

Internet use, loneliness, and mental health in Greek students

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Abstract

Background: Problematic internet use among university students is a rising phenomenon with repercussions worldwide. We aimed to determine the association between time spent online, loneliness, and mental health.

Methods: We conducted an online cross-sectional study using self-administered questionnaires on demographics, frequency of internet use as assessed by the Internet Addiction Inventory (IAT), depressive symptoms as reported by answering the Beck Depression Inventory (BDI), loneliness as depicted by the UCLA Loneliness scale, and general psychopathology on the self-reported General Health Questionnaire-28 (GHQ-28) scale. We performed statistical analysis using the IBM SPSS for Windows, Version 25.0.

Results: The mean age (n=294, 62.9 % female) was 23.19 ± 6.454 years. One-third (33.3 %) and 8.2 % were mildly and moderately addicted to the Internet, respectively. There was no participant with severe dependence. Nearly one-quarter (24.5 %) of participants reported mild, 10.6 % moderate, and 3.3 % severe depression and 44.8 % reported moderate and 11.9 % a moderately high degree of loneliness. Four in ten (41.8 %) of participants self-reported mental health problems. Mean IAT, BDI, UCLA Loneliness, and GHQ-28 score differences were statistically significant between IAT categories across all questionnaires. Correlations between the scales were statistically significant, and a binary logistic regression model revealed that the level of self-reported depressive symptoms, loneliness, and general psychopathology scores could predict internet use.

Conclusions: In our student sample, mental health problems were present in approximately 40 % of participants. They were significantly correlated with problematic internet use, thus complicating the development of essential communication skills in young adults. The higher the internet use, the greater the loneliness felt. Future studies should be more extensive, focusing on the relation of internet use with the type of use, family history of psychopathology, use of substances, and impulsivity. HIPPOKRATIA 2023, 27 (2):31-36.

Keywords: Internet use, students, loneliness, depression, mental health

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Introduction

The prophylactic measures during the COVID-19 pandemic's initial phase have profoundly modified how people work, comprehend, perform daily tasks, relate with loved ones, celebrate, and mourn, with technology playing a critical role in this transformation. The internet has become essential for communication, academic research, information, and entertainment. Especially during the pandemic, it met the needs for social recognition, support, and a sense of belonging. However, addicted severe and chronic internet users may lack self-confidence and social skills and tend to isolate themselves¹.

Problematic internet use (PIU) is a particularly worrying phenomenon worldwide for many age groups, starting from childhood. Younger adults are more familiar with technology and its use. Students often wish to escape classes and stressors arising from their academic obligations. Undergraduate university students are at the

highest risk for PIU, having an abundance of unstructured time, free, unlimited, and unsupervised internet access, demonstrating little control over their time after leaving their family home. At the same time, students face problems adjusting to university life and finding new friends while they are encouraged by their faculty to use various internet applications².

Previous studies of undergraduate university students have associated PIU with several demographic and psychiatric factors, including male gender, parental divorce, lower academic performance, living away from parents, marriage, using the internet at night, and using the internet to communicate with family and friends. Regarding psychiatric comorbidities, internet addiction has been associated with insomnia, stress, anxiety, depression, impulsivity, smoking, alcohol or coffee consumption, and drug use³⁻⁶.

This study aimed to determine the frequency of PIU in a randomly selected group of students in Greece and

its correlation with demographic factors, loneliness, and psychopathology. We hypothesized that students who spend more time online experience more mental health problems and feel lonelier.

