

Exploring the Relationship between Problematic Internet Use and Well-Being among Adolescents: The Mediating Role of Resilience, Self-control, Negative Mood, and Loneliness

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Abstract

The increase in the massive use of the internet use in recent years, especially among youth, has led to an increase in the phenomenon called Problematic Internet Use (PIU). Problematic internet use is defined as an excessive and disproportionate use of the internet, which may result in psychological, social, academic, and professional difficulties in one's life. PIU relates to an individual's inability to control internet use, which in turn leads to feelings of distress, anguish, and difficulties in daily activities. The problematic usage of the internet among adolescents has become an emerging mental health issue, and little is known about the nexus of relationships between problematic usage of the internet and the sense of well-being among youth. Thus, the current study aimed at examining the mediating role of four social-emotional variables in these relationships: resilience, self-control, negative mood, and loneliness. Data of 433 adolescents high school students (aged between 12 to 17, 219 [50.6%] boys and 214 [49.4%] girls) were analyzed using a Structural Equation Modeling (SEM). The analysis have revealed the following significant results: Among adolescents, low levels of resilience and high levels of negative mood (together), as well as low levels of self-control and high levels of negative mood (together) and low levels of resilience and high levels of loneliness, mediate these relationships. The findings indicate that high levels of PIU predict low levels of well-being. Girls were found to be higher in PIU, have more computer skills, and have more resilience than boys. The study results expose specific implications for intervention programs for adolescents in the context of PIU.

Keywords: PIU• Well-being• Resilience• Self-control• Negative mood• Loneliness

Introduction

Problematic internet use and well-being

Problematic Internet Use (PIU) is defined as an excessive use of the internet that results in negative outcomes; an overuse of the internet that may lead to psychological, social, academic, and/or professional struggles [1,2] resulting from massive increase in Internet usage during the last decade. The research literature addresses this phenomenon as a multidimensional syndrome that could be characterized by the individual's inability to control internet use, which in turn leads to feelings of distress, anguish, and difficulties in daily activities [1-3]. In other words, PIU refers to the inability to control one's Internet use, which over time involves psychological, social, academic, and occupational problems in life.

A problematic behavior can take different forms and is not homogeneous [4,5]. Lopez-Fernandez [6] adds that compared to

"pathological addiction" the term "problematic" describes the behavior in a broader way and, address greater flexibility and clinical value when contemplating a severity continuum regarding excessive internet use, allowing mental health agents to better understand the form and intensity of PIU's potential effect on troubled users' lives. Similarly, according to Tokunaga, PIU is not seen as a pathology or clinical disturbance but rather as a distinct pattern of cognitions and behaviors that prime negative results in daily life. Tokunaga states that PIU is situated in the middle range of the severity in the continuum of the problem and has a benign nature, whereas internet addiction is at the upper end of the continuum, requiring the experience of serious negative life consequences [7].

PIU can be defined as specific or generalized. Specific PIU refers to the excessive use of specific features of internet content, such as online gaming, online viewing of sexual videos, and more, whereas generalized PIU relates to non-specific and multidimensional internet use that results in negative consequences for the individual. Generalized PIU manifestations include cognitions and maladaptive behaviors related to non-specific internet use. In other words, the internet is, in these cases, used as a multipurpose vehicle [6]. The positive responses resulting from being online reinforce the individual's behavior, thus increasing the probability of a new occurrences. Once reinforcement occurs, the person will repeat the action more frequently to achieve this response, resulting in a decrease of the individual sense of well-being.

Caplan notify that individuals with low social competences prefer to establish online social interactions rather than traditional face-to-face interactions [8]. This preference may lead them to self-regulate in a deficient way when using the internet (through increased cognitive concern about being online and using the internet compulsively) and when using the internet to regulate mood (which, in turn, will increase deficient self-regulation). This deficient self-regulation will ultimately reveal negative consequences at many levels of the individual's life (e.g., social, emotional, academic/work, family).

Regarding the sources of the phenomenon, studies have drawn attention to compensatory mechanisms that may lead individuals to use the internet to cope with their initial psychosocial problems. Research has suggested that PIU often functions as an emotion-regulation strategy that helps individuals handle the effects of experiencing aggression and hostility and to escape from a hectic or stressful reality [9,10] exemplify a developmental point of view. They state that the critical time period to develop PIU is during adolescence, when ambiguity and confusion regarding one's own identity is relatively high, and that during adolescence, PIU is not attributed exclusively to the individual's characteristics, but also to the challenges and factors of adolescence and the relationships formed between individuals and their contexts over time.

