



The association between problematic internet use and hedonic and eudaimonic well-being: A latent profile analysis

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ABSTRACT

Problematic internet use (PIU) has become a public health concern globally and there are now many published studies examining the issue, particularly in relation to wellbeing. However most previous studies on the relationship between PIU and well-being have been conducted using a variable-centered approach with either indicators of ill-being (depression, stress, anxiety, loneliness), or only one dimension of well-being (happiness or life satisfaction). Therefore, the present study aimed to address this research gap by investigating the distinct dimensions of hedonic and eudaimonic well-being simultaneously as outcomes of PIU latent profiles, as well as sociodemographic variables and stress as antecedents. The profile indicators were items of the Internet Disorder Scale. Data were collected from 1202 participants (516 males), aged 19–59 years ($M = 29.24$ years, $SD \pm 9.40$). The results showed that four latent profiles emerged: ‘Low risk of PIU’ (56.4 %), ‘Medium risk of PIU with moderately-high psychosocial impairments’ (9.1 %), ‘Medium risk of PIU with poor internet-related self-control’ (27.4 %), and ‘High-risk of PIU’ (7.1 %). Both hedonic and eudaimonic well-being were outcomes of PIU profiles. The participants from the high-risk profile of PIU had the lowest levels on both dimension of well-being. The addiction criteria with the highest scores in the high-risk of PIU profile were preoccupation, mood modification, and jeopardizing social relationship or job opportunities. Age and stress were significant antecedents of PIU latent profile membership. Knowing the addiction criteria with highest values in the PIU high-risk profile can be a basis for developing tailored treatments for maladaptive internet use. Moreover, hedonic and eudaimonic well-being measures could be used to assess therapeutic progress.

1. Introduction

Approximately two-thirds of the world’s population (67.1 67.1%; 5.44 billion) are internet users worldwide Statista, 2024 [1]. Although most individuals use the internet in an adaptive and healthy way, some use it maladaptively, which can have detrimental effects on both mental and physical health. Although problematic internet use (PIU) has been studied for over 25 years [2], there is still a need to understand the difference between healthy internet users and problematic users, as well as investigate the links between maladaptive internet use and psychological well-being.

1.1. Problematic internet use and excessive internet use are not the same

There is now a plethora of terms in the literature that describe maladaptive internet use including (among others) ‘problematic internet

use’, ‘pathological internet use’, ‘internet disorder’, ‘internet use disorder’, ‘compulsive internet use’ and ‘internet addiction’ [3]. Moreover, some scholars argue that the term ‘addiction’ is improperly used since it is not yet a distinct nosological entity [4], included in DSM-5 [5], as is the case with gaming and gambling addictions which are viewed as bona fide addictions.

Although there is still not enough empirical evidence to establish whether PIU is a clearly nosologically defined psychopathological entity, it is still widely accepted that it is a global mental health problem [6]. Considering the multitude of denominations that broadly reflect the same phenomenon of maladaptive internet use, it is desirable to have a single denomination. Some scholars have suggested the name ‘internet use disorder’ rather than PIU [7,8] because it is not about the maladaptive use of the internet *per se*, but of its various functions, online channels, or content. This echoes that of Griffiths [9] who has long argued that individuals are not addicted to the internet, but have

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addictions on the internet.

PIU is a form of technological addiction comprising excessive human-machine interaction [2,9,10]. It involves a maladaptive use, excessive preoccupation, and lack of control over internet use, leading to impairments in personal, professional, and social domains of life [11]. Although addictive use implies excessive time spent on the internet, this does not mean that excessive internet users are necessarily addicted to the internet. There are differences between excessive internet users and addictive users [12] and there are many individuals who use the internet excessively without detrimental effects on their lives [13]. If excessive users spend too much time on the internet, they may still maintain good psychological functioning. In contrast to this, addictive behavior involves the impairment of impulse control and results in dysfunctional behavior. As Griffiths [11,14] has noted, the key difference between a healthy excessive behavior and an addiction is that healthy excessive behaviors add to life whereas addictions take away from it. Some argue that addictive use of the internet is only possible if all core criteria of addiction are met (e.g., salience, mood modification, tolerance, withdrawal, conflict, and relapse) [11]. On this basis, very few individuals meet all these core criteria for internet addiction.

1.2. Problematic internet use and comorbid mental health issues

Previous studies have reported a co-occurrence of PIU with various mental health issues including (among others) depressive symptoms [15–20], anxiety [14,21,22], social anxiety [23,24], anxious attachment [25,26], stress [27,28], sleep disorders [12,27,29], eating disorders [30,31,32], loneliness [19,29,33–38], and attention-deficit hyperactivity disorder (ADHD) [39,40]. A meta-analysis carried out examining PIU and comorbidities among Asians [41] reported that relationships with ADHD and anxiety were more prevalent among adolescents with PIU, and depression more prevalent among middle-aged adults with PIU. Positive associations have also been reported between PIU and impulse control disorder [42], compulsive buying [43], and compulsive sexual disorder [44].

1.3. Problematic internet use and sociodemographic variables

The findings regarding the gender covariates of PIU are inconsistent. There are some studies that have reported a higher risk of PIU among males [45–48], whereas others have reported a higher risk for females [42,49,50], and no differences across gender [51–53]. Other findings have been more nuanced. For instance, Dieris-Hirche et al. [54] reported that males have higher risk for PIU than females when there are comorbid conditions (e.g., depressive symptoms). Large-scale studies with higher quality data [55,56] tend to show that males spend more time online gaming and females spend more time online using social media. These findings may explain the discrepancies in gender use. In terms of age, many studies [54,57–59] have highlighted that younger users appear to be more prone to PIU.