Materials and Methods

The Research and Ethics Committee of the Aristotle University of Thessaloniki approved the proposal (decision No 3.480, date: 18/1/2022). The sampling method was opportunistic (convenience sampling). The inclusion criteria were acceptance to participate and study at higher education in Greece. Participation was voluntary and anonymous. Participants provided detailed informed consent and signed a relevant form before answering research tools. The questionnaire, requiring approximately 20 minutes to complete, was compiled using Google Forms. To ensure maximum participation, we posted the following link: https://docs.google.com/forms/d/e/1FAIpQLSdfxL1May4k5_jV27ap67VdB6Bi6SpZh603y9u2_NvpFsQNZw/viewform?vc=0&c=0&w=1&flr=0&usp=mail_form_link at various Facebook pages, including i) “University of Thessaly, Medical Faculty, Be informed and inform” [<https://www.facebook.com/groups/333030459080>], ii) “Doctoral candidates - ELIDEK Scholars” [<https://www.facebook.com/groups/1940918709456723>], iii) “Doctorates / PhD / Doctoral Candidate Positions in Greece and Abroad” [https://www.facebook.com/groups/784371858577388/?hoisted_section_header_type=recently_seen&multi_permalink=1632006520480580], iv) “Aristotle University of Thessaloniki School of Pharmacy Students” [https://www.facebook.com/groups/foititespharmauthgr/?notif_id=1645039695745496¬if_t=group_r2j_approved&ref=notif], v) “Students in Athens” [<https://www.facebook.com/groups/11339721887/>], and vi) “K.AN.TA.I.F.I. - Refuge of Insubordinate Sufferers but Capable Medical Students” [<https://www.facebook.com/groups/13658581638864>].

Questions on demographics, substance use, and personal or family history of mental illness preceded data collection through the following questionnaires:

1. The Internet Addiction Questionnaire (IAT), the most popular assessment tool for internet use^{7,8}, has scores ranging from normal (0-30), mild (31-49), moderate (50-79), to severe use (dependence, 80-100).

2. The Beck Depression Inventory (BDI) measures the severity of depression⁹. Its cut-offs in the present study sample were 0-9 no depression, 10-18 mild, 19-29 moderate, and 30+ severe depression¹⁰.

3. The University of California, Los Angeles (UCLA) Loneliness Scale measures personal perception of loneliness and social isolation^{11,12}. Low levels of loneliness are indicated by scores between 20 and 34, moderate levels between 35 and 49, moderately high levels between 50 and 64, and high levels by scores ≥ 65 .

4. The Greek version of the General Health Questionnaire-28 (GHQ-28) exhibits the subject's general health

in the preceding few weeks using behavioral items scored on a 4-point Likert scale¹³. The lowest possible score for GHQ-28 is zero, whereas the highest is 84. Goldberg et al¹⁴ proposed that individuals scoring 23 or below should be classified as non-psychiatric, while individuals with scores greater than 24 as having psychiatric symptoms. Nevertheless, this score should not be used as an absolute cut-off, and researchers are recommended to establish a threshold score based on the mean of their sample, with higher GHQ-28 scores indicating higher levels of distress¹⁴. We have used 25 as the cut-off score, as we explain below in the manuscript's results section.

The IAT, the BDI, and the UCLA Loneliness Scale, provided to us following personal communication with Professor K Kafetsios, are not copyright-protected in the Greek language. Permission to use the GHQ-28 in Greek was obtained by personal communication with Professor G Garyfallos¹³.

Statistical analysis

The analysis was implemented in IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). All tests were two-tailed at a $\alpha=0.05$ level of significance. The normality of distribution for all variables, with emphasis on the IAT, BDI, UCLA Loneliness, and GHQ-28 scales, was checked by the Chi-square test for categorical variables and the Kolmogorov-Smirnov test for quantitative variables. All scales presented a non-normal distribution (p value <0.001). Therefore, non-parametric tests were applied.

Descriptive statistics were estimated and summarized as number (n) and percentage (%) for qualitative variables and mean \pm standard deviation for quantitative variables. The chi-square (χ^2) test was used to compare categorical variable pairs. In contrast, the Mann-Whitney U test and Kruskal-Wallis Analysis of Variance tests (ANOVAs) were employed to compare a scale with a categorical variable (of less or more than two categories, respectively). Additionally, the correlation between the scales (IAT, BDI, UCLA Loneliness, GHQ-28) was tested by Spearman's rho, both in the total sample and per IAT category. Lastly, a binary logistic regression model was developed to measure the association between internet addiction and several risk factors. The IAT was transformed into a categorical variable of two categories (1. Low levels- reference category, 2. Medium or high levels), which was used as the dependent variable in the model. We also used UCLA Loneliness and GHQ-28 as covariates, while adjustment was made according to gender, age, and BDI. Bootstrapping was performed in STATA 17.0, and assumptions of the bootstrapping technique were entirely based on the observed trends of the variables as estimated in a larger sample to enhance the p values in the adjusted odds ratio (OR) model.