The problematic usage of the internet among adolescents has become an emerging mental health issue in recent years and the prevalence of adolescents' PIU in Europe and the US increased during the last decade from 7.9% to 25.2% [11,12]. A large-scale sample of school-based adolescents in Spain (n=40,955) reported a 16.3% prevalence of PIU, higher among females and older adolescents [11]. Studies have reported various outcomes of PIU among teens: depression and loneliness, aggressive behavior, and social isolation [13,14].

Ehlers and Clark suggests [15] excessive internet use can help adolescents avoid emotions following distressful experiences, and that adolescent bullying victims may tend to "bury" themselves in the internet to forget the harm they experience in the reality. In addition, the easy use and high accessibility of the internet may relieve hard feelings that tend to accompany adolescents in general. PIU may serve as a maladaptive coping strategy for adolescents who cope with various stress encounters. The

virtual world may serve as a place to escape, and in turn, PIU may prime other emotions and decline in the subjective well-being.

Accordingly, the research literature indicates a decline in one's sense of well-being after overuse of the internet, as well as negative associations between PIU and subjective well-being [16,17] and comorbidities with many emotional problems, mood disturbances and low levels of self-control [18]. Yet, these findings are not unequivocal, in spite of study findings regarding the associations between PIU and poorer well-being, on the other hand, there are studies like Ellison, et al. [19] that have found a significant positive association between Facebook over-use and improved psychological well-being. Therefore, exploration of the role of social-emotional factors that mediate the relationship between PIU, and well-being is necessary. The research literature points to the need for a deeper understanding of the relationships between PIU and well-being in adolescence, and little is known about the social-emotional mediators in these relationships. Thus, the main aim of the current study was to explore the nexus between PIU and well-being among adolescents, we investigate these relationships through a Structural Equation Modeling (SEM) approach that enables us to examine a series of interrelated dependence relationships between the variables. Therefore, we examined the associations in-light of the social-emotional mediators: resilience, self-control, negative mood, and loneliness. In other words, the current study examined the potential mediation effect of four social-emotional factors in the relationship between PIU and psychological well-being among adolescents.

Problematic internet use, resilience, and self-control

Resilience and Self-control are both positive, protective factors in the examined relationship. Resilience relates to the ability to use mental processes and behaviors that protect the self from the negative impact of various stressors [20].

Resilience is the embodiment of the individual's qualities that enable him to thrive in the face of adversity [21] and to overcome the negative effects associated with risk exposure. It may be viewed as a measure of one's stress-coping ability for reducing negative psychological outcomes such as anxiety, depression, and other issues associated with negative experiences. Resilience may serve as a protective factor that moderate the relationship between risk exposure and a negative outcome, by either neutralizing the relationship between the two or weakening it. Resilience may have an immunization effect, especially in adolescence, when past negative experiences may help build resilience in experiencing future risk [22].

The literature points to the negative associations between resilience and PIU, and finds resilience reduces the negative psychological effects associated with PIU [23]. Studies indicate resilience may moderate the relationship between online risk exposure and negative affect, by reducing the effect of online risk exposure on negative affect. According to Robertson, Yan, and Rapoza, resilience is a strong protective factor for PIU [24,25], whereas high levels of resilience enable the individual to maintain normal physical and psychological functioning, so that resilient teens are more likely to respond to stress with adaptive and successful coping strategies, than prevent the harm to the sense of well-being.

Another explored variable as a mediator in the current study is self-control, namely, the ability to regulate one's emotions, thoughts, impulses, and behaviors that involves problem solving, planning, dependability, attentional control, and future-oriented time perspective. It is an executive function and cognitive process that serves to buffer certain behaviors and emotions, temptations, and impulses [26]. Previous studies have empirically shown PIU is characterized by high impulsivity and poor inhibitory control [27,28] and that self-control is negatively associated with high levels of PIU [29,10]. In addition, research in the Netherlands and in Korea indicates PIU is correlated with subclinical symptoms, such as high levels of aggression and low levels of self-control (in contrast to loss of control) and narcissism [30]. Moreover, research suggests higher self-control and resilience are negatively associated with PIU among adolescents [31].

