

Research article

Internet addiction of university students in the Covid-19 process

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ABSTRACT

This study delves into the intricate dynamics of internet addiction among university students, leveraging a comprehensive quantitative approach to unravel the myriad factors influencing this modern-day malaise. Utilizing logistic regression analysis, this research delineates the predictive significance of Daily Internet Usage Time (DIUT) and Communicative Internet Use Frequency (CIUF) on the propensity for internet addiction, with the analysis substantiating these variables as potent predictors. The model elucidates a significant variance in internet addiction, affirming the complexity of internet addiction as influenced by a constellation of behavioral patterns.

Amidst the backdrop of the COVID-19 pandemic's exacerbation of digital dependency, this investigation sheds light on the escalation of internet use to addictive levels, prompted by prolonged isolation and the pivot to online learning platforms. This study underscores the resultant educational and psychological ramifications, highlighting a surge in addiction and its associated detriments such as diminished academic performance, social isolation, and a deterioration in mental health.

Comparison of these findings with existing literature reveals a nuanced understanding of internet addiction, characterised by the interaction between individual behaviours and broader socio-economic and psychological contexts, such as the duration of daily internet use and the frequency of communicative internet use. This synthesis argues for a holistic strategy to address internet addiction, emphasizing the need for educational interventions, improving digital literacy and promoting healthy digital habits.

By pinpointing the multifaceted nature of internet addiction and its predictors within the university student demographic, this research contributes to the ongoing discourse on digital dependency, proposing a multidisciplinary approach to develop resilient academic environments and support systems. It underscores the urgent need for targeted research to identify predictive factors of internet addiction, thereby enabling the formulation of effective strategies and policies for mitigating its impact on students' academic and psychological well-being. This study not only captures the complexity of internet addiction but also provides critical insights crucial for developing informed educational strategies and interventions in the digital age.

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1. Introduction

The internet is a global network that facilitates communication, news sharing, and various multimedia tasks. It has become an integral part of our lives due to its accessibility to information and communication capabilities.

The COVID-19 pandemic has highlighted the increasing significance of digital skills in everyday life. However, the rapid integration of the internet has also brought about challenges related to pathological overuse. While long-term and uncontrolled digital engagement can enhance digital literacy, it also carries the risk of developing into digital addiction. The pandemic has worsened this situation, resulting in students using the internet excessively, beyond normal or even addictive levels. This is characterized by patterns such as uncontrolled internet use and neglect of social life [1]. The global implementation of containment and quarantine measures to mitigate the spread of COVID-19 [2] and restrictions across various sectors have had wide-ranging and uncertain impacts [3]. The pandemic's socio-economic effects have limited young people's physical activity and social interaction spaces, resulting in a heightened affinity and addiction to the internet.

These impacts have significant educational consequences. Although the shift to online learning platforms and the reliance on digital tools for education have become necessary, they have also presented several challenges. Research has linked the excessive use of the internet and digital media to family disintegration [4], gaming addiction driven by a heightened interest in online activities [5], and elevated levels of technological stress [6]. Furthermore, there has been a significant increase in internet addiction (IA) and depression [7]. Problematic smartphone use has led to issues such as nomophobia, impaired social belonging, and sleep deprivation [8]. Additionally, there has been a rise in IA and social media consumption [9].

The increasing frequency of internet use by university students has begun to pose significant educational and psychological challenges. As a result of these challenges, problems such as internet addiction or a decline in academic performance and negative effects on mental health are becoming more common. Almost every development that has facilitated access to education has also raised concerns about digital addiction, student wellbeing and academic performance. The increase in screen time and the use of digital resources for educational purposes has created a need to critically examine digital literacy and to develop strategies to promote balanced use of the internet. This highlights the importance of educational interventions aimed at promoting healthy digital habits among students. The increasing trend of IA, which is linked to a range of psychological problems such as depression, anxiety, social isolation, low self-esteem and loneliness, makes it almost imperative for educators to take action on this issue [10–25].

Research has shown that excessive internet use can have a negative impact on students' academic performance. Studies have found a link between excessive internet use and poor academic performance, attention deficit hyperactivity disorder (ADHD) and social phobias, which can exacerbate IA [11,23,26]. Excessive internet use has been shown to impair students' ability to concentrate, which negatively affects their educational outcomes. Factors that contribute to students' susceptibility to problematic internet use include psychological and developmental characteristics specific to late adolescence and young adulthood, easy access to the internet, and expectations surrounding the use of computers and the internet for educational purposes.

Based on these findings, there is an urgent need for educational policies and programmes that address digital addiction and its impact on students' academic and psychological well-being. By implementing interventions that promote digital literacy and responsible internet use, educators can help reduce the negative consequences of digital overuse and support students in achieving a healthier balance between their online activities and academic responsibilities. Kurt, Genc and Avci (2020) [27] in a meta-analysis of 71 studies on IA, found that the addiction rate in Turkey was 13%. Although there is a limited number of studies to determine the variables of IA in Turkey, where internet access has become easier and internet use has increased rapidly, IA has come to the fore in the recent pandemic years. IA is higher among university students and differs significantly from other levels of education. These findings suggest the need for studies to identify variables that may predict IA among young people in higher education. In this context, Kandell (1998) [28] notes that research on internet addiction is still in its infancy and emphasises the need for a better understanding and complementary treatment of IA.

Comprehensive educational policies and programmes are needed to address the pressing challenges of digital addiction and its impact on students' academic and psychological well-being. A meta-analysis by Kurt Genc and Avci (2020) [27] shows an addiction rate of 13% among the Turkish population, indicating a growing concern about IA, especially among university students. This rate highlights the prevalence of IA in Turkey and reveals a significant difference in the level of dependence at different levels of education. In particular, university students show a higher tendency towards IA.

Targeted research is needed to identify predictors of IA in higher education. It is important that the academic community prioritises understanding the factors that contribute to IA among students. As internet access becomes more widespread and its use increases, especially in light of the recent pandemic, there is an urgent need for interventions that improve digital literacy and promote responsible use of the internet among students. These initiatives are essential to help students maintain a balanced approach to their online activities and to ensure that excessive digital engagement does not negatively affect their academic pursuits.

Kandell (1998) [28] noted that research into IA is still in its early stages. It is therefore important to develop a more nuanced understanding of the phenomenon and treatment options. This is particularly true in the education sector, where there is a growing need to integrate effective strategies into the curriculum that address digital addiction and support the overall wellbeing of students. Educators can provide students with the tools and resources they need to cope with the complexities of the digital age. This promotes a healthier and more productive educational environment.