1.4. Problematic internet use and well-being

In the literature, positive psychology proposes two approaches regarding the concept of psychological well-being (i.e., hedonic and eudaimonic). Hedonic well-being [60] has (i) an affective dimension which reflects individuals' subjective happiness or the affective balance between positive and negative emotions, and (ii) a cognitive dimension, which reflects the extent to which individuals are satisfied with their lives. Eudaimonic well-being [61] reflects what good life means, that is, the extent to which individuals activate their own resources, and abilities to (i) live a meaningful life, (ii) fulfil their goals, (iii) self-develop throughout their life, (iv) manage all the challenges in various contexts and roles, and (v) establish and maintain good relationships with others.

According to the model proposed by Ryff [62], eudaimonic

well-being has six components (i.e., self-acceptance, autonomy, positive relations, environmental mastery, meaning in life, and personal growth). Also, in the eudaimonic approach, Diener et al. [63] propose the flourishing construct, that means good relationships, positive self-esteem, purpose in life, and optimism. In other words, eudaimonic well-being explains what the individual does to feel good, and hedonic well-being shows this state from an affective and cognitive point of view.

Regarding the relationship between PIU and well-being, there are inconsistent findings. For example, findings have indicated negative association between PIU and life satisfaction [64,65], happiness [66], quality of life [67], psychological quality of life [68], and health-related quality of life [58]. In contrast, a positive indirect relationship between PIU and well-being was reported during the COVID-19 pandemic [69] through mediating role of social compensation (i.e., one dimension of online socialization that means the extent to which online interactions compensate for offline issues in initiation and maintaining relationships). In addition, Montag et al. [69] reported a decreasing impact on well-being in the case of the other dimension of online socialization, that is, online displacement (the extent to which online relationships replace offline ones). Another study [70] highlighted no significant association between PIU and psychological quality of life, only for physical and social well-being. In two meta-analyses [71,72], a negative association between PIU and well-being (operationalized as self-esteem and life satisfaction) was reported. In a more recent systematic review and a meta-analysis [73,74], a significant association between PIU and lower quality of life was also reported.

1.5. Gaps in the literature, theoretical frameworks, and the present study

Based on the aforementioned literature, there are a number of gaps. First, there are only a few studies that have used a person-centered approach to identify levels of PIU risk using latent profile analysis (i.e., [49,53,75–80]). Moreover, various measures of PIU were used. For example, a German study [53] used the Compulsive Internet Use Scale [81] which only evaluates some criteria of PIU (i.e., loss of control, preoccupation with online activities, and mood change), but not all. The CIUS was developed based on the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) criteria for dependence and pathological gambling. Therefore, the measure does not include all criteria for behavioral addiction in the literature. More specifically, this scale did not include the tolerance criterion. The authors said that 'tolerance appeared not to be typical for compulsive internet, neither in the cases described in literature nor in [their] own qualitative study' ([81], p. 22).

The other studies [49,75–79] used the 15-item Internet Disorder Scale (IDS-15; [77]), which is a scale developed using the DSM-5 criteria for internet gaming disorder (2013) and includes all six core criteria of behavioral addiction [11]. Most of them were conducted using Asian populations (Chinese, Iranian, Turkish) and all reported a three-profile membership for PIU. The remaining others were conducted in Italian [76] and German [53] culture. The study of Pontes and Griffiths [77] was conducted on a sample including US, Indian, and UK participants. The study in Italy reported a four-profile membership for PIU, the German study reported six profiles, and Pontes and Griffiths' study, reported three profiles. These findings indicate that the classification of PIU (i.e., number of latent profiles or various subgroups identified) was different in various cultures. In addition, most studies were developed as aforementioned on Asian cultures (Chinese, Iranian, Turkish). To date, no previous study has been carried out in an Eastern European culture, therefore the present study fills this gap.

In all the previous studies, the profile indicators were the four dimensions of the IDS-15 (i.e., [1] escapism and dysfunctional emotional coping; [2] withdrawal symptoms; [3] impairments and dysfunctional self-regulation; [4] dysfunctional Internet-related self-control). Only one previous study [77] used all 15 items of the IDS-15 to identify PIU latent profile membership. The present study used the shortened nine-item version of the IDS (IDS-SF9) to examine the latent profiles

using the nine items as indicators.

Secondly, debatable aspects related to gender covariates of PIU still persist in the literature. As aforementioned, there are studies that have reported gender differences [49,82,83], or no differences (Chang & Law, 2008 [84]). Therefore, another aim of the present study was to examine gender alongside other sociodemographic variables (i.e., age, age of internet use initiation, and education) as covariates membership profiles of PIU.

Thirdly, existing findings based on a variable-centered approach have highlighted strong positive associations between high stress levels and PIU among adolescents [85,86], college students [87,88], and adults [89–91]. Therefore, the present study used a person-centered approach to examine whether stress is an antecedent of various subgroups or latent profiles of PIU. Fourthly, to the best of the present authors' knowledge, no previous studies have analyzed both types of well-being (i.e., hedonic and eudaimonic well-being) as outcomes of latent profiles of PIU. Therefore, the present study fills this gap in the literature. Previous studies [92] reported that hedonic well-being is more volatile and that eudaimonic more stable. Therefore, the present study explored whether the outcomes of latent profiles are both types of well-being or just hedonic or eudaimonic.

The theoretical framing of this research includes the addiction components model [11] and the model of compensatory internet use [93]. According to this model, when individuals suffer from particular life difficulties or psychosocial problems, they use the internet to alleviate negative feelings or to compensate for what is unsatisfactory in their lives. The pre-existence of such problems, as well as compensatory motivation increases the risk of negative outcomes. Similarly, the gratification hypothesis (Chen et al., [94]) underlines that the virtual environment will be accessed intensively by individuals because such immersion allows insecurities, dissatisfactions, and fears, or the relationship with others to be less salient (at least temporarily). In these situations, addictive use of the internet is a defensive mechanism in the context of negative emotions and stress rather than a coping mechanism.