Problematic internet use, negative (depressive) mood, and loneliness

Both negative mood and loneliness have a negative, risk factor in the examined relationships. Negative moods can direct people's behavior and have important implications for mental and physical well-being. They may last for hours, days, weeks, or longer and have been connected in the clinical research literature to depression, anxiety, and low self-esteem.

Research shows problematic and excessive use of the internet has a detrimental effect on mental well-being [32] and is associated with depressive mood symptoms [33]. Currently, most of the research on general SNS (Social Networks Sites) use and specifically on Facebook use imply on the effects of the overuse on mental well-being, namely, depression and negative mood [34,35]. Kross [16] found Facebook overuse predicts declines in two aspects of well-being: how people feel moment to moment (now) and how satisfied people are with their lives (in general). Further research [36] have highlighted that as time spent on SNSs increases, so does negative mood and depression. Yet, Donnelly and Kuss [37] found no relationship between time spent on SNSs and depression. In a recent study [38], PIU was associated significantly with high levels of negative mood, depression, anxiety, and stress. The same study reports a significant negative association between PIU, social support, and resilience, and a significant positive association between social support and resilience.

Costa, et al. [39] explored the relationships between PIU, social networking, and feelings of loneliness among a sample of 548 Portuguese adolescents and young adults. Results indicate that social networking was reported among the main engagements preferences of by 90.6% of the females and 88.6% of the males and PIU was associated with loneliness independently of age and perceived social support. They concluded that online communication likely to engenders feelings of loneliness.

Loneliness can be seen as a discrepancy between an individual's expectations of interpersonal relations and his or her social situation in reality [40] and is experienced through an unpleasant emotional reaction to isolation and a lack of connection to or communication with others, closely related to depression and negative moods. Caplan's research identified independent variables that played the most important role in predicting the extent to which an individual suffered from negative outcomes due to internet use, and only loneliness explained a significant amount of variance of the negative outcomes [41]. This particular result is noteworthy because it lends support to arguments that social isolation plays an important role in PIU [42].

Findings concerning the effect of SNS use on loneliness are varied; for example, Burke, et al. [43] found AFU (Active Facebook Use) decreases feelings of loneliness, whereas PFU (Passive Facebook Use) increases them. These findings help explain the inconsistency within other studies, suggesting certain aspects of Facebook usage have a positive effect on an individual's well-being, whereas others have a more negative effect [44]. In support of Burke et al. [43], Frison and Eggermont [45] found PFU increases feelings of loneliness, and Shaw, et al. [46] found that PFU increases social-anxiety symptoms. Similarly, Verduyn et al. [47] reported that PFU reduces well-being by inducing envy. Yet, Young et al. [44] findings indicate participants perceive PFU to have no effect on mood.

However, perceived loneliness was associated with PIU, independently of age and indicators of social support. The authors explained that whereas evolution created neurophysiological mechanisms to recognize satisfying social relationships based on sensory information and bodily feedback present in face-to-face interactions, these mechanisms are greatly absent in online communication. Hence, online communication likely engenders feelings of loneliness that may arise with the overuse of the internet.

Either way, PIU has been related to feelings of loneliness. Research suggests excessive online communication may engender feelings of loneliness. In Costa et al. study [39], high levels of loneliness were associated with PIU independent of age, gender, and indicators of social support in a sample of 548 Portuguese adolescents.

The current study

This study examined the mediating role of four social-emotional variables in the relationship between PIU and well-being. Accordingly, first we hypothesized a significant and inverse relationship between PIU and WB, and secondly, we hypothesized that resilience, self-control, negative mood, and loneliness will mediate the relationship between PIU and well-being.

Method

Participants

We enlisted 433 adolescent participants ages 12-17: 219 boys (50.6 %) and 214 girls (49.4%) (Table 1).

Table 1. Sample descriptive statistics.

	Count	Percent
Gender		
Male	219	50.6
female	214	49.4
Class		
G7	120	27.1
G8	114	25.7
G9	123	27.8
G10	29	6.5
G11	22	5
G12	35	7.9
Computer Skills		
Low	51	11.8
Medium	95	21.9
Hight	185	42.6
Excellent	103	23.7

The grade distribution was as follows: 27.1%-7th graders, 25.7%-8th graders, 27.8%-9th graders, 19.4%-10th, 11th, and 12th grades. Computer skills was serves as a control variable. The majority (66.3%) reported on were high to excellent skills, whereas 11.8% and 21.9% reported their skills were low and medium, respectively. Table 2 presents the research indices, descriptive statistics, and reliabilities.