2. Literature review

The concept of addiction has broadened to include not only substance dependence, but also behavioural patterns, particularly in

the context of increased internet use. This comprehensive view of addiction now encompasses digital behaviours, signifying a shift in how we perceive the societal and psychological impacts of technology [29,30].

The digital world's allure, with its power and freedom, can be enticing, particularly for creators within these spaces. However, this allure can lead to IA, which is characterized by excessive or uncontrolled preoccupation, impulsivity, and behaviors that cause disruption and distress [31–34]. IA is a psychological dependence on the internet, characterized by increased engagement in online activities, discomfort when offline, and a tolerance to the effects of being online [28].

The significance of addressing this issue within educational contexts is highlighted by the ability to predict IA in children and teenagers through variables such as weekly internet use, loneliness, and classroom behaviour [35]. The urgency of integrating digital literacy and responsible internet use into educational programs is highlighted by the consequences of online addiction, such as impaired academic performance and sleep disturbances.

In Turkey, the growing dependence on digital platforms is reflected by the transition towards e-government applications and the increase in distance education, especially during the COVID-19 pandemic [36,37]. According to Yılmaz, Aydoğdu, and Koçtürk (2022) [24], the pandemic has worsened internet and smartphone addictions among students, which are now more closely linked to mental health problems.

Research on IA indicates that there are no significant gender differences in addiction levels, although some studies suggest that males may have higher levels of addiction than females [38–44]. Moreover, addiction levels are significantly influenced by socio-economic status and the duration of online activity. Individuals from lower socioeconomic backgrounds and those who spend more time online are more susceptible to addiction [41,45].

The issue of IA among university students has become more prominent in the post-pandemic landscape. A comparative analysis of studies intends to reveal its multifaceted impacts on academic performance, psychological well-being, and social dynamics. The studies showcase varied perspectives and findings across different cultural and educational contexts. Salubi and Muchaonyerwa (2023) [46] investigate the prevalence of IA among postgraduate students in a South African university setting. They find a significant correlation between extended internet usage and addiction levels. The study highlights the need for educational interventions and suggests that librarians can play a role in promoting digital literacy and responsible internet use. Gu et al. (2023) [47] examine the relationship between IA, loneliness and academic burnout among Chinese university students. Their findings suggest that loneliness plays a partial mediating role in the effect of IA on academic burnout, highlighting the psychological basis of this dependency and its direct impact on students' academic engagement. Zafar (2023) [26] examines the relationship between IA, online gaming and family functioning in Karachi, Pakistan. The study finds a strong correlation between family dynamics and online gaming addiction, suggesting that family relationships play a crucial role in mitigating or exacerbating IA among students. Shek, Chai and Zhou (2023) [48] examine the risk and protective factors associated with IA during the pandemic in Hong Kong. The research highlights the impact of COVID-19-related stress on IA and suggests the need for comprehensive support systems to address the psychological challenges faced by students. Çimşir and Akdoğan (2023) [49] examine the mediating role of emotion dysregulation in the relationship between inferiority and IA among Turkish university students. The study suggests that emotional dysregulation is a significant factor in the development of IA. Therefore, addressing emotional well-being is crucial in combating this issue. Hamid et al. (2023) [50] investigated the addiction to medical websites and its potential link to illness anxiety disorder among Arabian youth after the COVID-19 pandemic. The study highlights a significant correlation between health-related IA and hypochondriasis, emphasizing the necessity for awareness and intervention in health-related internet usage. Miškulin et al. (2023) [51] examine the effects of the COVID-19 pandemic on IA among Croatian university students. The longitudinal study shows a significant increase in moderate and severe IA rates during the pandemic. This points to the profound impact of pandemic-related stressors on students' internet use patterns. Albikawi (2023) [52] investigates the predictors of cyberbullying and cybervictimization among female nursing university students in Saudi Arabia. The study establishes a correlation between IA and an elevated risk of cyberbullying and victimization, highlighting the crucial requirement for cyber wellness education and support systems within academic institutions. Zulkifli and Mohamed (2023) [53] investigate the relationship between IA, mental health, and suicidal behavior among undergraduate students in Malaysia. Their findings show a significant association between IA and adverse mental health outcomes and highlight the urgent need for mental health services and interventions targeting IA. Rim et al. (2023) [54] examine the relationship between IA and attachment styles among Tunisian medical students. The study shows that IA is associated with academic failure and low self-esteem. This highlights the importance of tailored interventions that take into account students' psychological profiles and attachment styles. Zhukova et al. (2023) [55] examine the relationship between personality traits and the level of IA among students of pedagogical universities. Their findings highlight the role of individual differences in susceptibility to IA and the importance of personalised approaches in prevention and treatment efforts. Finally, Mahato et al. (2023) [56] examine the association between cognitive failure and IA among high school students in West Bengal, India. The study highlights the detrimental effects of IA on students' cognitive functioning and academic performance. It emphasises the importance of educational strategies that promote cognitive flexibility and healthy internet use habits. In conclusion, these studies provide a detailed understanding of the complex dynamics of IA in education. A multidisciplinary approach involving educators, families and mental health professionals is necessary to create a supportive and resilient academic environment for students striving to meet the challenges of the digital age.

Therefore, there is a critical need for educational policies and programmes that promote digital literacy and healthy online habits to address IA. As the digital environment evolves, it is important to promote a balanced and healthy digital life for students and society. This is a global challenge, as seen in countries like South Korea and Malaysia, which have taken measures to combat IA, especially among young people. A concerted international effort is necessary to address this challenge.

3. Research questions

RQ1. What are the levels of loss of control, desire to stay online more, negativity in social relationship, and IA among university students?

RQ2. Is there a significant correlation between IA and perceived academic success, attendance status, the duration of regular use of the internet, income level, grade level and daily internet usage time of university students?

RQ3. Is there a significant difference in IA levels according to ...

- a. ... gender, education type, personal computer ownership,
- b. ... family income, accommodation, academic unit, grade level, perceived academic success, daily internet usage time of university students?

RQ4. Are there any effects of daily internet usage time, communicative internet usage frequency and duration of regular internet use on the likelihood that participants have IA?

4. Methodology

This section provides information about the research model, the population and sample, the data collection tool and the process.