Results

A total of 294 questionnaires were answered. Just over half of the respondents were medical and health sciences students (51 %), 19 % were studying classics, education, or psychology, 15.6 % engineering or science, 6.5

% law, 6.1 % economics and business, and 1.8 % other. The mean age of respondents was 23.19 ± 6.454 (range: 19-60) years, and 62.9 % were female. Age was negatively correlated with the level of internet use as a trend toward significance (Spearman's $\rho = -0.107$, $p = 0.084$). Several (29.9 %) had consulted either a psychologist or a psychiatrist in the past, and 16.4 % reported a positive family history of mental illness. Of our sample, 13.4 % were smokers, 74.8 % reported using alcohol, but only 3.6 % admitted to any other drug use, mainly cannabis. Just over one-quarter of participants (26.9 %) reported visiting internet pornographic sites regularly, and 9.9 % were gambling through the internet. The sample's mean Body Mass Index (BMI) was 23.23 ± 4.063 , indicating that the participants were of normal average weight for height and, thus, were probably leading non-sedentary lives.

For the whole sample, the mean IAT score ($n = 294$) was 28.48 ± 13.538 (range 3-74), with 58.5 % using the internet typically (IAT score 0-30), 33.3 % being mildly addicted (IAT score 31-49), and 8.2 % reporting moderate addiction (IAT score 50-79); the mean BDI score ($n = 273$) was 9.54 ± 8.500 (range 0-54), with 61.5 % reporting no depression (BDI score 0-9), 24.5 % mild depression (BDI score 10-18), 10.6 % moderate depression (BDI score 19-29), and 3.3 % severe depression (BDI score 30-63); the mean UCLA Loneliness scale score ($n = 277$) was 38.09 ± 10.233 (range 21-77), with 42.6 % reporting a low degree of loneliness (UCLA Loneliness score 20-34), 44.8 % a moderate degree of loneliness (UCLA Loneliness score 35-49), 11.9 % a moderately high degree of loneliness (UCLA Loneliness score 50-64), and 0.7 % a high degree of loneliness (UCLA Loneliness score 65-80). The mean GHQ-28 score of the total sample ($n = 282$) was 24.66 ± 13.171 (range 0-82). According to Goldberg et al¹⁴, 25 was taken as the cut-off threshold for our sample to differentiate between participants without (58.2 %, GHQ-28 ≤ 25) and with (41.8% GHQ-28 ≥ 26) mental health problems.

Table 1 summarizes the demographic characteristics of the participants according to the degree of internet use as depicted by the IAT scoring. There was no participant with severe dependence. There was no statistically significant difference in demographic factors between groups by IAT categories (Table 1).

Table 2 illustrates IAT, BDI, UCLA Loneliness, and GHQ-28 scores between the IAT categories. Mean score differences were statistically significant between the IAT categories across all questionnaires.

In the total sample, correlations between the scales were tested by Spearman's ρ and found statistically significant (Table 3).

A binary logistic regression model was developed to measure the association between internet addiction and several risk factors. We used the normal (0-30), mild (31-49), and moderate (50-79) IAT categories, excluding the severe use (80-100) IAT category for the analysis since there were no participants scoring at severe levels. In the

entire analysis, normal, mild, and moderate levels were utilized. In the regression model, however, we utilized the IAT score as a dependent variable with two categories based on the guidelines of the IAT developers^{7,8} to predict the probability of high levels of internet addiction (i.e., non-normal, meaning mild and moderate levels) versus the lower level of addiction (i.e., normal).