Table 2. Indices in the research, descriptive statistics, and reliabilities.

	Means	STD	Minimu m	Maximu m	Items	α Cronbach
PIU	2.33	0.76	1	4.67	6	0.74
Resilience	2.82	0.65	0.44	4.68	25	0.91
Self-control	3.35	0.68	1	5	13	0.78
Negative Mood	1.82	0.56	1	3.7	20	0.9

Social Loneliness	2.2	0.84	1	5	6	0.85
Emotional Loneliness	1.78	0.75	1	5	10	0.9
Loneliness	1.94	0.71	1	4.88	16	0.92
Well-Being	5.17	1.16	1	7	5	0.75

Procedure

Following receiving approval from the Research Ethics Board, the Ministry of Education, and the school principals, we sent a letter to the students' parents to request their consent for children's participation in the study. After receiving the signed letters from the parents, we randomly sampled the classes and gave the participants an hour to fill out the questionnaires in their classes. The researchers were in the classroom and carefully explained to the students how to fill out the questionnaire aside an explanation regarding anonymity.

They also clarified that the students did not have to participate and could leave the study whenever they wished or if they felt uncomfortable.

Measures

Demographic questionnaire: The demographic questionnaire revealed information about age, gender, place of birth, level of computer skills (as a control variable).

Problematic Internet-Use Questionnaire (PIUQ): Problematic internet use was assessed using the shortened six-item version (PIUQ-SF-6 Demetrovics et al., [48] of the Problematic Internet Use questionnaire (PIUQ, Demetrovics et al. [49]. The questionnaire estimates the extent of internet use as reflected by the reported need to stay online excessively instead of being engaged in other routine activities such as studying, eating, and sleeping. It also estimates the need to hide the extent of use, harm-to-life areas such as declining mood, and the ability to reduce the amount of time if needed. A sample item includes "How often do you feel tense or nervous if you can't use the Internet for as long as you want?" Participants were asked to respond to these questions on a 5-point Likert scale (1=never, 5=always). Cronbach's alpha was 0.74 for this study.

Well-being: Well-being was assessed by the SWLS (satisfaction-with-life scale (Diener, et al. [50]. The five items (e.g., I am satisfied with my life) are rated on a 7-point scale (1=strongly disagree, 7=strongly disagree). Factor loadings were significant (ps<0.001), ranging from 0.61 to 0.84. Cronbach's alpha in this study was 0.75.

Resilience scale: Connor & Davidson [21]: This scale contains 25 items, each rated on a 5-point scale (0=not true at all, 4=true nearly all of the time), with higher scores representing greater resilience. The scale measures resilience as an accumulation of personal strengths and positive adaptation to stressful events and has demonstrated a significant inverse relationship with indices of psychological distress and positive correlations with measures of well-being. Sample items include "I can get through difficult times," "I am determined," and "I take things in stride." The scale has shown high construct validity with α ranging from 0.87 to 0.95. Cronbach's alpha was 0.91 for this study.

Self-control scale: This scale used 13 items (e.g., "I am good at resisting temptations") and was developed to measure self - control as a uni-dimensional measure of traur self-control, assessing individual differences in self - control. Participants rated each item on a 5-point scale (1=not at all like me, 5=very much like me). Scores are averaged, with higher scores indicating higher levels of self-control. Cronbach's alphas were 0.78 for this study [51].

Negative mood scale: This questionnaire included 20 items (e.g., "I felt depressed"), rated on a 3-point scale (0=rarely or none of the time, 3=most or all of the time). All 20 items are averaged, with a Cronbach's alpha of 0.85 [52].

Loneliness scale: Consisting of 16 primary items and eight filler items on a 5-point Likert scale (1=never, 5=always) (higher scores reflect greater loneliness or intense feelings of loneliness; e.g., "It's easy for me to make new friends at school" or "I feel left out of things at school"), constitute the loneliness measure. The scale relates to social and emotional loneliness. Cronbach's alpha in this study was 0.92 [53].