4.1. Research model

In this study, quantitative data were collected to understand whether students have IA, as well as which factors are correlated with it and whether different variables are among the causes of this addiction. Using these data, various statistical analysis techniques were applied to explore the relationship between university students' IA and academic and social factors. In the first stage, a scale was distributed to assess students' level of IA. This approach is consistent with general data collection methods in quantitative research [57].

Table 1a
Nominal Demographics of sample.

Academic units	N	%
Faculty of Arts and Sciences	172	15.1
Vocational School of Health Services	372	32.7
School of Physical Education and Sports	52	4.6
Faculty of Architecture and Engineering	127	11.2
Adilcevaz Vocational School	116	10.2
Islamic Sciences Faculty	34	3.0
Tatvan Vocational School	156	13.7
Hizan Vocational School	92	8.1
Others	16	1.4
Personal computer ownership	N	%
Yes	242	21.3
No	895	78.7
Duration of Regular Internet Use	N	%
Primary school	47	4.1
Middle school	116	10.2
High school	445	39.1
Post-secondary classroom	203	17.9
Bachelor's degree	326	28.7
Total	1137	100
Income Level	N	%
Low	334	29.4
Medium	793	69.7
High	10	0.9
Perceived Academic Success	N	%
Low	163	14.3
Moderate	874	76.9
High	100	9.8
Total	1137	100

The raw data obtained were divided into three categories according to the high level of dependency scores, and first a descriptive statistical analysis such as mean and standard deviation for dependency levels was used to reveal the general situation of the group towards IA. This step was carried out in accordance with the principles outlined by Trochim and Donnelly (2006) [57], who emphasise the importance of summarising data in order to understand central trends and variability in the data set. The research then continued with correlational analysis using the Spearman-Brown correlation coefficient as suggested by Cohen et al. (2003) [58]. This method was used to examine the relationships between students' IA levels and various factors such as academic achievement and daily internet use, and to provide information about the direction and magnitude of these relationships. Next, analysis of binary and multiple variables was carried out according to the methods described by Agresti [59]. This analysis helped to understand how IA varied across different demographic and behavioural categories. Finally, binomial logistic regression was used to determine the effects of DIUT, CIUF and DoRU on participants' likelihood of having IA.

The use of these different statistical techniques has enabled a comprehensive analysis of IA among students, as confirmed by the references mentioned above. This model not only captures the multifaceted nature of internet addiction, but also provides insights that are crucial for developing informed educational strategies and policies.

4.2. Population and sample

The population consists of students studying in different academic units of a state university in the East Anatolian region of Turkey in the spring semester of the 2020–2021 academic year. The data were collected from all units that could be reached on a voluntary basis using a simple random sampling method [60]. As the data collection was attempted during the pandemic period, it was not possible to access students directly in their faculties. Therefore, data were collected through an online form. The nominal and ordinal demographic characteristics of the students included in the sample are presented in Table 1a and Table 1b.

As seen in Tables 1a and 1b, the sample of the study consists of 1137 students randomly selected from the population. Of these, 682 (60%) were female and 455 (40%) were male. The majority of the students in the sample were enrolled in regular education programmes (88.7%) and resided in dormitories (61.6%). A significant proportion of the students did not have access to a personal computer (78.7%), and their income (69.7%) and academic performance were at moderate levels (76.9%).

Table 1b
Ordinal Demographics of sample.

	N	%
Gender		
Male	455	40.0
Female	682	60.0
Form of education		
Regular	1008	88.7
Evening	129	11.3
Accommodation		
With family	235	20.5
Dormitory	700	61.6
Lodgings	202	17.9
Daily internet usage time (hours)		
1–3	565	49.7
4–6	378	33.2
7–9	84	7.4
10 or more	110	9.7
Attendance Status		
I never miss classes.	136	12.0
I sometimes miss classes.	850	74.7
I use all allowed absences.	126	11.1
Sometimes I exceed allowed absences.	25	2.2
Grade level		
Fresher	401	35.3
Sophomore	399	35.1
Junior	245	21.5
Senior	54	4.7
Fifth Graders	6	0.5
Postgraduate	32	2.8
Total	1137	100

4.3. Data collection tool

The researchers employed a two-part tool to collect data. The first part gathered demographic information of the participants, while the second part used the 'Internet Addiction Scale (IAS)'. The IAS, developed by Hahn and Jerusalem in 2001 and adapted into Turkish by Sahin and Korkmaz in 2011 [61], comprises 19 items distributed into three dimensions. The survey includes three categories: 'Loss of Control' (7 items), 'Desire to Spend More Time on the Internet' (4 items), and 'Negativity in Social Relationships' (8 items). Respondents rated their experiences on a scale of 1 (never) to 5 (always).

The reliability of the scale was assessed using multiple coefficients: Spearman-Brown reliability coefficient (0.767), Guttman Split-Half coefficient (0.765), and Cronbach's alpha (0.858). The correlation between the factors ranged from 0.758 to 0.808. Spearman-Brown values ranged from 0.862 to 0.894, Guttman split-half values ranged from 0.841 to 0.890, and Cronbach's alpha values for each sub-dimension ranged from 0.887 to 0.926.

The overall Cronbach's alpha reliability coefficient for the research data is 0.941. The Cronbach's alpha coefficients for the sub-dimensions of the scale are as follows: 0.877 for 'Loss of Control', 0.891 for 'Desire to Stay Online More', and 0.916 for 'Negativity in Social Relationships'. These findings indicate a high level of reliability for both the scale as a whole and its individual sub-dimensions, with Cronbach's alpha values ranging from 0.877 to 0.916.

The provided visual representation in Fig. 1 and corresponding statistics offer insights into a Confirmatory Factor Analysis (CFA) conducted to examine latent constructs related to IA. The CFA model comprised three factors: 'Loss of Control', 'Desire to Stay Online More', and 'Negativity in Social Relationships', each measured by a series of observed variables (m1 to m19).

The chi-square test for exact fit was significant ($\chi^2(149) = 1003, p < 0.001$). This statistic traditionally suggests a lack of fit between the hypothesized model and the observed data. However, it is important to note that this statistic is sensitive to sample size. Therefore, it is advisable to rely on additional indices to assess model fit.

The Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) were 0.937 and 0.928, respectively. Both indices are above the accepted threshold of 0.90, indicating a good fit between the model and the [62]. The Standardized Root Mean Square Residual (SRMR) was reported as 0.0473, which is well below the threshold of 0.08, indicating a good fit [62]. The Root Mean Square Error of Approximation (RMSEA) was 0.0710, with a 90% confidence interval of 0.0669–0.0752. Although it is slightly above the preferred benchmark of 0.06, it is still below the upper limit of 0.08, indicating a reasonable error of approximation and an acceptable fit [63].

