. However, three items: items 3, 4, and 7 displayed lowest levels of item-total correlation and squared multiple correlation, indicating that they could affect the internal consistency of the IAT. In fact, with the exception of the three aforementioned items, the majority of the item-total correlations were

Table 7
Standardized solution of the CFA with RML method (N = 327).

Item	Loading	Error	R ²
<i>F1</i>			
3	0.65	0.76	0.43
9	0.59*	0.81	0.34
10	0.57*	0.82	0.33
11	0.80*	0.61	0.63
12	0.65*	0.76	0.42
13	0.69*	0.73	0.47
15	0.80*	0.59	0.65
17	0.48*	0.88	0.23
18	0.78*	0.63	0.61
19	0.68*	0.74	0.46
20	0.85*	0.53	0.72
<i>F2</i>			
1	0.56	0.83	0.32
2	0.65*	0.76	0.42
5	0.63*	0.78	0.39
6	0.60*	0.80	0.36
8	0.58*	0.82	0.34
14	0.68*	0.74	0.46
16	0.62*	0.78	0.39

Note. * $p < 0.05$; R² = Squared multiple correlation.

Table 8
Correlations of the two IAT factors with other variables (N = 659).

	F1	F2
Sex (reference category: men) ^a	0.17**	0.15**
Age	-0.14**	-0.14**
Time spent online	0.29**	0.43**
Preferred time for online connection	0.17**	0.24**
Usually I sleep with the mobile phone turned on	0.24**	0.21**
Motivation for Internet connection: Communication	0.03 (ns)	0.15**
Motivation for Internet connection: Surfing	0.04 (ns)	0.05 (ns)
Motivation for Internet connection: Online activities	-0.17**	-0.17**
Self-diagnostic item	0.38**	0.35**
Perception of own social wellbeing	-0.10*	-0.13**
Rosenberg Self-Esteem Scale (RES)	-0.27**	-0.25**
South Oaks Gambling Screen (SOGS)	0.45**	0.30**

Note. ^aPoint-biserial correlation. * $p < 0.05$, ** $p < 0.001$, ns (not significant).

high. As regards item 3, and consistent with previous results (Barke et al., 2012; Pontes et al., 2014), in this study, we note that the formulation of this item (How often do you prefer the excitement of the Internet to intimacy with your partner?) might present some problems for the subjects for varying reasons (e.g., for people who do not have a partner; for people who prefer to stay alone; or for people who feel embarrassed to answer such a question, and so on).

Furthermore, item 4 which asks “Do you form new relationships with fellow online users?” may no longer be viewed as anomalous behaviour. In the past, while this item might have represented a critical behaviour to measure Internet addiction risk, presently, with the spread of social networking sites, chat rooms, instant messages services and other collaborative tools, it may already be a norm for a lot of people (Chong Guan et al., 2015; Sung et al., 2014). This result reflects the on-going rapid changes taking place with Internet-related technologies as people build new social relationships through social networking sites, like Facebook, among others (Ryan et al., 2014).

A similar consideration may apply to item 7, which refers to the subject's desire to check the mailbox frequently. Subjects could interpret this behaviour as subjectively normal, and hence unproblematic given the accessibility of more efficient communication environments readily available on mobile devices (e.g., WhatsApp, Viber, Messenger, etc.) (Chang & Man Law, 2008; Fernández-Villa et al., 2015; Jelenchick et al., 2012; Karim &

Nigar, 2014; Lai et al., 2013; Lee et al., 2013). In this regard, new modalities of recent online pervasive services even reduce the need to check the online mailbox (e.g., automatic push mail notification), compared to the first generation of communication systems. Our analysis is not new since previous studies have already identified item 7 as problematic (Barke et al., 2012; Chang & Man Law, 2008; Demetrovics, Szeredi, & Rózsa, 2008; Karim & Nigar, 2014).

The result from the EFA recommended dropping the items 4 and 7 and indicated a two-factor solution for the Italian version of IAT with 18-items. The first factor was named “interpersonal, emotional and obsessive conflict as a result of Internet use,” while the second factor was “online time management and compromised social and personal life quality.” This result appears to be consistent with other previous studies, which indicated the problematic loadings of the items 4 and 7, thus suggesting the importance of considering some specific areas of improvement on the current version of the IAT (Chong Guan et al., 2015; Fernández-Villa et al., 2015; Jelenchick et al., 2012; Khazaal et al., 2015; Lee et al., 2013; Mirko Pawlikowski et al., 2013; Pontes et al., 2014; Sung et al., 2014).

The first factor “interpersonal, emotional and obsessive conflict as a result of Internet use” indicates the possible negative social consequences from an excessive use of the Internet. The prevalence of items related to negative emotions (e.g., items 11, 12, 15, and 20) underline the subjects' maladaptive use of Internet and its related services. Similar to, and in relation to this result, Chen (2012) argues that university students who surf the Internet excessively not only exhibit weaker development in terms of identity and intimacy, but also show compulsive behaviour which increases their social impairment in handling interpersonal relationships. In this regard, we note that the role interpersonal factors play in Internet addiction has already been widely described (Koo & Kwon, 2014, for a review).