Data analysis and results

Modeling strategy. To explore the nexus between PIU and well-being among adolescents, we used an SEM approach. SEM enables the statistical examination of a series of interrelated dependence relationships between theory-based latent variables and their indicator variables, by measuring directly observable indicator variables. An SEM is a composition of regression equations in the order of previously designed hypotheses [54]. This modeling strategy allows the integration of latent factors that advance the common pre-calculated indicators by including measurement errors [55,56].

Based on the answers to the adolescent questionnaires, we built latent factors and tested their construct validity first, and continued with a full SEM, to estimate factor associations that followed the research hypotheses. The expected outcome was adolescent's well-being, which was identified by self-reported resilience, self-control, negative mood, and loneliness, whereas the core explanatory factor was PIU. In other words, PIU was expected to explain these individual emotions and outcome, and the variables resilience, self-control, negative mood, and loneliness were

expected to be mediators in this link. This was complemented with additional background variables: age, gender, and computer skills. For all analyses, we used the Mplus package version 8.0 [57,58].

The measurement model: When taking the SEM approach, a preliminary measurement model is necessary to confirm factor structure, also termed as construct validity. In other words, this step ensures the hypothesized structure of the latent factors is found in the empirical data by means of model-fit indices. We applied the parceling technique to the latent factors, except for the PIU and the well-being factors, which were based on a small number of items and did not meet the preliminary requirements of this technique. "Parceling" is a method based on a preliminary exploratory analysis across items. If the instrument includes a larger number of highly correlated items, the parceling technique is a solution that reduces complexity yet is statistically acceptable [59].

The model performed to a satisfactory level as shown in the goodness-of-fit indices: CFI=0.935, TLI=0.928, RMSEA=0.040, SRMR=0.063, and $\chi^2(736)=1241.64$, $p<0.001$. In this model, we used the full-information maximum likelihood-FIML [60] approach, which substitutes missing value with correlated data. This approach required a random pattern for the missingness. Our prior analysis showed that in all grades except 8th, missing data were randomly distributed [61-63].

The structural model, SEM: Model results are shown in Table 3 for the unstandardized coefficients, and in Figure 1 for the standardized coefficients.

Table 3. Structural model results, unstandardized estimates. *** $p<0.001$, ** $p<0.01$, * $p<0.05$; squared boxes for observed variable, oval shapes for latent factors; straight arrows for regression effect; double spearhead arches for correlations.

DV ®							
IV €	Sca2 PIU	Sca3 Resilience	Sca4 Self-Control	Sca5 mood	Negative	Sca6 Loneliness	Sca7 Well Being
	0.03	0.05***	-0.02*	0.003		0.06	-0.13
Age	(0.04)	(0.01)	(0.01)	(0.01)		(0.04)	(0.08)
Gender	0.42***	-0.04	0.04	0.10**		0.02	0.13
	(0.12)	(0.03)	(0.03)	(0.03)		(0.08)	(0.15)
Computer Skills	0.01	0.06***	0.03*	0.02		0.04	-0.01
	(0.07)	(0.01)	(0.02)	(0.02)		(0.04)	(0.08)
PIU	-	-0.05**	-0.14***	0.05*		0.05	-0.16*
Sca2		(0.02)	(0.02)	(0.02)		(0.06)	(0.13)
Resilience	-	-	0.40***	-0.38***		-1.30***	0.44
Sca3			(0.06)	(0.08)		(0.26)	(0.51)
Self-Control	-	-		-0.21*		-0.12	0.16
Sca4				(0.09)		(0.23)	(0.47)
Negative mood						0.53***	-2.79***
Sca5						(0.07)	(0.6)
Loneliness							-0.67*
Sca6							(0.28)
Well Being							0.25
Sca7							(0.15)

	0.04	0.22***	0.32***	0.37***	0.28***	0.56***
R2	(0.02)	(0.04)	(0.07)	(0.05)	(0.06)	(0.05)

In Figure 1, the oval shapes represent latent factors, whereas rectangles represent observed variables. Because standardized coefficient estimates are comparable, we report these estimates rather than the unstandardized format. For example, older students were associated with higher resilience ($\beta=0.31, p<0.001$) but negatively associated with self-control ($\beta=-0.12, p<0.05$; respectively). Girls were more strongly associated with negative mood and PIU than were boys ($\beta=0.18, p<0.01$; $\beta=0.20, p<0.001$; respectively). Students with higher computer skills showed stronger self-control and resilience ($\beta=0.11, p<0.05$; $\beta=0.22, p<0.001$; respectively). These skills and age were positively correlated ($r=0.23, p<0.001$).