To recap, the purpose of the present study was to explore: (i) various latent profiles of PIU risk by applying the IDS-9SF items as indicators [77] (ii) sociodemographic variables (i.e., age, gender, age of internet use initiation, and education); as covariates of PIU risk profiles; (iii) stress as an antecedent of PIU risk profiles; and (iv) both hedonic and eudaimonic well-being as outcomes of PIU risk profiles.

2. Methods

2.1. Participants and procedure

The sample comprised 1202 participants (516 males), aged 19–59 years ($M_{age} = 29.24$ years, $SD \pm 9.40$). Their highest reported education levels were high-school (28.9 %), bachelor's degree (39.4 %), master's degree (29.8 %), and doctoral degree (1.9 %). A convenience sampling strategy including snowball sampling was used. To recruit volunteer participants, a link to an online survey was shared via social networking sites, e-mail campaigns, and WhatsApp. The survey took approximately 20 min to complete. Information was provided regarding the purpose of the research on the first page, and informed consent was received from all participants. It was specified that individuals could withdraw from the study at any stage without any explanation for the decision. All data were collected anonymously, from January–March 2023. To successfully submit the survey, all questions needed to be answered. Therefore, there were no missing data.

2.2. Ethics

All research procedures applied were in accordance with the ethical standards of the committee on human research. The present study adhered to the tenets of the Helsinki Declaration of 1975 as revised in 2000. Research approval was received from the university ethics

committee of the corresponding author.

2.3. Measures

Various sociodemographic data were collected including gender, age, education level, and age of internet use initiation. A number of psychometric tests were used to assess the remaining study variables (described below). For those instruments without a Romanian version, the adapted versions followed the recommended forward-backward translation procedures described by Sousa and Rojjanasrirat [95].

Problematic internet use was assessed using the nine-item Internet Disorder Scale Short-Form (IDS9-SF; [83]). The IDS9-SF was developed based on the DSM-5 criteria for IGD [5]. All of these criteria map onto the six core characteristics of addiction, namely salience, mood modification, tolerance, withdrawal, conflict, and relapse [11]. Items (e.g., "Have you jeopardized or lost an important relationship, career or an educational opportunity because of your online usage?") are rated on a five-point scale from 1 (*never*) to 5 (*very often*). Higher scores indicate higher risk of disordered internet use. The authors of this scale [83] emphasized that endorsement of five or more of the nine items based on the answer "very often" should be used to differentiate between likely-disordered and non-disordered cases. The IDS9-SF had good psychometric properties in the present study in terms of construct validity. More specifically, confirmatory factor analysis (CFA) showed good model fit to the data: $\chi^2 = 38.07$, $df = 9$, $p < 0.001$, comparative fit index (CFI) = 0.92, Tucker-Lewis index (TLI) = 0.90, root mean square of approximation (RMSEA) = 0.07, 90 % CI [0.06; 0.08], and standardized root mean square residual (SRMR) = 0.04. The IDS9-SF had good internal consistency (i.e., McDonald's $\omega = 0.85$).

Stress was assessed using the four-item Perceived Stress Scale (PSS-4; Cohen et al., [96]). It includes two positively worded items (e.g., "In the last month, how often have you felt confident about your ability to handle your personal problems?") and two negatively worded (e.g., "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?"). The items are rated on a four-point Likert scale, ranging from 0 (*never*) to 3 (*often*). The positively items are reversed and the higher total scores indicate a higher level of perceived stress. The PSS-4 had good psychometric properties in the present study in terms of construct validity. CFA showed good model fit to the data: $\chi^2 = 38.07$, $df = 9$, $p < 0.001$, CFI = 0.98, TLI = 0.96, RMSEA = 0.06, 90 % CI (0.04-0.09), and SRMR = 0.02. The PSS-4 had good internal consistency (i.e., McDonald's $\omega = 0.84$).

Happiness was assessed using the three positively worded items (e.g., "I felt happy") included in the six-item Short Depression-Happiness Scale (SDHS; Joseph et al., 2004 [97]; Romanian version; [98]). It evaluates the frequency of some mood states during the past week. The total score of items assessing happiness ranges from 0 to 9, and a higher score indicates a higher level of happiness. McDonald's ω for the three happiness items obtained in the present study was 0.84.

Life satisfaction was assessed using the five-item Satisfaction with Life Scale (SWLS; Diener et al., [99]). Items (e.g., "In most way my life includes my ideal") are scored from 1 (*strongly disagree*) to 7 (*strongly agree*). The total score ranges from 1 to 35, and a higher score indicates a higher level of life satisfaction. The SWLS had good psychometric properties in the present study in terms of construct validity. CFA showed good model fit to the data: $\chi^2 = 1.34$, $df = 5$, $p < 0.001$, CFI = 0.98, TLI = 0.96, RMSEA = 0.07, 90 % CI (0.05-0.09), and SRMR = 0.01. The SWLS had good internal consistency (i.e., McDonald's $\omega = 0.87$).

Eudaimonic well-being was assessed using the eight-item Flourishing Scale (FS; Diener et al., 2010). Items (e.g., "In most way my life includes my ideal") are scored from 1 (*strongly disagree*) to 7 (*strongly agree*). The total score ranges from 7 to 56, and a higher score indicates a person has many strengths and psychological resources. The authors of this scale reported its unidimensionality and in the present sample the single-factor structure was satisfactory. More specifically, $\chi^2 = 24.07$, $df = 8$, $p < 0.001$, CFI = 0.91, TLI = 0.86, RMSEA = 0.10, 90 % CI (0.09;

0.11), and SRMR = 0.08. The results also showed that the bi-factor second order adapted version of the FS had more psychometric robustness. Therefore, this model had a good fit to the data: $\chi^2 = 18.07$, $df = 8$, $p < 0.001$, CFI = 0.94, TLI = 0.91, RMSEA = 0.08, 90 % CI (0.07; 0.09), and SRMR = 0.06. Taking into account that some items cross-loaded both factors, it was theoretically justified to perform a bi-factor exploratory structural equation modelling (ESEM) analysis. The results of bi-factor ESEM proved a very good fit to the data: $\chi^2 = 13.07$, $df = 8$, $p < 0.001$, CFI = 0.99, TLI = 0.96, RMSEA = 0.06, 90 % CI (0.05; 0.08), and SRMR = 0.02. The FS had good internal consistency (McDonald's $\omega = 0.89$).