The IAT was transformed into a categorical variable of two categories (1. low levels-reference category, 2. mild or moderate levels), which was used as the dependent variable in the model (Table 4).

We also used UCLA Loneliness, GHQ-28, and others as covariates, while adjustment was made according to gender, age, and BDI. The presented models had high levels of goodness (bootstrapping $r^2 > 0.72$; prior bootstrapping $r^2 > 0.51$) after performing bootstrapping in STATA for a doubled sample size ($n = 590$). Assumptions of the bootstrapping technique were entirely based on the observed trends of the variables as estimated in a larger sample to enhance the p values in the adjusted OR model.

Discussion

This cross-sectional study estimated the prevalence of PIU among university students in Greece. To the best of our knowledge, this is the first study on Greek students to address PIU since the breakout of the COVID-19 pandemic and the first to examine PIU associations with psychopathology, loneliness, and depression in this population. In our sample, most internet use was typical. However, one-third of respondents were mildly addicted, and less than one in ten were moderately addicted. Interestingly, no participants were severely dependent on the Internet. In the study population, internet use was independent of age, gender, place of residence, marital status, number of persons living in the same house, having children, routine exercise, BMI, education, family history of mental illness, or previous contact with a mental health provider.

Furthermore, the level of internet use was associated with the severity of depressive symptoms, degree of loneliness, and the possibility of having a mental health disorder. Interestingly, the level of self-reported depressive symptoms, loneliness, and general psychopathology scores could predict internet use.

Confirming our initial hypothesis, we found that the higher the internet use, the greater the loneliness. With the rise of online social networking, more people rely on digital platforms to establish and maintain social relationships. The internet can be a valuable tool in easing loneliness by strengthening existing relationships and forming new social connections. However, by using virtual media to avoid the discomfort of social interaction, loneliness is heightened and, in turn, influences people's interactions with the digital world. Lonely people tend to favor using the internet for socializing. They are more likely to substitute online time for offline social activities. However, a bidirectional dynamic relationship between loneliness and social internet use emerges, with lonely people pos-

Table 1: Sample demographics of the online cross-sectional study that included 294 respondents. None of the participants reported severe internet use according to the Internet Addiction Test scores (>80).

Internet use (IAT score range)	normal use (0-30)	moderate use (31-49)	severe use (50-79)
	172 (58.5)	98 (33.3)	24 (8.2)
	F(2) = 1.638, p = 0.196		
Mean Age in years, n = 264	23.56 (7.142), n = 153	22.74 (4.824), n = 87	21.25 (3.124), n = 24
Gender	$\chi^2(4) = 3.727, p = 0.444$		
Male	67 (22.9)	31 (10.6)	6 (2.0)
Female	102 (34.8)	65 (22.2)	17 (5.8)
Other	2 (0.7)	2 (0.7)	1 (0.3)
Place of Residence	$\chi^2(10) = 16.663, p = 0.082$		
Capital City	10 (3.4)	17 (5.8)	5 (1.7)
City >1 million population	73 (42.9)	44 (44.9)	9 (37.5)
City 100.000-1 million population	37 (21.8)	17 (17.3)	6 (25.0)
City 20.000-100.000 population	19 (11.2)	9 (9.2)	1 (4.2)
City <20.000 population	15 (8.8)	5 (5.1)	3 (12.5)
Village/Countryside	16 (9.4)	6 (6.1)	0 (0.0)
Marital Status	$\chi^2(8) = 11.618, p = 0.169$		
Single	122 (71.8)	81 (82.7)	20 (83.3)
Married	11 (6.5)	2 (2.0)	0 (0.0)
Divorced	1 (0.6)	1 (1.0)	0 (0.0)
Lives with others	4 (2.4)	4 (4.1)	2 (8.3)
Other	32 (18.8)	10 (10.2)	2 (8.3)
No of Persons in the Same House	$\chi^2(8) = 7.942, p = 0.439$		
Living Alone	52 (30.6)	34 (34.7)	4 (16.7)
Two persons sharing	44 (25.9)	18 (18.4)	5 (20.8)
Three persons sharing	22 (12.9)	16 (16.3)	3 (12.5)
Four persons sharing	37 (21.8)	19 (19.4)	7 (29.2)
Five or More persons sharing	15 (8.8)	11 (11.2)	5 (20.8)
Children	$\chi^2(2) = 3.415, p = 0.181$		
Yes	10 (5.8)	2 (2.0)	0 (0.0)
No	161 (94.2)	96 (98.0)	24 (100.0)
Regular Exercise	$\chi^2(2) = 0.819, p = 0.664$		
Yes	101 (59.4)	53 (54.1)	13 (54.2)
No	69 (40.6)	45 (45.9)	11 (45.8)
Education	$\chi^2(6) = 4.219, p = 0.647$		
High School	27 (15.8)	20 (20.6)	7 (29.2)
University	129 (75.4)	67 (69.1)	16 (66.7)
Masters	12 (7.0)	7 (7.2)	1 (4.2)
PhD	3 (1.8)	3 (3.1)	0 (0.0)
Family History of Psychiatric Disorder	$\chi^2(2) = 0.311, p = 0.856$		
Yes	23 (17.4)	10 (14.9)	2 (13.3)
No	109 (82.6)	57 (85.1)	13 (86.7)
Contact with Mental Health Professional	$\chi^2(2) = 0.819, p = 0.664$		
Yes	38 (29.5)	19 (28.4)	6 (40.0)
No	91 (70.5)	48 (71.6)	9 (60.0)