Students' PIU showed a negative association with resilience and self-control ($\beta=0.18, p<0.01$; $\beta=0.55, p<0.001$; respectively), but a positive association with negative mood ($\beta=0.19, p<0.05$). Students with higher resilience were associated negatively with negative mood and loneliness ($\beta=-0.34, p<0.001$; $\beta=-0.52, p<0.001$; respectively). Similarly, higher self-control was associated with lower negative mood ($\beta=-0.21, p<0.05$). Resilience and self-control positively correlated ($r=0.40, p<0.001$), as were negative mood and loneliness ($r=0.53, p<0.001$). Negative mood and loneliness showed a negative association with students' well-being ($\beta=-0.52, p<0.001$; $\beta=-0.28, p<0.01$). In this model, effects were rolling from the background through PIU, resilience, and loneliness, to subjective well-being. This created possible indirect effects whereby the effect of an independent variable on the dependent variable can be explained through a mediator.

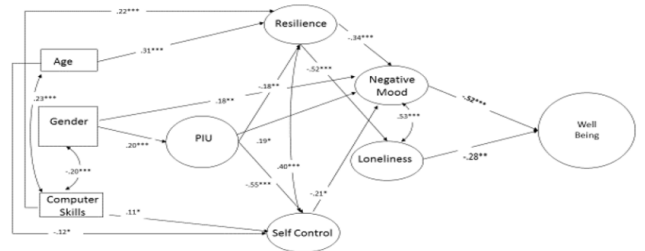


Figure 1. Structural model results, standardized coefficients. *** $p<0.001$, ** $p<0.01$, * $p<0.05$; squared boxes for observed variable, oval shapes for latent factors; straight arrows for regression effect; double spearhead arches for correlations.

Table 4 presents these indirect effects in addition to the path coefficients by which they are composed, that is, the full path from the independent variable to the outcome variable. We limited this estimation to indirect effects, which involved research factors. The minimum indirect path included two paths only: from the direct path to the mediator, and from the mediator to the outcome. However, indirect effects may be explained through two or more mediators.

Table 4. Model indirect effects and their components, unstandardized estimates. * $p<0.001$, ** $p<0.01$, * $p<0.05$; Standard error in parentheses; 95% confidence interval in squared brackets. Arrow for effect direction.

Independent	Mediator 1	Mediator 2	Dependent	Independent	Mediator 1	Mediator 2	Independent	Indirect Effect	95% CI
				Mediator 1	Mediator 2	Dependent	Dependent		
PIU	Resilience	Negative mood	Well Being	-0.05**	-0.38***	-2.79***	0.156	-0.048*	[-0.108, -0.015]
				-0.02	-0.08	-0.6	-0.127	-0.022	
PIU	Self-Control	Negative mood	Well Being	-0.14*** (0.02)	-0.0189	-2.79*** (0.60)	0.156	-0.0038	[-0.193, -0.021]
				-0.09	-	-0.6	-0.127	-0.022	
Resilience	Negative mood	-	Well Being	-0.38*** (0.08)	-	-2.79*** (0.60)	0.442	1.056** (0.309)	[0.542, 1.709]
				-0.26	-	-0.28	-0.513	-0.395	
Resilience	Loneliness	-	Well Being	-1.30***	-	-0.67*	0.442	0.870*	[0.237, 1.725]
				-0.26	-	-0.28	-0.513	-0.395	
Self-Control	Negative mood	-	Well Being	-0.21*	-	-2.79***	0.16	0.595*	[0.135, 0.134]
				-0.09	-	-0.6	-0.474	-0.301	
Problematic Internet Use	Resilience	-	Negative mood	-0.05** (0.02)	-	-0.38*** (0.08)	0.051* (0.014)	0.017* (0.007)	[0.006, 0.034]
				-0.09	-	-0.6	-0.474	-0.301	
Problematic Internet Use	Self-Control	-	Negative mood	-0.14*** (0.02)	-	-0.0189	0.051* (0.014)	0.031* (0.014)	[0.007, 0.060]
				-0.09	-	-0.6	-0.474	-0.301	
Problematic Internet Use	Resilience	-	Loneliness	-0.05** (0.02)	-	-1.30*** (0.26)	0.052	0.059* (0.025)	[0.020, 0.115]
				-0.09	-	-0.6	-0.474	-0.301	