2.4. Data analysis

Data analysis was performed using Mplus 8.8 (2022). Descriptive statistics of the sample characteristics in terms of age, number of years using the internet, gender, and educational level were computed depending on the PIU levels. Statistical analysis performed in the person-centered approach included: (i) PIU latent profiles identification, (ii) antecedents, and (iii) outcomes of the profile membership. More specifically, LPA was conducted to identify sets of latent profiles using the items of the IDS-9SF as continuous indicator variables. In order to handle non-normally distributed data, the robust maximum likelihood (RML) estimator was used, since it produces robust standard errors. Models with 2–5 classes were considered.

A study on taxometric analyses in the case of LPA [100] reported that LPA must be conducted on a sample size of at least 500 in order to have sufficient statistical power for the correct identification of the model (i.e., to capture the correct distance between the latent profiles). The present study more than satisfied this requirement (i.e., sample size of 1202 participants). In addition, all the techniques recommended in the literature were used for choosing the true number of latent profiles (i.e., information-theoretic methods, likelihood ratio statistical test methods, and entropy-based criterion).

Various information criteria (Morin et al., 2016) were applied to make the optimal model selection: log likelihood (LL), Akaike information criterion (AIC), Bayesian information criterion, sample size adjusted BIC (SSA-BIC), and entropy (R^2). Lower values for the AIC, BIC, and SSA-BIC show a better balance between model fit and parsimony while higher values for R^2 (i.e., >0.80) prove better classification utility as well profile separation. A supplementary comparison test, that is, bootstrap likelihood ratio test (BLRT) was conducted to provide evidence for the optimal model selection. As recommended in the literature (McLachlan & Peel, 2000 [101]) statistically significant test result ($p < 0.05$) indicates that the model with k profiles fits the data better than the model with one latent profile less, that is, $k-1$ profiles. In order to check if age, gender, and number of years of internet use were covariates of the latent profiles, the R3STEP procedure was applied. In addition, the role of stress as antecedent of the latent profiles was verified, using the same procedure. The BCH approach (Asparouhov & Muthén, 2015 [102]), considered as optimal technique to analyze distal outcomes in LPA, was applied to verify if profile membership predicted hedonic and eudaimonic well-being. An overall test was carried out to see whether there were significant differences among all latent profiles. In addition, pairwise difference tests were computed to emphasize whether hedonic and eudaimonic well-being were significantly different between any two profiles.

3. Results

3.1. Descriptive statistics

The sociodemographic characteristics of participants, i.e., gender, age, age of internet use initiation, internet use frequency, and education are shown in Appendix. Descriptive statistics in terms of means, standard deviations, skewness, and kurtosis of research variables are

provided in Table 1. Univariate normality was obtained (as shown in Table 1) in the case of the global scores of research variables, except well-being whose score was slightly negatively skewed.

3.2. Latent profile analysis of problematic internet use

Various LPA models including 2-profile to 5-profile solutions were checked in terms of fit statistics. As shown in Table 2, gradual improvement was observed up to the 4-profile solution and the 5-solution diminished the quality of the classification. Although some of the fit indicators (i.e., AIC, BIC, and SSA-BIC) had lowest values for the 5-profile solution, the entropy was lower than the previous one (i.e., the 4-profile solution). Moreover, in the 4-profile model, the average latent profile probabilities for the most likely profile membership were: 0.93, 0.93, 0.95, and 0.96. All were well above the cutoff (>0.80) recommended by Watson et al. [103] and higher than those characteristics compared to the 5-profile solution. Therefore, the results provided support for the 4-profile solution as the best fitting model to the present study's data.

3.3. Four-profile model of problematic internet use

The best fitting (4-profile) model of PIU is depicted in Fig. 1. This is based on within-profile item means obtained for each indicator of profile membership, more specifically each item of the IDS9-SF. Parameter estimates for within-profile item means for the four-profile model, are shown in Table 3.

As can be seen, the first profile 'Low risk of PIU' comprised 56.4 % of participants and was characterized by very low scores of all items, with the exception of Item 1 (salience or preoccupation) which had a moderate mean (i.e., >3 out of 5). It should be noted that all scored items in the first profile were less than those obtained in all the other profiles. The second profile 'Medium risk of PIU with moderately-high psychosocial impairments' comprised 9.1 % of participants and was defined by Item 1 (preoccupation or salience), Item 8 (escapism and mood modification), and Item 9 (jeopardizing or losing a significant relationship, job, or educational or career opportunity) which had moderate values (i.e., >3 out of 5). The remaining items (Items 2 to 7) had low scores (i.e., <3 out of 5). The third profile 'Medium risk of PIU with poor internet-related self-control' comprised 27.4 % of participants and was depicted by the highest mean (i.e., 4.09 out of 5) on Item 1 (salience criterion), moderate means for four items (>3 out of 5 on Items 2, 3, 4 and 8), and low means (<3 out of 5) on Items 5, 6, and 7. The lowest mean (<2 out of 5) was obtained on Item 9 (jeopardizing or losing a significant relationship, job, or educational or career opportunity). The fourth and last profile 'High-risk of PIU' comprised 7.1 % of participants indicated by very high values (i.e., >4 out of 5) of Item 1 (preoccupation) and Item 8 (escapism and mood modification), and very close to 4 (out of 5) in the case of Item 9 (jeopardizing an important relationship, or losing a job, educational or career opportunity). All the other items had means higher than 3.5 (out of 5). It should also be noted that Item 1 had means higher than 3 (out of 5) across all four profiles. In sum, the results demonstrated a simultaneously increased pattern of all profile's indicators (as can be

Table 1

Descriptive statistics of the research variables (mean, SD, skewness, kurtosis).