The path coefficients of the model, represented by the standardized regression weights, ranged from 0.70 to 0.92, indicating a strong association between the observed variables and their respective latent constructs. The high magnitudes of these coefficients suggest that the latent constructs are well-represented by the observed variables.

Additionally, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) values of 52375 and 52677,

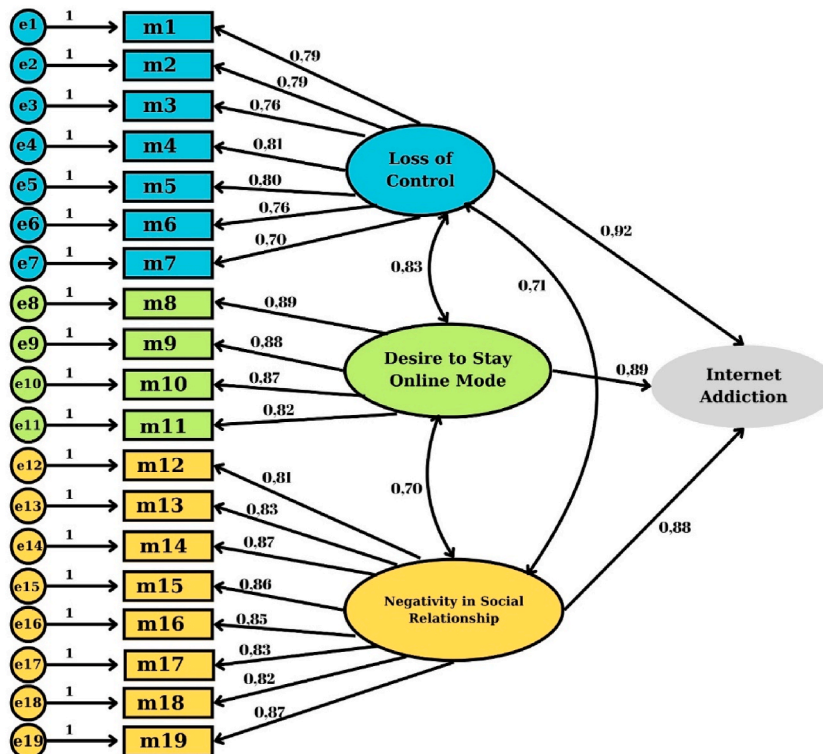


Fig. 1. CFA results for IAS.

respectively, provide useful information for comparing models. However, it is important to note that they are more effective when comparing competing models.

In conclusion, despite the significant chi-square statistic, the overall fit indices (CFI, TLI, SRMR, RMSEA) indicate that the model fits the observed data acceptably. It is important to note that model fit is only one aspect of model evaluation. Other factors that should be considered when interpreting the model’s adequacy include its theoretical underpinnings, the reliability of the measures, and the potential for cross-validation.

4.4. Process

Before collecting data, approval from the ethics committee was obtained to ensure adherence to established research ethical standards. The study was based on voluntary participation, and all participants were thoroughly briefed on the research objectives, the voluntary nature of their involvement, the option to withdraw at any time without consequences, and the strict confidentiality of the information provided. Informed consent was obtained from all participating students.

Data was collected in the spring semester of the 2020–2021 academic year. Participants completed online questionnaires on their mobile devices, following explicit instructions on how to fill the items. The survey typically took between 10 and 15 min to complete. The initial organization of data was done using Microsoft Excel, followed by a detailed analysis using the Jamovi software package.

The analysis began by calculating central tendency and dispersion measures to examine the data. Tests for normality and homogeneity of the distribution were then conducted. Only after ensuring that the dependent and independent variables met the assumptions, causal comparative, correlational, and predictive statistical methods were used to address the study’s sub-questions.

To interpret the results within the sample, score ranges and corresponding dependence levels were calculated. Each item on the scale was given a score between 1 and 5, and percentages were calculated for each score to compare them in a meaningful way. The percentage for the mean score interval was set to 26.66, assuming equidistant intervals ((100-20)/3). IA was classified into three levels: low (0–46.66), medium (46.67–73.32), and high (73.33–100).

This structured approach to data analysis highlights the methodological rigor employed, ensuring that the findings of this study provide valuable insights into the patterns and implications of IA among students.

5. Results

This section presents the results of the analysis conducted to achieve the research objectives. Firstly, we examine the classification of students according to their levels of IA. The following is a detailed breakdown of subcategories of IA, along with corresponding percentages and frequencies of students identified as addicted, at-risk, or non-addicted. Additionally, the analysis includes correlation coefficients of IA for ordinal variables, such as perceived academic success, attendance, grade level, income group, regular internet usage time, and daily internet usage time. The following section presents the results of the causal comparative analysis for nominal variables, including gender, type of education, personal computer ownership, income level, accommodation type, academic department, grade level, perceived academic achievement, and daily internet use measured in hours.

Finally, the analysis includes whether the variables of daily internet usage time, regular internet usage time, and internet use for entertainment/communication purposes predict IA.

5.1. Internet addiction levels of university students

This section presents a statistical analysis of university students’ IA levels. It examines various dimensions of IA, such as Loss of Control, Desire to Stay Online Longer, and Negativity in Social Relationships. To understand how many students are affected by addiction, a quantitative assessment is conducted to provide an understanding of the prevalence and severity of IA in these subgroups. These data are crucial for identifying individuals at risk and formulating targeted interventions. Descriptive statistics about IA levels of university students are given in [Table 2](#).

Upon examination of the data in [Tables 2](#) and it is evident that the mean scores of university students on the Loss of Control (LoC) and Desire to Stay Online More (DtSOM) dimensions of the Internet Addiction Scale suggest a tendency towards the risk group in terms of IA. Furthermore, the mean scores of the Negativity in Social Relations (NiSR) dimension and the overall score indicate that a significant proportion of the students are not addicted. Based on the findings, it can be concluded that around 63.5% of the surveyed

Table 2
Internet addiction levels of university students.