The second factor “online time management and compromised personal wellbeing” describes the risks of Internet addiction in terms of compulsive use with negative effects on personal wellbeing. Items related to this factor ask to what extent a subject unsuccessfully attempts to curb online time (e.g., items 1 and 16). Other aspects deal with the consequences of Internet use for daily functioning (e.g., items 2, 6, and 8). The conceptual implications of the second factor result is consistent with a previous study carried out by Quiñones-García & Korak-Kakabadse (2014), which provided a relationship between compulsive Internet use, loss of control and negative attitudes on personal and social lifestyles.

Our results show that the two dropped items do not compromise the overall structure of the instrument, as long as there is a possibility of removing some items from the initial configuration of the IAT, as previous studies have considered (Faraci et al., 2013; Khazaal et al., 2015; Pontes et al., 2014). As regards the explained level of variance, we found that the IAT is a valid instrument for assessing the risk of Internet addiction among the Italian sample of university students.

This study is one of few Italian investigations that tested the two-factor model of the IAT with a sample of university students by applying Robust Maximum Likelihood (RML) estimation methods. The result of the confirmatory factor analysis fitted well, showing the existence of an interplay between the dimensions of Internet addiction and the nature of this disorder. In addition, few studies on the psychometric properties of the IAT have carefully explored the non-normality of the data with the risk that the final results could be influenced by the application of non-suitable statistical estimation methods (Lu & Yeo, 2015; Watters et al., 2013).

Furthermore, we also realize that it is impossible to totally compare the results of the current Italian IAT validation with the study carried out by Ferraro et al. (2007) because that study did not

report data about IAT dimensionality explored with a confirmatory factor analysis, and tested for its reliability and its validity. On the other hand, in comparing the current two-factor model with the results of the last two Italian studies, except for some differences on items' distribution, these last two studies exhibited common results in terms of IAT reliability and factors correlation (Faraci et al., 2013; Fioravanti & Casale, 2015). Moreover, the highest agreement was found between the present study and that done by Fioravanti and Casale (2015), except for items 4 and 7, which were grouped in the second factor. However, the present IAT factorial model indicated a limited number of errors of covariance, contrary to the results obtained in the study of Fioravanti and Casale (2015), confirming fewer relationships between the items. In addition, according to the results of the CFA, in the present study, the latent factors were moderately correlated to each other, whereas the other two studies obtained higher values. This result indicates a good discriminant validity between extracted factors, but does not exclude finding solutions that are more parsimonious.

Another result worth noting in the current study is related to the factor loadings. For the first factor, items with high loadings asked subjects if they felt preoccupied when they were offline, if they tried to hide long online sessions, and if they tried to appear ambiguous when asked about what they were doing online. This factor was correlated with self-esteem scale and with the self-diagnostic item suggesting that subjects with personality problems would have higher scores on this scale.

For the second factor, items with high loadings included decreased productivity due to the time spent online. The items of this second factor were correlated with time spent online and use of Internet for communication purposes and subjects' lowest social wellbeing. We note that these items capture specific problematic behaviour when subjects overuse Internet services.

Based on these results, our two-factor model provided a good fitness compared to other factorial solutions proposed in current literature on the matter. The results from the current confirmatory factor analysis suggest that Internet addiction can be measured into two distinct factors, rather than one, confirming the multidimensional nature of this disorder. The application of robust exploratory and confirmatory model, in turn, point to the importance of considering a revision of the current version of the IAT questionnaire.

The present study satisfied the condition of convergent and divergent validity since the two-factor model had a significant correlation with other variables used to measure the risk of Internet addiction (Dhir et al., 2015a). Both the two IAT factors, and in particular the second factor, were moderately correlated with time spent online per day by the subjects. The correlation values were consistent with other results from previous studies (Calvo-Francés, 2016; Dhir et al., 2015a; Lu & Yeo, 2015; Ngai, 2007; Romano et al., 2013). This weak correlation value may be explained by the different ways subjects connect to the Internet through different devices (e.g. smartphone, desktop computers, tablets, and other mobile devices). In this regard, it is also important to consider the motivation for Internet connection rather than just examining Internet connectivity per se for an excessive amount of time (Fioravanti & Casale, 2015).

A significant moderate relationship existed between the two IAT factors, in particular with the first factor and the self-diagnostic item where subjects measured themselves as Internet addicted. This result is consistent with other previous studies, supporting the view that Internet addiction may depend on different kinds of behavioural problems (Karim & Nigar, 2014; Lai et al., 2013; Widianto et al., 2011).