Variable	Mean	SD	Skewness (Std Error of Skewness)	Kurtosis (Std Error of Kurtosis)
PIU	20.99	7.23	0.556 (0.071)	-0.228 (0.141)
Stress	10.34	3.32	0.251 (0.071)	-0.309 (0.141)
Life satisfaction	25.85	6.04	-0.605 (0.071)	-0.192 (0.141)
Happiness	11.71	2.62	-0.438 (0.071)	-0.591 (0.141)
Eudaimonic WB	45.42	7.93	-1.002 (0.071)	1.073 (0.141)

Abbreviation: PIU: problematic internet use; WB: well-being.

Table 2
Model fit information for latent profile analysis of problematic internet use.

No. of profiles	Free parameters	LL	AIC	BIC	SSA-BIC	R ²	BLRT/p
2	28	1.23	31384.01	31526.58	31437.64	0.87	-17086.29/.001
3	38	1.48	30783.63	30977.12	30856.41	0.82	-15664.00/.001
4	48	1.30	30401.96	30646.36	30493.90	0.91	-15353.81/.001
5	58	1.35	30028.34	30323.67	30139.43	0.88	-15152.98/.001

Note: bold indicates best fitted model. LL = log likelihood; AIC = Akaike information criterion. BIC = Bayesian information criterion; SSA-BIC = sample size adjusted BIC; R² = entropy. BLRT = bootstrapped likelihood ratio test.

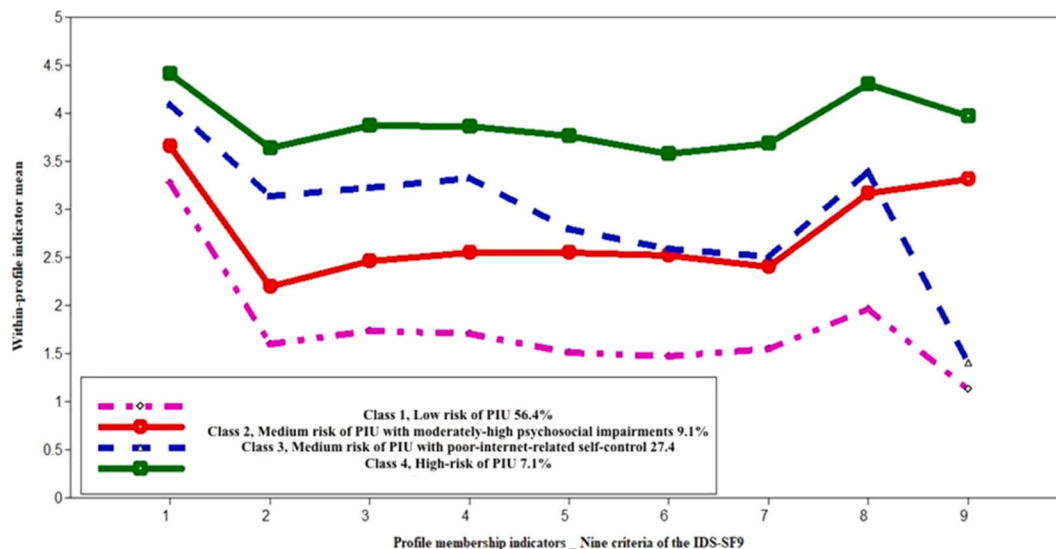


Fig. 1. Parameter estimates for the four-profile model of risk of PIU and within-profile item means.

Table 3
Parameter estimates for the four-profile model.

Profile prevalence	Profile 1 n = 678	Profile 2 n = 109	Profile 3 n = 330	Profile 4 n = 85
Profile indicators	Within-profile means estimate (SE)			
PIU 1	3.27 (0.04)	3.65 (0.11)	4.09 (0.06)	4.41(0.10)
PIU 2	1.59 (0.03)	2.19 (0.14)	3.14 (0.07)	3.63 (0.12)
PIU 3	1.74 (0.03)	2.45 (0.12)	3.22 (0.07)	3.87 (0.14)
PIU 4	1.71 (0.04)	2.55 (0.14)	3.32 (0.07)	3.86 (0.15)
PIU 5	1.50 (0.03)	2.54 (0.13)	2.79 (0.08)	3.76 (0.15)
PIU 6	1.47 (0.03)	2.52 (0.11)	2.58 (0.07)	3.58 (0.19)
PIU 7	1.54 (0.04)	2.40 (0.18)	2.50 (0.08)	3.69 (0.15)
PIU 8	1.96 (0.04)	3.17 (0.15)	3.39 (0.09)	4.30 (0.09)
PIU 9	1.13 (0.01)	3.31 (0.09)	1.40 (0.03)	3.97 (0.13)

Note: SE: standard error; PIU: problematic internet use.

seen in Table 3) except Item 9 (jeopardizing or losing a significant relationship, job, or educational or career opportunity), which recorded in the third profile a lower level than the second profile.

3.4. Sociodemographic variable as covariates of PIU latent profiles

Starting with the ‘Low risk of PIU’ profile as the reference group, the logistic regression results showed that age of internet use initiation was not an antecedent of problematic internet use profiles. Although there were increases of odds ratios in all other profiles compared to the reference group, these differences were not statistically significant because the lower limits had values lower than 1 (i.e., between 0.75 and 0.95). A similar pattern emerged in the case of education level (as shown in Table 4).

Regarding participant age, the results highlighted that this was a

Table 4
Effects of predictors on membership in latent profiles of PIU.