Internet Addiction (IA) Dimensions	N	\bar{x}	SD	Levels					
				Not addicted		Risk group		Addicted	
				n	%	n	%	n	%
Loss of Control (LoC)	1137	49.0	17.1	593	52.2	437	38.4	107	9.4
Desire to Stay Online More (DtSOM)	1137	52.3	20.9	504	44.3	417	36.7	216	19.0
Negativity in Social Relations (NiSR)	1137	34.3	16.2	904	79.5	196	17.2	37	3.3
Overall	1137	43.5	15.4	722	63.5	373	32.8	42	3.7

students were non-addicts according to their overall scores, while approximately 40% were considered dependent. The highest level of addiction was reflected in the DtSOM dimension, which accounted for 19%, while the addiction levels in other sub-dimensions appeared to be more manageable.

5.2. Correlations between internet addiction and the variables

The Pearson correlation reveals the relationship between IA and a set of ordinal variables, such as perceived academic achievement, attendance, regularity of internet use, income level, grade level, and daily internet use time. The upcoming chart presents the results that shed light on the nature and degree of these relationships. The evaluation of 1137 participants provided insight into the interplay between IA and various academic and behavioral factors. Monotonic relationships were detected through visual inspection of the scatter plot, while Pearson correlations were used to measure these relationships. Fig. 2 is set to present these correlations and provides a statistical map of how IA is related to important aspects of student life.

As shown in Fig. 2, the correlation matrix provides statistical information about the relationships between IA and various variables related to students' academic and daily experiences. It explains how IA interacts with perceived academic success (PAS), attendance (AtS), regular internet usage time (DoRU), income level (IL), class level (GL) and daily internet usage time (DIUT). The matrix shows that there is a significant negative correlation between IA and perceived academic success (PAS) ($r = -0.100, p < .001$). This suggests that higher levels of IA may be associated with lower levels of PAS. Conversely, there is a significant positive correlation between IA and attendance (AtS) ($r = 0.157, p < .001$), suggesting that students with lower attendance rates may experience higher levels of IA. The analysis shows a significant negative correlation between IA and DoRU ($r_s = -0.106, p < .001$). This suggests that longer periods of regular internet use are associated with lower levels of addiction, potentially reflecting more integrated and balanced use of the internet in daily routines. However, there does not appear to be a significant correlation between IA and income level (IL) ($r_s = 0.039, p = .188$) or grade level (GL) ($r_s = 0.024, p = .413$). The analysis indicates that the levels of IA among students in this sample are not noticeably impacted by socioeconomic and academic variables. Additionally, a significant positive correlation between IA and DIUT ($r_s = 0.313, p < .001$) was found, which is one of the strongest correlations in the matrix. This suggests a robust relationship where higher internet usage times are strongly associated with higher levels of IA. In summary, the matrix indicates that certain academic and behavioral factors are significantly associated with IA. This provides insights into the complex interplay between students' online habits and their academic engagement and achievement.

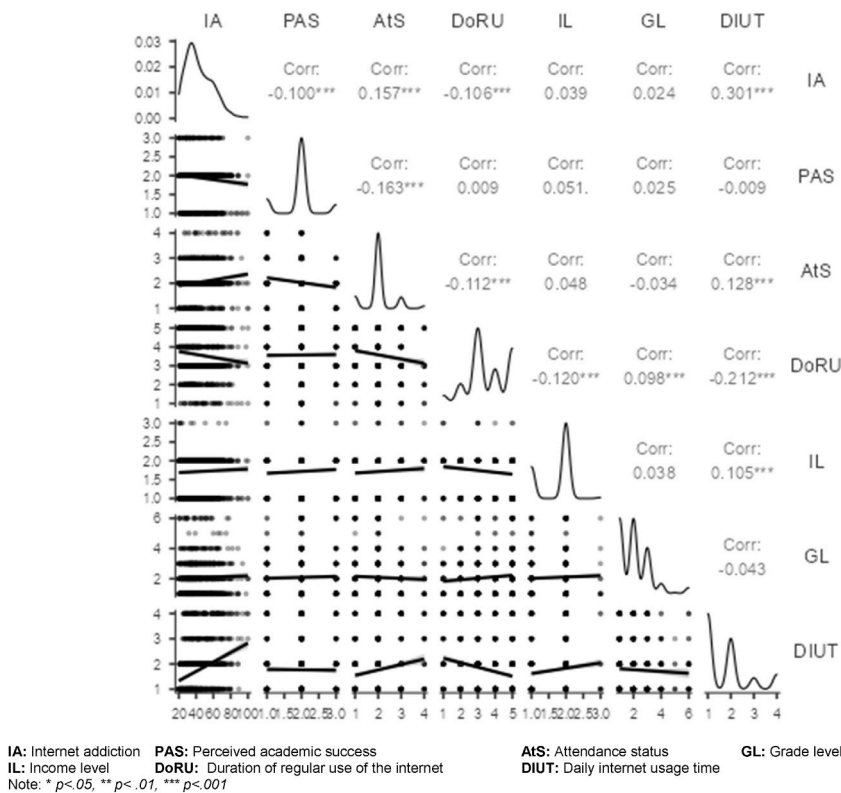


Fig. 2. Pearson correlations of internet addiction and the ordinal variables. IA: Internet addiction PAS: Perceived academic success AtS: Attendance status GL: Grade level. IL: Income level DoRU: Duration of regular use of the internet DIUT: Daily internet usage time. Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

5.3. Causal comparisons according to nominal variables

The third research question investigates the variables that differentiate IA. To answer this question, Mann-Whitney U tests were conducted for dichotomous variables and Kruskal Wallis H tests were conducted for other variables. The results of the analyses are presented under two subheadings.

5.3.1. Differences of internet addiction according to the dichotomous variables

Examining variations in internet addiction (IA) levels across different binary variables is another aspect of this study. The following analysis, presented in Table 3, employs the Mann-Whitney U test to ascertain whether there are any significant differences in IA scores among genders, students in mainstream and secondary education programs, and computer owners versus non-owners. To assess the impact of these categorical variables on IA, we analyzed the distribution of IA scores among the aforementioned groups. Medians were used to compare the central tendency of IA in each subgroup. The Mann-Whitney U statistic and corresponding p-values were used to measure the significance of observed differences.

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To assess the impact of these categorical variables on IA, we analyzed the distribution of IA scores among the groups. Medians were used to compare the central tendency of IA in each subgroup. The Mann-Whitney U statistic and corresponding p-values were used to measure the significance of observed differences.