Values are reported as number with percentage in brackets except for mean age reported with standard deviation in brackets, n: number.

sibly requiring assistance with social media use to maximize already-existing friendships or forge new ones^{15,16}. A survey on the moderating effect of social internet application use in students showed that those who are lonely and more socially active online exhibit a stronger social-compensatory use orientation, which correlates to more PIU¹⁷. Indeed, interpersonal problems and loneliness play

a crucial role in PIU¹⁸. Recent studies have found that PIU can cause feelings of loneliness regardless of age and social support, likely due to the absence of sensory information and physical feedback often present in face-to-face communication¹⁹. Furthermore, an Italian cross-sectional nationwide population-based case-control study showed that boredom and loneliness might mediate the

Table 2: Internet Addiction Test, Beck Depression Inventory, UCLA Loneliness and General Health Questionnaire-28 total scores according to the level of internet use as assessed by the Internet Addiction Test.

Internet use (IAT score range)	normal use (0-30)	mild addiction (31-49)	moderate addiction (50-79)
Mean Total IAT Score	F(2) =535.619, p <0.001		
	19.38 (6.836)	37.32 (5.045)	57.58 (6.633)
Mean Total BDI Score	F(2) =17.403, p <0.001		
	7.56 (7.899)	11.18 (7.841)	17.45 (9.655)
Mean Total UCLA Score	F(2) =24.033, p <0.001		
	35.32 (9.205)	40.22 (9.353)	48.87 (11.694)
Mean Total GHQ-28 Score	F(2) =24.896, p <0.001		
	20.91 (11.818)	27.88 (12.330)	37.75 (13.879)

Values are reported as means with standard deviation in brackets. IAT: Internet Addiction Test, BDI: Beck Depression Inventory, UCLA: University of California, Los Angeles Loneliness scale, GHQ-28: General Health Questionnaire-28.

Table 3: Correlations between the scales (Internet Addiction Test, Beck Depression Inventory, UCLA Loneliness, and General Health Questionnaire-28) tested by Spearman's rho in the total sample.