PIU risk profile membership	Odds ratio (OR)	Lower limit 2.5 %	Upper limit 2.5 %
Reference profile: Low risk of PIU			
Medium risk of PIU with moderately-high psychosocial impairments			
Age of internet use initiation	1.01	0.75	1.16
Age	1.59	1.21	2.08
Gender	1.05	0.83	1.19
Education	0.73	0.57	0.95
Medium risk of PIU with poor internet-related self-control			
Age of internet use initiation	1.04	0.82	1.23
Age	1.86^a	1.50	2.29
Gender	1.17	0.93	1.28
Education	0.88	0.68	1.14
High-risk of PIU			
Age of internet use initiation	1.14	0.95	1.29
Age	2.22^a	1.51	3.29
Gender	0.93	0.75	1.12
Education	1.05	0.89	1.25

Odds ratios (OR), 95 % confidence interval for the effects of age at internet use began, age, and gender on profile membership.

^a p < .001.

covariate of profile membership. As can be seen in Table 4, the odds ratio increased in each profile (OR > 1) compared to the reference group and reached the threshold of statistical significance. Therefore, young internet users had a higher risk of becoming problematic users compared to adults. However, gender had no significant contribution to problematic internet use profiles, since the OR was >1 and a lower limit of

the confidence interval was <1 in the second profile, as well as an OR < 1 and lower limit <1 in the third profile.

3.5. Stress as antecedent of PIU latent profiles

The logistic regression results showed that stress (as mentioned in Table 4) had a significant contribution to the profile membership. More specifically, OR significantly increased in each profile ($OR > 1; p < 0.01$) in comparison with the reference group (i.e., low risk of PIU profile).

3.5.1. Hedonic and eudaimonic well-being as outcomes of PIU latent profiles

The results of overall likelihood ratio tests conducted (see Table 5) showed highly significant Wald's χ^2 , which means that PIU profile membership was significantly related to hedonic well-being (i.e., happiness and life satisfaction) and eudaimonic well-being (i.e., flourishing). Pairwise comparisons showed that participants in the 'Low risk of PIU' profile were most happy, satisfied with their life, and recorded highest scores on eudaimonic well-being than participants in the other three profiles. An interesting pattern emerged because no significant differences were found between 'Medium risk of PIU with moderately-high psychosocial impairments' and 'High-risk of PIU' profile. There were no differences in the two indicators of hedonic well-being (i.e., happiness and life satisfaction) or for eudaimonic well-being.

4. Discussion

The present study explored latent internet use profiles using all items of IDS9-SF as indicators. Based on the person-centered approach, the results indicated that (i) younger internet users with high levels of perceived stress had higher risk of PIU and (ii) PIU profile membership served as a predictor for both types of well-being (i.e., hedonic and eudaimonic). Four different profiles emerged, from low-risk to high-risk of PIU.

In the 'Low risk of PIU' profile, apart from the first criterion (pre-occupation with online behavior) whose mean was slightly above moderate level (i.e., 3 out of 5), all the other criteria had very low values. Therefore, participants included in this profile had low-risk of developing maladaptive use, although the preoccupation criterion was higher than all others. The fact that this criterion is above average in this profile is not at all surprising considering the increased reliance in being online in contemporary society. Therefore, this single criterion with moderate value is not concerning because, as Griffiths [13] explained, it is not the intensive use of the internet that is maladaptive, but only when psychological functioning is impaired.

The second profile ('Medium risk of PIU with moderately-high psychosocial impairments') was typified by moderate scores on three criteria (i.e., preoccupation, escapism/relieving dysphoric mood, and jeopardizing important relationships or losing career and/or education opportunities). In addition, the psychosocial impairment criterion had a value almost three times higher than both first and third profiles.

The third profile ('Medium risk of PIU with poor internet-related self-control') had the highest scores on five criteria (i.e., preoccupation, withdrawal, tolerance, self-control, escapism and relieving dysphoric mood). As aforementioned, Item 9's mean value (jeopardizing important relationships or losing career and/or education opportunities) was lower

than the second profile and similar to the first profile, since their distinctive feature was poor self-control, not psychosocial impairments. To some extent, the present study's results parallel the findings of Pontes and Griffiths [83] because they reported the participants belonging to the medium risk profile scored markedly high on the 'Escapism and dysfunctional emotional coping' dimension. The present study's results showed that escapism or dysphoric mood relief was the criterion with the highest scores in both medium risk profiles. In slight contrast to the study by Pontes and Griffiths [83] who reported one medium PIU risk profile, the present study identified two medium PIU risk profiles which were different in terms of the risk indicators (i.e., one characterized by psychosocial impairments and the other characterized by poor internet-related self-control). Once again, these results emphasized the advantages of the person-centered-approach, which allowed the highlighting of significant differences, despite the fact that the total PIU mean scores were relatively similar (i.e., medium level).

The high-risk of PIU profile comprised participants with the highest scores on all criteria. Therefore, participants here markedly exhibited more internet-related problems than previous profiles, since two criteria scored higher than 4 (out of 5) and all other higher than 3 (out of 5) criteria scored. This pattern is similar to previous studies [49,83].

In terms of number of latent profiles, the present study's results align with only one previous study [76] which also reported four latent risk profiles of PIU among Italian participants, but with a gradual increase in the risk of PIU (i.e., low risk, medium risk, high-risk, and very high-risk). Moreover, in addition to the previous studies, the very high-risk profile only appeared in the study by Monacis et al. [76]. The authors explained that the fourth profile emerged possibly because some of their participants were addicted gamers.

Regarding the sociodemographic variables as antecedents of the internet use profiles, the results confirmed that age (but not gender) was a significant antecedent of PIU profile membership. As aforementioned, using gender as covariate was theoretically justified, considering the inconsistent findings regarding female or male proneness in developing PIU. The present study's findings are in line with the previous research which has reported that males and females are equally distributed depending on their risk of PIU [51–53,76]. However, males and females appear to engage in different online activities [3] with males preferring online gaming to social media use and vice-versa for females (Andreassen et al., [104]).