The analysis revealed that IA medians had similar distributions across all groups examined. This shows that variables such as gender, type of education and computer ownership do not have a significant effect on the IA levels of the participants. The median IA score for men (41.1) and women (40.0) showed no statistically significant difference ($U = 149953$, $p = .338$). Additionally, the types of education were not different in terms of regular (median = 40.0) and secondary education (median = 40.0) types of education ($U = 63125$, $p = .590$). Using the full sampling distribution for U, owning a computer did not lead to a significant difference in IA scores between computer owners (41.1) and noncomputer owners (40.0) ($U = 105035$, $p = .472$ [64]. These results show that internet addiction is consistent among these variables in the sample.

5.3.2. Differences of internet addiction according to polytomous variables

The Kruskal-Wallis tests are useful for examining the variances in internet addiction (IA) across a range of polytomous variables. The analysis in Table 4 scrutinizes differences in IA scores among subgroups based on income level, type of accommodation, academic unit, grade level, perceived academic success, daily internet usage time, and attendance status. This assessment aims to identify patterns and relationships that can inform future educational and psychological interventions.

Each subgroup within the variables was compared with the median IA scores providing a central reference point. The Kruskal-Wallis test, a non-parametric method, was used because of its effectiveness in dealing with data that do not necessarily follow a normal distribution. This analysis is crucial in determining whether the observed median differences between groups are statistically significant.

The results show that IA scores are similarly distributed across most of the variables examined, with no significant differences. However, there are exceptions where some variables show significant differences. For example, there are statistically significant differences in median IA scores between different academic units and in daily internet usage time, as indicated by the corresponding p-values. These differences suggest that factors such as the department of study and the extent of daily internet engagement may influence students' susceptibility to IA. The analysis offers a detailed comprehension of the correlation between internet addiction and different academic and lifestyle factors among university students.

Upon closer in Table 4 examination of the Internet Addiction (IA) scores across various groups, it was found that the distributions were significantly diverse. This was initially indicated by a visual inspection of boxplots. The statistical analysis revealed significant differences in IA scores among various variables, including income levels ($\chi^2(2) = 7.71$, $p = 0.021$), academic departments ($\chi^2(8) = 15.7$, $p = 0.048$), perceived academic success ($\chi^2(2) = 8.94$, $p = 0.011$), and daily internet usage time ($\chi^2(3) = 94.8$, $p < 0.001$).

To explore these differences further, we conducted pairwise comparisons using Dunn's (1964) method, with a Bonferroni correction applied to account for the risk of type I error due to multiple comparisons. We set significance at a stringent threshold of $p < 0.001$. This post hoc analysis revealed significant differences in IA scores, especially between the groups with low (Median = 45.3) and medium (Median = 40.0) perceived academic success, and between the low and high (Median = 36.8) groups, both reaching the $p =$

Table 3

Mann-Whitney U test for internet addiction according to gender, education types and PC ownership variables.

	Variable	Groups	χ^2	Median	Statistics	df	p
Overall (IA)	Gender	Female	43.1	40.0	149953	1136	0.338
		Male	44.2	41.1			
	Education Types	Regular education	43.7	40.0	63125	1136	
		Evening education	42.4	40.0			
	PC Ownership	PC Owner	43.8	41.1	105035	1136	
		Non-PC	43.4	40.0			

Table 4
Kruskal Wallis Test analysis data on internet addiction by study variables.

Dimensions	Groups	N	x	Median	df	χ^2	p	Difference
Income Level	Low	334	42.4	37.9	2	7.71	0.021	None
	Middle	793	44.1	41.1				
	High	10	37.2	28.9				
Accommodation	With Family	235	43.9	42.1	3	5.21	0.157	None
	Dormitory	700	43.9	40.0				
	Lodgings	202	42.1	37.9				
Academic Unit	FAaS	172	41.5	39.5	8	15.7	0.048*	None
	VSoHS	372	44.9	40.0				
	SoPEaS	52	46.6	42.6				
	FoAaE	127	43.4	41.1				
	AVS	116	42.2	38.9				
	ISF	34	49.2	47.9				
	TVS	156	42.6	38.4				
	HVS	92	41.5	35.8				
	Others	16	43.8	40.6				
	Grade Level	Fresher	401	43.0				
Sophomore	399	43.4	40.0					
Junior	245	44.2	41.1					
Senior	54	45.0	41.1					
Fifth Graders	6	56.5	62.6					
Graduated	32	41.2	38.9					
Perceived Academic Success	Low	163	47.2	45.3	2	8.94	0.011*	1–2
	Middle	874	43.1	40.0				1–3
	High	100	41.3	36.8				
Daily internet usage time (hours)	1–3	565	39.4	33.7	3	94.8	<0.001	2–1
	4–6	378	45.3	35.8				3–1
	7–9	84	50.3	41.1				4–1
	10 or more	110	53.1	52.1				4–2
Attendance Status	NA	136	41.1	37.9	3	29.7	<0.001*	3–1
	ST	850	42.8	40.0				4–1
	FRoA	126	48.6	48.4				3–2
	EtR	25	55.1	53.7				4–2

0.001 level of significance. Similarly, significant differences were observed in IA scores between students who reported using the internet for '10 or more hours' (Median = 52.1) daily compared to those who used it for '4–6 h' (Median = 35.8) and '1–3 h' (Median = 33.7), with p-values below 0.001.

These findings suggest that students who perceive lower academic success and those who use the internet extensively are more susceptible to higher levels of internet addiction. However, no other group combinations showed significant differences in IA scores. This highlights that certain factors have a greater influence on the spectrum of internet addiction among university students.

5.4. Impact of internet usage on addiction likelihood

A binomial logistic regression was performed to ascertain the effects of DIUT, CIUF and DoRU on the likelihood that participants have IA. Linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied using all six terms in the model resulting in statistical significance being accepted when $p < 0.00625$ [65]. Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. In Table 5, there were four standardized residuals with a value of between 3.376 and 3.011 standard deviations, which was kept in the analysis.

As seen in Table 5, the logistic regression model was statistically significant, $\chi^2(3) = 52.80, p < 0.001$. The model explained 16.7% (Nagelkerke R^2) of the variance in IA and correctly classified 96.3% of cases. Of the four predictor variables only three were statistically significant: DIUT, CIUF and constant (as shown in Table 1). Increasing DIUT or CIUF was associated with an increased likelihood of exhibiting IA.

Table 5
Logistic regression predicting likelihood of internet addiction based on DIUT, DoRU and CIUF.