A lowest significant relationship between both the IAT factors, especially for the second factor, and the personal social wellbeing

was found. The correlation value was smaller and could be used as a predictor factor of Internet addiction (Kim, LaRose, & Peng, 2009; Wang et al., 2013). This result may be explained by the fact that majority of the subjects used Internet in a moderate manner, indicating that they feel a good level of personal and social wellbeing. In fact, most of the subjects exhibited a good level of self-esteem, and the two-factor model showed a moderate level of association with the self-esteem scale. This finding can contribute to providing evidence that self-esteem works as a protective factor to reduce the risk of Internet addiction (Zhang et al., 2015). Finally, a significant correlation was found between the IAT and the SOGS gambler profile. According to Tonioni et al. (2014) subjects with Internet addiction show similarities with pathological gamblers. Indeed, our findings were also consistent with the result of a systematic review, suggesting an association between Internet addiction and interpersonal impairments (Kuss & Lopez-Fernandez, 2016).

Based on Young's cut-off criteria, we found that only a small percentage of subjects showed a moderate risk of addiction. On the other hand, an even smaller percentage were actually Internet addicted. Then, as previously mentioned, as regards the gender profile, males and females showed significant difference in their IAT scores. In this study, males obtained higher Internet scores compared to females. Our outcomes in this regard are consistent with other previous studies (Lai et al., 2013; Servidio, 2014).

6. Limitations and future studies

While the current sample of subjects is large enough for reliable results, using the study to make universal generalizations based on the Italian sample of university students would certainly be risky. Nonetheless, we think that the sample can be useful to draw a generalization on the behaviour of students, but only at the level of the local university from which all the students in the study belonged. Thus, our findings should be interpreted with some caution. The results may be affected by the specific characteristics of the university environment, and further systematic research should be designed to include a nationally representative sample of university students.

In addition, another limitation of this study was the inability to test the convergent validity of the IAT in the Italian language with another recent instrument measuring Internet addiction. One reason is that to date, apart from the IAT, there are no recent instruments in the Italian language which measure the risk of Internet addiction. In any case, even with this limitation, the IAT showed a good reliability when assessed with self-esteem and gambling questionnaires.

Moreover, while the IAT has been recognized as a significant instrument to measure the risk of Internet addiction, it was based on the already superseded DSM-4 criteria. Further studies should explore Internet misuse by applying the new perspective that may be culled from the new DSM-5 edition. Given current changes, not only with Internet usage but also with definitions of disorders, it is now necessary to design and test more updated measures for exploring the maladaptive use of Internet and its related services.

Young's proposed criteria should also take into account the temporal growth of both Internet use and its services. In the current study, this difficulty has been recognized when we identified two problematic items: item 4 and item 7. This shows the importance of updating the current assessment instruments to accurately measure the risk of Internet addiction. Also, future investigations should address the issues posed by items 4 and 7 by investigating their appropriateness, also considering the possibility of rewording these items, keeping in mind the effects of new mobile communication systems on the subject's behaviour (Hawi et al., 2015). In

the alternative, as the current study proposes, it is important to adopt robust methods for carrying out statistical analyses.

Finally, it is important in future studies to clearly distinguish between the time spent online exclusively for study reasons (which could require long hours spent online) as opposed to the time spent for other Internet-related activities (e.g., free-time, search information, etc.). We tried to reduce this limitation in the study by exploring different sets of online behaviour, which can modulate the relation between Internet use and risk of addiction.

7. Conclusion

Despite some limitations, the results of the present study add an important step to the current literature on the IAT confirming a two-factor model, and which could contribute to future assessments of Internet addiction. We underline the importance of adopting robust statistical methods in order to have more stable results in terms of item information as well as reliability. The disparity between the different psychometric assessment approaches of the IAT makes comparisons hard to establish (Fernández-Villa et al., 2015). This study, in addition, underlines the opportunity to revise some items of the IAT, in order to improve the questionnaire to better understand the risk of Internet addiction by considering actual technological and social developments (Jelenchick et al., 2012; Pontes et al., 2014). The reliability test of the two-factor model of the IAT showed good psychometric properties. It also has convergent and divergent validity as indicated by the significant correlation with other assessment instruments (self-esteem and pathological gambling) reflecting the risk of Internet addiction. We can also affirm that self-esteem may be a useful buffer against Internet addiction, especially in examining the individual differences that may incline the subject to develop the disorder (Zhang et al., 2015). Finally, the association between Internet addiction disorder and pathological gambling confirms the hypothesis that subjects share the same psychological and neural mechanisms (Lee et al., 2012).

Furthermore, researches that use the IAT can help policy makers to design Internet management strategies, particularly for university students who use a multiplicity of online communication tools. According to the nature of the technologies, the Internet can offer students more opportunities to exchange ideas not only with their friends but also with colleagues and professors from other universities in other parts of the globe, thus enhancing the internationalization of the educational system. In understanding the risks associated with maladaptive Internet use, academic researchers interested in this matter may use the results of this study to refine the present version of the IAT and improve this current validation. Finally, from the perspective of social psychology, this study may also be useful for all those involved in university student development (e.g., student's family, local administration, teachers, etc.) insofar as they may need to view the Internet as a double-edged sword. The study underlines, as many other investigations have, that the Internet is a useful resource, but it may also pose a considerable risk for students if they use it in a distorted way.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://>

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