In terms of age, the results concur with previous studies that PIU is more prevalent among younger people (e.g., Ref. [54,57–59]). It is not surprising that some young internet users have a higher spectrum of risk of PIU. It is well-known that 'screenagers' or 'digital natives' [13] are highly immersed in the internet medium, since they often use technology-based communication to meet new people, expand their social capital (Allen et al., [105]), maintain friendship communication, keep up-to-date with the news, entertainment, gaming, and to meet romantic partners [106, 107]. Beyond these, for a minority of users (irrespective of age), the potential satisfaction specific to the initial use turns into maladaptive use. This can be explained by various intra-individual and psychosocial factors (and in accord with extant theories [93,108,109]). This minority of users at high-risk of PIU includes younger aged internet users who are omnipresent online and have a tendency to use excessive immersion to escape from stressors and difficulties encountered in their life or to compensate unmet needs in

Table 5
Means and differences between outcomes of internet use profiles – happiness, life satisfaction (hedonic well-being) and eudaimonic well-being.

Outcomes of latent profiles	Profile 1 Mean (SE)	Profile 2 Mean (SE)	Profile 3 Mean (SE)	Profile 4 Mean (SE)	Overall test Wald's χ^2	Pairwise comparison
Happiness	12.32(0.09)	10.81(0.26)	11.16(0.16)	10.05(0.29)	93.29 ^a	1 > 2; 1 > 3; 1 > 4; 2 = 4
Life satisfaction	27.12(0.21)	23.50(0.61)	25.00(0.37)	22.03(0.73)	81.72 ^a	1 > 2; 1 > 3>4; 2 = 4
Eudaimonic WB	47.62(0.29)	41.51(0.86)	43.63(0.45)	39.82(0.88)	127.01 ^a	1 > 2; 1 > 3>4; 2 = 4

^a $p < .001$.

real life.

The other variable investigated in the present study (i.e., age of internet use initiation) did not have any significant impact on internet use profile membership. This may seem counter-intuitive since some of the participants who started using the internet from early childhood would theoretically have a higher risk of maladaptive use than those who started later (because their self-regulation skills would not be sufficiently developed to be able to delay gratification need and control time spent in online communication). However, given that there was no significant relationship, other variables than those investigated in the present study (i.e., intra-individual and/or psychosocial factors) may mediate or moderate the relationship between age of internet use initiation and risk for PIU.

The present study found that education level was not associated with PIU risk which is contrary to prior research (e.g., Ref. [110–112]). Previous studies have been conducted in Asian cultures, and the explanation given for the association between PIU and high education level was the intensive use of the internet for academic and professional purposes by those with higher education levels. It is doubtful that occupational and/or educational intensive use is the cause of maladaptive use because it is well-established that it is not time spent online that is the problem. Risk factors for PIU are more likely to be the unsatisfied psychological needs or specific personality traits or pre-existing pathologies such as childhood trauma [113], hyperactivity [114], extreme loneliness, and/or depression [115,116].

In addition to the age covariate of profile membership, the present study's findings indicated that perceived stress was antecedent of PIU latent profiles, since more participants with higher levels of stress were included in the high-risk internet use group. These results concur with previous studies using a variable-centered approach (e.g., Dong & Potenza, 2014 [117]; Gong et al., [118]) which have shown that unmanageable stressors are associated with maladaptive use of PIU. Those individuals who have the subjective perception of being overwhelmed by stress have a greater tendency to take refuge in online activities. Considering compensation theory [93] and the I-PACE model (Interaction-Person-Affect-Cognition-Execution model) [108], stress would be an antecedent to PIU, given that addictive behavior is a form of compensation to negate stressful experiences.

The present study's findings also demonstrated that latent PIU risk profiles had both types of well-being as outcomes. Given the inconsistent findings related to association between maladaptive internet use and well-being, the present study found a significant difference in hedonic and eudaimonic well-being of participants included in the 'high-risk of PIU' profile and those from 'low-risk of PIU', as well 'medium risk of PIU with poor internet-related self-control' profiles. These results concur with those using a variable-centered approach that have highlighted a negative association between PIU and (i) cognitive dimension of hedonic well-being (i.e., life satisfaction) [64], (ii) quality of life [67], (iii) psychological quality of life [68], and (iv) well-being [69].

As aforementioned, an interesting pattern emerged from the pairwise comparisons analysis of second profile 'Medium risk of PIU with psychosocial impairments' with the fourth profile 'high-risk of PIU'. More specifically, there were no statistically significant differences in terms of hedonic and eudaimonic well-being. That is, in both profiles, the internet users were more unhappy and less satisfied with their lives (hedonic well-being), having a low confidence in their ability to activate their potential and resources to accomplish their purposes and live a good and meaningful life (eudaimonic well-being). The above average score (i.e., >3 out of 5) obtained by internet users in second profile on Item 9 shows that they had jeopardized or lost important relationships, career or educational opportunities because of their internet use. All of these are closely related to at least three dimensions of eudaimonic well-being (i.e., positive relations, environmental mastery, and personal growth), but also to the cognitive component of hedonic well-being (i.e., life satisfaction). These results agree with extant theories in positive psychology [62]. Losing career opportunities because of maladaptive

internet use can lead to negative feeling toward self, such as self-blame and self-doubt, which in turn contribute to low self-esteem and poor self-efficacy. These are closely related to one dimension of well-being, namely self-acceptance [62]. Therefore, it is not surprising that those in the second profile (medium PIU risk with moderately-high psychosocial impairments) had low levels of both hedonic and eudaimonic well-being as those in the fourth profile (high-risk of PIU). In addition, those individuals in the second profile were less happy and satisfied with life than participants from the other profile with a moderate risk of PIU (who had poor internet-related self-control). This appears plausible because Criterion 9 (i.e., jeopardizing or losing a significant relationship, job or education/career opportunities because of internet use) has links with three dimensions of well-being, i.e., positive relationships, personal growth, and meaning or purpose in life).