	B	SE	Wald	df	p	Odds Ratio	95% CI for Odds Ratio	
							Lower	Upper
DIUT	-0.146	0.145	1.005	1	0.316	0.86	0.650	1.150
DoRU	0.532	0.154	11.940	1	<0.001	1.70	1.259	2.301
CIUF	1.024	0.259	15.700	1	<0.001	2.79	1.678	4.623
Constant	-7.045	1.055	44.553	1	<0.001	0.00		

6. Discussion

The comparison of the current research findings on IA among university students with existing literature offers a nuanced perspective on this multifaceted issue. This discussion aims to compare the levels of addiction highlighted in the research with related studies, while acknowledging both similarities and differences. Furthermore, it attempts to synthesize a comprehensive understanding using a rhetorical method.

The research finding that university students' mean scores on the Loss of Control (LoC) and Desire to Stay Online More (DtSOM) dimensions of the Internet Addiction Scale lean towards the risk group for internet addiction is consistent with the broader understanding of addiction as encompassing both substance abuse and behavioural patterns, particularly as internet use escalates [30,32].

This alignment is further supported by the characterisation of IA as a psychological dependence characterised by increased engagement in online activities, discomfort when offline, and tolerance to the effects of being online, as described by Kandell (1998) [28] and supported by Dowling and Quirk (2009) [31], Jiang and Leung (2011) [32], and Shaw and Black (2012) [66].

In contrast, it is worth noting that the influence of cultural and educational contexts on IA cannot be ignored, as evidenced by the comparison of this study's findings with those from other contexts. For instance, Salubi and Muchaonyerwa's (2023) [46]. investigation in a South African university setting revealed a significant correlation between prolonged internet usage and addiction levels, which aligns with the findings of the current research. However, a study conducted by Zafar (2023) [26] in Karachi, Pakistan, shows that there may be an association between family dynamics and online gaming addiction. This highlights the potential influence of cultural values and family structures on the prevalence of IA.

The synthesis resulting from this comparative analysis suggests that a multidisciplinary approach to internet addiction may be necessary. Both the current research findings and the literature review suggest that IA is a complex phenomenon shaped by an interplay of social, cultural, and educational factors. Therefore, addressing IA requires collaboration among educators, families, and mental health professionals to create a supportive and resilient academic environment for students navigating the challenges of the digital age. The synthesis resulting from this comparative analysis shows that a multidisciplinary approach to Internet addiction may be necessary. Both the existing research and the literature review indicate that IA is a complex phenomenon shaped by the interaction of social, cultural and educational factors. Therefore, addressing IA requires collaboration between educators, families, and mental health professionals to create a supportive and flexible academic environment for students to navigate the challenges of the digital age.

In conclusion, the comparative analysis of existing research and relevant literature provides a comprehensive perspective on IA. While similarities highlight universal aspects and common struggles against IA, differences highlight the need for solutions that are tailored to individual, social and cultural contexts. This discussion argues for an inclusive approach that recognises the multifaceted nature of IA and tailors interventions to the different needs and backgrounds of those affected.

Based on existing research, college students tend to score in the average range on the Loss of Control (LoC) and Desire to Stay Online (DtSOM) dimensions of the Internet Addiction Scale. This may indicate a potential risk for IA. It is worth noting that the majority of students surveyed, approximately 63.5%, were classified as non-addicted based on their total scores. However, it is important to note that approximately 40% of the students were classified as dependent, and the highest level of dependence was observed on the DtSOM dimension at 19%. This study examines the relationship between levels of dependence and various factors in students with IA.

The topic of investigating the relationship between addiction levels and certain behaviors or demographic factors in IA research has been widely explored. The findings of this study align with the broader literature, indicating a nuanced spectrum of IA among individuals. For example, Kandell (1998) [28] defines IA as increased online activity, restlessness when offline, and tolerance to the effects of being online. Similarly, in this study, addictive characteristics were observed in a significant proportion of the population, particularly in the DtSOM dimension.

However, it should be noted that the results of this study may differ from those in other cultural and educational contexts. This difference may be due to a number of factors, including differences in methodology, cultural contexts and demographic characteristics of the study populations. For example, studies conducted in different parts of the world, such as Salubi and Muchaonyerwa (2023) [46] in South Africa and Zafar (2023) [26] in Pakistan, show different levels of IA. This suggests that there may be cultural differences and different patterns of internet use. In addition, the text refers to access to digital technologies.

The synthesis of existing research with the literature shows that while there are commonalities in how IA manifests among college students, the extent and nature of this addiction is strongly influenced by contextual factors. These factors include cultural norms, access to technology, socio-economic status and individual psychological characteristics. The observed variability in the extent of addiction and its association with different factors across studies highlights the need for a contextualised understanding of IA. It is clear that a one-size-fits-all approach to IA may not be effective; instead, interventions should be tailored to the specific needs and conditions of different populations.

In summary, the existing research and literature highlights both universal and unique aspects of internet addiction. While the core features of IA remain consistent, the degree to which individuals are affected and the specific dimensions of addiction that are most prominent can vary significantly depending on a number of factors. It is recommended that multidisciplinary and culturally sensitive approaches be adopted in research and interventions aimed at addressing IA. It is important to recognise the multifaceted nature of IA in order to develop effective strategies to reduce its impact on individuals and society.

Juxtaposing existing research findings with the broader literature on IA reveals a rich tapestry of insights into the prevalence, predictors and impact of IA in different contexts. The current research shows that variables such as gender, level of education and computer ownership do not significantly affect the level of IA among participants, and that IA is evenly distributed across these demographic characteristics. This finding contrasts with various conclusions drawn from the literature, where factors such as socio-economic status, educational context and psychological well-being are often associated with levels of internet addiction. This

discussion aims to synthesize these findings by exploring the reasons for the observed similarities and differences using a rhetorical method.

The research suggests that IA is a common problem across different demographic groups, regardless of gender or level of education. This is consistent with the existing literature, which highlights the global accessibility of digital platforms as a driving force behind the widespread nature of internet addiction [2,3]. For example, the COVID-19 pandemic has had a widespread impact on the level of digital engagement worldwide. This has drawn attention to the potential risk of IA regardless of demographic factors [1,2].

The literature review discusses the influence of contextual and demographic variables on levels of IA. Several studies have identified various factors, including socio-economic status, educational demands and psychological factors, as significant predictors of IA [19,20,27]. These studies suggest that IA is widespread, but its intensity and manifestation may vary considerably due to individual and contextual differences. This raises questions about the potential role of factors not considered in the current research, such as psychological well-being and socio-economic status, in mediating IA.