Note the mediators between PIU and personal well-being are resilience and negative mood (together), self-control and negative mood (together), and resilience and negative mood (together). The model shows PIU affects well-being through resilience and negative mood (indirect=-0.048, $p<0.05$) and through self-control (indirect=-0.087, $p<0.05$). We found resilience affects well-being through negative mood and loneliness (indirect=1.056, $p<0.01$; 0.870, $p<0.05$; respectively), and self-control indirectly affects well-being (0.595, $p<0.05$). Finally, PIU provides indirect effects on negative mood through resilience and self-control (indirect=0.017, $p<0.001$; indirect=0.031, $p<0.05$), and through resilience on loneliness (indirect=0.059, $p<0.05$). Note that in Table 2, the right column presents a 95% confidence interval of the indirect parameter based on a bootstrapping resampling with 1,000 repeats [58,64].

In line with our hypothesis and in answering the research question regarding whether self-control, resilience, negative mood, and loneliness mediate the relationship between PIU and personal well-being, the model analysis shows the following mediator paths: low levels of resilience and high levels of negative mood (together), low levels of self-control and high levels of negative mood (together), and low levels of resilience and high levels of loneliness mediate these relationships.

The findings indicate high levels of PIU predict low levels of well-being. PIU affects well-being through low resilience and negative mood. It also affects well-being through low self-control and negative mood. We found girls were higher in PIU, had more computer skills, and were more resilient than boys. We found no differences between girls and boys in loneliness.

Discussion

The main purpose of the current study was to explore in depth the network of associations between PIU and a sense of well-being among adolescents, and social-emotional factors (resilience, self-control, negative mood, and loneliness) that may mediate these relationships. In line with the hypothesis, we found that low levels of resilience and high levels of negative mood (together), as well as low levels of self-control and high levels of negative mood (together), mediate the relationships between PIU and well-being.

PIU is a multidimensional syndrome consisting of cognitive and behavioral symptoms that result in social, academic, or professional problems [65], and thus may affect one's sense of personal well-being. In general, the research literature indicates a decrease in one's sense of well-being after excessive use of the internet, as well as negative associations between PIU and subjective emotional well-being [16,66,67]. Yet these findings are not unequivocal in spite of inconsistent findings regarding these associations between PIU and a variety of the psychosocial problems of youth, such as higher levels of emotional difficulties, especially depression and lower self-esteem [68,69]. Kross et al. [16] report that overuse of Facebook negatively influences subjective well-being, increasing negative feelings on a moment-to-moment basis and reducing sense of well-being in general [44]. Likewise, positive associations were found between PIU and the self-destructive behaviors of youth as well as high comorbidities with negative mood and loneliness [40], mood disturbances, substance use, anxiety, impulsivity, low levels of self-control [18] and social isolation [7]. A significant link between PIU and sense of well-being as well as poorer academic performance was found by Piguet [67] and by Boubeta et al. [17].

Most of these studies address young-adult populations, whereas the current study focused on youth. Regarding age, PIU seems to increase with age as in this study. Studies suggest post-compulsory students (late adolescence) present more PIU than the early courses (10-12 years) [70], yet adolescents have higher levels of PIU than middle-aged people [6].

As for gender differences, studies offer contradictory findings. For instance, Zhenhe, et al. [71] found adolescent boys tend to be higher in PIU than do girls. By contrast, in their study exploring PIU among nine European countries, Laconi et al. found PIU was more prevalent among girls [72].

In this study, we found girls have a higher association with negative mood and PIU than boys, and students with stronger computer skills showed stronger self-control and resilience.

The current study found that among adolescents, these associations are mediated through low levels of resilience and high levels of negative mood (together) and through low levels of self-control and high levels of negative mood (together). The nexus of relationships that was found show that high levels of resilience and self-control can be considered protective factors that may reduce the negative effect of PIU on the sense of adolescents' well-being, whereas high levels of negative mood and loneliness could be risk factors that may increase this negative effect, and vice versa.