4.1. Theoretical contributions

The first strength of the present study is the contribution to the paucity of research examining the relationship between PIU and well-being using a person centered approach because most previous research has tended to use a variable-centered approach. LPA used in the present study captured the heterogeneity and diversity of internet users and their online activities, and showed distinct patterns and latent profiles of PIU. Therefore, it was possible to explore the way in which data were clustered according to various levels of internet use, as well as the antecedents and outcomes of the identified membership profiles. Consequently, criteria with highest mean in each latent profile were identified. For instance, in the high-risk profile, criteria such as preoccupation, escape/relieving dysphoric emotions, and jeopardizing relationships, education and/or occupation because of maladaptive internet use had the highest scores.

A second strength is that the present study is among the few in a Latin-speaking culture (to the authors' knowledge, only one previous study [76] was conducted in Latin-speaking culture [in Italy]), the others being either in English, German, Chinese, Persian, or Turkish samples. As expected, the results of the present study clustered (like the Italian study), into four latent profiles, unlike the other studies which reported three PIU risk profiles (English and Asian studies), or six PIU risk profiles (German study).

The third strength was the attempt to overcome the limitations of approaches in which well-being has been conceptualized in a reductionist manner, either through life satisfaction [119], or being conflated with various indicators of poor mental health (i.e., depression, loneliness or hopelessness [120,121]), by using theoretical framing promoted in positive psychology (i.e. hedonic and eudaimonic well-being [61–63]).

The fourth strength was the present study's findings extend the extant empirical body of literature on the topics of various PIU covariates in terms of gender, age, age of internet use initiation, as well as perceived stress as antecedent of profile membership.

4.2. Practical implications

The use of LPA in relation to PIU and its antecedents and outcomes also has benefits for practitioners. Firstly, it can help to enhance their awareness of the complex ways of association between PIU and the hedonic and eudaimonic well-being of their clients. Secondly, it gives empirical support to help tailor more effective and targeted prevention strategies and interventions for PIU, such as cognitive-behavioral therapy and motivational interviewing. Such interventions must take into account that the criteria with the highest scores obtained by the participants included (i) in the 'high-risk of PIU' profile are total preoccupation with internet use (salience), escapism and relieving dysphoric emotions (mood modification), and jeopardizing interpersonal relationships and losing education or career opportunities (conflict); (ii) in the 'medium risk of PIU with poor internet-related self-control', total

preoccupation with internet use (salience), escapism and relieving dysphoric emotions (mood modification); and (iii) in the ‘medium risk of PIU with moderately-high psychosocial impairments’ profile, ‘total preoccupation with internet use’ (salience) and ‘jeopardizing interpersonal relationships and losing education or career opportunities’ (conflict). Thirdly, understanding the association between PIU and well-being has clinical utility in that practitioners can use eudaimonic and hedonic measures to assess the progress of therapeutic interventions.

4.3. Limitations and future research directions

The present study has a number of limitations. Because it used a convenience sample and a cross-sectional design, the findings cannot necessarily be generalizable, and it was unable to establish any causal relationships. Moreover, the use of self-report measures has several biases related to social desirability and memory recall. Future studies using representative samples and designs that could determine causal factors between PIU, stress, and well-being would provide complementary evidence to the findings reported here. More specifically, experimental or longitudinal studies, especially latent transition analysis and time series would be very useful to overcome the limits of cross-sectional design, as well to explore both the direction of the relationships between PIU and stress, as well PIU and well-being. In other words, further research exploring the trajectories of risk and protective factors regarding PIU is needed. Also, the present study did not examine supplementary aspects of internet use, such as the most used online functions (e.g., social networking, gaming). Therefore, it is perhaps unsurprising that the findings demonstrated no gender differences in profile membership. Therefore, future research must take into account various functions of internet use as additional indicators of PIU latent

profiles in order to obtain a more comprehensive picture of various homogeneous subgroups or PIU latent profiles, as well deepen understanding of their impact on hedonic and eudaimonic well-being. Cross-cultural research could also provide more insights concerning dilemmatic aspects related to the socio-demographic covariates of PIU.

5. Conclusion

Although internet communication is already several decades old, it is still necessary to evaluate its impact on individuals’ well-being. Considering the ubiquity of the internet, as well as the fact that millennials have grown up in a hyper-digitalized world, empirical research is needed to understand this relationship and prevent maladaptive use of online technologies. The present study provided evidence using latent profile analysis that younger internet users with high levels of perceived stress have a higher risk of PIU. In addition, maladaptive internet use appears to be a predictor for low levels of both types of well-being (i.e., hedonic and eudaimonic well-being). Early identification and intervention to prevent problematic internet use may significantly improve the psychological and physical health of users.

CRediT authorship contribution statement

Elena Stănculescu: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. **Mark D. Griffiths:** Supervision, Writing – review & editing.

Data availability

Data will be made available on request.

Appendix

Sociodemographic variables		n (%)
Gender	Male	516 (42.9)
	Female	686 (57.1)
Age (years)	18–25	526 (43.8)
	26–35	395 (32.9)
	36–59	281 (23.3)
Age of internet use initiation	Before 6 years old	139 (11.6)
	Between 7 and 12 years old	482 (40.1)
	Between 13 and 17 years old	408 (33.9)
	After 18 years old	173 (14.4)
Time spent on internet (weekly)	Less than 7 h	104 (8.6)
	Between 8 and 14 h	212 (17.6)
	Between 15 and 20 h	125 (10.4)
	Between 21 and 30 h	209 (17.4)
	Between 31 and 40 h	167 (13.9)
	More than 40 h	387 (32.1)
Education	High-school	347 (28.9)
	Bachelor	474 (39.4)
	Master	358 (29.8)
	Doctorate	23 (1.9)

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