The findings from the current research and literature suggest a nuanced understanding of internet addiction. It is important to acknowledge the general risk of internet addiction across different demographics, while also recognizing the complex interplay of individual, contextual, and socio-economic factors in determining addiction levels, as highlighted in the literature. Internet addiction is a complex phenomenon that can be better understood and addressed through a multidimensional approach.

It is important to consider methodological differences, the scope of variables examined, and the populations studied when interpreting discrepancies between current research and literature. While gender and computer ownership may not have a direct correlation with internet addiction in the current study's sample, it is important to acknowledge that other unexamined factors, such as psychological well-being, socio-economic status, or specific internet usage patterns, may play a crucial role in other contexts. Therefore, it is essential to consider these factors when examining internet addiction to gain a more comprehensive understanding of the issue.

In conclusion, it can be observed that the dialogue between current research findings and the broader literature highlights the intricate nature of internet addiction as a global phenomenon with local nuances. It is imperative to take into account a wide range of factors, including demographic variables, in order to gain a comprehensive understanding of and address internet addiction. Future research could benefit from exploring the nuances of internet addiction further, using a holistic and multidisciplinary approach. This could help to unravel the complex web of factors that contribute to this issue. A comprehensive understanding is crucial for developing targeted interventions that address the specific needs and challenges of diverse populations in the digital age.

This text also presents a comparison of existing research findings on the distribution of college students' Internet Addiction (IA) scores with the broader literature, emphasizing the multifaceted nature of internet addiction. A rhetorical approach is employed to examine the similarities and differences between these findings, supported by statistical evidence of significant differences in IA scores based on income levels, academic majors, perceived academic achievement, and daily internet usage time. This comparison emphasizes the complex interplay of individual, contextual, and behavioral factors that contribute to internet addiction, thus improving our understanding of this multifaceted phenomenon.

Research shows that internet addiction is a complex issue, as there are significant differences in IA scores across different demographic characteristics and behaviours. It is necessary to draw attention to the role of perceived academic performance and intensive internet use in this issue. Internet addiction is a complex issue influenced by various socio-economic factors, educational demands, psychological well-being and levels of digital engagement [1–3]. Evidence from both existing research and the literature shows that internet addiction is multifaceted and goes beyond simplicity.

Several variables have been identified in the literature as important determinants of internet addiction, including income level, academic major, perceived academic achievement and daily internet use [8,9,41]. In addition, family dynamics, technological stress and mental health problems have been introduced as additional variables. It should be noted that these variables should be taken into account when examining internet addiction in its context. The heterogeneity of research approaches and findings in internet addiction studies is highlighted by this inconsistency in focus. This suggests that a comprehensive understanding of internet addiction requires consideration of a wider range of variables, although certain factors may have a more significant impact in certain contexts.

A synthesis of existing research and literature shows that internet addiction is influenced by both individual characteristics and contextual factors. This study highlights that there are significant differences in IA scores due to perceived academic achievement and heavy internet use; this means that personal behaviour and self-perception have a direct impact on internet addiction. On the other hand, the literature review provides a broader understanding of these behaviours by placing them within a socio-economic, educational and psychological framework.

This synthesis highlights the importance of a holistic approach to tackling internet addiction, taking into account both the micro-level effects identified in existing research and the macro-level factors discussed in the literature. The text highlights the importance of educational interventions, digital literacy programmes and mental health services that are tailored to the individual's specific needs and circumstances. It also recognises systemic issues such as socio-economic inequalities and education policy.

In conclusion, the comparison of existing research and the literature review highlights the complex nature of internet addiction as a result of the interaction of multiple factors. The multifaceted nature of effective strategies to alleviate internet addiction suggests that it is important to integrate individualised support with broader systemic changes. This comprehensive approach is crucial to developing resilient educational and social environments that promote healthy digital engagement and reduce the risks of internet addiction.

The current research findings provide a quantitative insight into the predictive power of various factors on Internet Addiction (IA) through logistic regression analysis. The statistical significance of the logistic regression model and its ability to explain some of the variance in IA provides an opportunity to compare these findings with themes and findings from the broader literature on internet addiction. This rhetorical discussion aims to explore the connections, differences and implications of these findings in the context of

current research.

The logistic regression model identified Daily Internet Use Time (DIUT) and Communicative Internet Use Frequency (CIUF) as significant predictors of IA, consistent with the existing literature's emphasis on behavioural patterns as central to understanding internet addiction. It is widely acknowledged that the quantity and compulsive nature of internet use are key determinants of addiction, as demonstrated by numerous studies. The literature review suggests that uncontrolled and excessive internet use, which can be influenced by socio-economic and psychological factors, may lead to addiction. This is supported by studies conducted by Liu et al. (2022a, 2022b) [2,3] and Touloupis & Athanasiades (2022) [1].

However, the broader literature introduces a more nuanced set of factors that influence IA, going beyond behavior to also include socioeconomic status, academic pressure, and psychological well-being. These studies suggest that internet addiction cannot be fully understood or addressed by focusing solely on internet usage patterns. Instead, they advocate a holistic approach that takes into account the interaction between individual behavior and the broader socio-economic and psychological context [8,9,41]. This perspective reveals gaps in the explanatory scope of the logistic regression model, suggesting that, although important, the model only captures part of the complex web of factors that contribute to impact assessment. Combining the results of the logistic regression model with the results of the literature search suggests a comprehensive understanding of internet addiction. The importance of DIUT and CIUF in predicting IA highlights the importance of behavioral patterns in the development of addiction. However, the broader context of the literature highlights the need to consider how these behaviours are embedded in and influenced by wider socio-economic and psychological environments. This synthesis argues for a comprehensive approach to the study and management of internet addiction that combines the rigour of quantitative models, such as logistic regression, with the depth of qualitative insights from a wide range of literature. Such an approach recognises the importance of behavioural indicators, while also acknowledging the important role of socio-economic and psychological factors. This highlights the need for interventions that target and address specific behaviours, such as DIUT and CIUF, as well as holistic interventions that consider the broader context in which these behaviours occur. In summary, the comparison of existing research and literature reviews suggests a multidimensional understanding of internet addiction that recognises the importance of both individual behaviour and broader situational factors. This integrated perspective is essential for developing effective strategies to prevent internet addiction and highlights the need for differentiated, multidimensional interventions tailored to the complex realities of individuals' lives.

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Compliance with ethical standards

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CRediT authorship contribution statement

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Hanife Gülhan Orhan Karsak: Writing – review & editing, Writing – original draft, Resources, Methodology, Data curation, Conceptualization.
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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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