Variables	IAT Total Score	BDI Total Score	UCLA Total Score	GHQ-28 Total Score
IAT Total Score (n =294)				
BDI Total Score (n =272)	0.358**			
UCLA Total Score (n =276)	0.367**	0.556**		
GHQ-28 Total Score (n =281)	0.408**	0.775**	0.569**	

n: number, IAT: Internet Addiction Test, BDI: Beck Depression Inventory, UCLA: University of California, Los Angeles Loneliness scale, GHQ-28: General Health Questionnaire-28, **: correlation is significant at the 0.01 level (2-tailed).

Table 4: Univariate and multivariate associations between the level of internet addiction and selected risk factors.

Covariates	Medium/high internet addiction			
	OR (95 % CI)	p-value	OR adjusted* (95 % CI)	p-value
BDI	1.075 (1.041-1.110)	<0.001	-	
UCLA	1.071 (1.043-1.100)	<0.001	1.046 (1.009-1.085)	0.01
GHQ28	1.060 (1.037-1.082)	<0.001	1.028 (1.001-1.057)	0.04

CI: confidence interval, OR: Odds Ratio, *: Adjusted ORs to gender, age and BDI, BDI: Beck Depression Inventory, UCLA: University of California, Los Angeles Loneliness scale, GHQ-28: General Health Questionnaire-28.

relationship between the likelihood of PIU onset and maintenance and depressive symptomatology in 18 to 35-year-olds²⁰.

Both genders show similar academic and email internet use, and we also found no difference in the extent of internet use between the genders, replicating the findings of an extensive internet survey²¹. Internet addiction symptoms were previously associated with mental disorder symptoms, with age being inversely related to internet use, as in our sample^{19,22}.

In our student sample, probable mental health problems, as self-reported by GHQ-28, were present in approximately two in five participants (41.8 % of the total). Moreover, according to the BDI, six in ten students (59.6 % of the total) self-reported symptoms of mild or moderate depression, and 30.9 % reported symptoms of severe depression. Time spent online was significantly longer during the pandemic, with most adults reporting increased internet use. Anxiety and depression were as-

sociated with age under 33, increased substance use, and increased internet use²³. Furthermore, the Internet's anxiety-provoking potential could reproduce a "global fear" reinforced by the massive and unmediated exposure to its content, potentially increasing vulnerability to anxiety and suicidal ideation. In addition, "recreational" practices, or "challenges" with the power of self-harm, are often carried out by adolescents and young adults on various sites. Such practices increased with social isolation measures during the COVID-19 pandemic²⁴. A recent meta-analysis that included a total of 498,167 participants from 223 studies showed a moderate positive association of PIU with anxiety, loneliness, depressive symptoms, and other mental health outcomes and a negative association with subjective well-being²⁵.

Young college students are at the developmental stage where the conflict between isolation and privacy shapes the formation of close bonds with others, enhances adult life skills, molds personality, and defines close friend-

ships. Obstacles to this process are anxiety, emotional stress, stressful factors, and, in general, psychopathology, creating conditions for PIU with incomplete development of life communication techniques. Easy access to the Internet leads to problem-solving by avoiding stressful reality and promoting loneliness. The effects of internet addiction on students who are future professionals negatively affect not only their academic performance but also their long-term job ambitions and society.

The present study showed strong correlations between the degree of internet use and general psychopathology, degree of loneliness, and depression. The current findings should be translated under the light of some methodological limitations. Primarily, a power analysis was not conducted prior to sampling, and the sampling technique was nonprobabilistic. These facts may have limited the generalizability of the current findings. Additionally, the selected scales and tools were self-reported. Therefore, information and recall biases may have been inserted into the study. Lastly, the multivariate regression analysis was modeled based on the bootstrapping technique and may have over-estimated the effects of the observed associations.

While we cannot determine causality, the associations examined here suggest that vulnerable individuals may benefit from professional support to prevent internet addiction and other psychopathologies. Moreover, university counseling services should be more visible in the student life network, making them more accessible to vulnerable students.

In future studies, a more representative and larger sample size is required to enhance data reliability. More extensive studies should address the relation of the level of internet use with the type of use, family history of psychopathology, use of substances, and impulsivity.

Conflict of Interest

Authors declare no conflicts of interest.

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