Online activities take up an increasing amount of time in the lives of internet users, thereby reducing the time available to participate in alternative enjoyable pastime activities and to engage with real-life family and friendship circles, which may lead to increased loneliness and stress [2]. Alternatively, internet use and gaming may serve as a means of escaping real-life problems. Therefore, the ability to cope with stress may be weakened, particularly in the case of adolescents [13].

Resilience aids the individual in coping with various stress encounters [22]. Indeed, it is an intrinsic capability as well as competence that can be developed [73]. Wisniewsk et al. [74] found resilience plays a key role as a coping mechanism following exposure to risk, and thus affects outcomes following risk exposure in protecting teens, either neutralizing or reducing the negative effects of internet addiction and online risk exposure. Resilience may mitigate the negative effect of online risk exposure as an addictive internet use. In particular, the role of resilience as a first-stage moderator in the two-stage moderated mediation model suggests a new conceptualization of resilience as a form of risk prevention. This new view yields important theoretical and practical implications because it offers a more proactive way of reducing the negative outcomes of online risk (e.g., negative affect) through fostering and developing resilience among youth [74].

On the other hand, low levels of self-control, found to be a mediator of loneliness in the examined relationships, are characterized by high impulsivity and poor inhibitory control [28,75] which may result in negative long-term consequences that involve emotional stress. This in turn may lead to a propensity for the development of pathological psychological and somatic disorders, such as depression, anxiety, and somatization, and a decrease in one's sense of well-being [75,76].

Loneliness also plays a significant role in psychological health, predicting negative outcomes from internet use [41]. Caplan depict a circle in which the lonelier an individual is, the more the individual prefers online interaction, and the greater one's negative mood, the greater the loneliness reported. Moreover, the extent to which an individual prefers online interpersonal communication because of the perceived social benefits is the PIU variable that yielded the strongest correlations with well-being [41].

Based on the results of the current study, in order to find factors that can prevent or reduce emotional difficulties, we suggest nurturing resilience and self-control, along with developing coping strategies that focus on reducing feeling of loneliness and negative mood, in order to prevent the decrease in well-being that is associated with PIU. We suggest that developing education programs that focus on these variables may even prevent the excessive use of the internet in the first place, but mostly the negative outcomes and the decrease in the sense of well-being. More specifically, our findings imply every health education program that wishes to prevent or reduce the phenomenon of PIU and its addictive negative implications should address and highlight these variables: strengthening resilience and self-control and reducing negative mood and loneliness among youth.

Limitations and Future Research

Some limitations of this study should be noted. The study findings are based on self-reported scales, whereas these research questions could benefit from external information data (e.g., parents or teachers for validation, as well as qualitative methods include focus-group information and personal interviews).

The term problematic internet use needs more exploration and clarification. Although in this study we addressed the term PIU, there are terms relate to similar characteristics under different names. Future studies should systematically investigate the adequacy of the term PIU at a more empirical level. For instance, because PIU is associated with specific online

activities, therefore having a focus, exploring how the use of specific features contributes to excessive and potentially problematic internet use is pertinent. As such, studies with an experimental design may be useful in exploring and deepening the nature of online addictive behaviors. Similarly, future studies using behavioral data may be beneficial in fulfilling this objective and clarifying the distinction between normal use, excessive use, and problematic use of the internet.

Importantly, future studies should focus on cause and effect. Some of the variables explored here may also predict addictive behaviors on the internet. Loneliness and negative mood may lead to overuse of the internet and may lead teenagers to look for anonymous relationships on the internet, which then may trigger their vulnerability, thus creating a vicious circle. Future studies should explore the temporality of events. Longitudinal research could be beneficial for that purpose. In addition, further investigation should focus on gender differences in separate samples for boys and girls, because the study results imply initial gender differences regarding the examined relationships.

Conclusion and Implications for Interventions

This study offers an innovative contribution to the field, since the findings provide more precise, focused information for the developers of intervention programs for youth for coping with PIU as well as school counselors and educational psychologists, thus can contribute to a more specific, accurate understanding of the topics that should be addressed when facing the PIU phenomenon and its negative effects. Emphasizing nurturing resilience and self-control, in addition to addressing loneliness and mood, may be the best way to prevent a decrease in well-being, and guide more sensible use of the internet among adolescents.

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