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The relationship between social network addiction, online gaming addiction, and suicide ideation: mediating and moderating role of loneliness

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Abstract

Digital addictions, specifically social network addiction (SNA) and online gaming addiction (OGA), are emerging as major public health issues, particularly due to their potential links with mental health risks. While previous research has identified associations between these forms of behavioral addiction and increased feelings of loneliness, their role in influencing suicidal ideation (SI) remains less understood. The present study aimed to examine the correlations between SNA, OGA, and SI, with a focus on the mediating and moderating role of loneliness. Conducted as a cross-sectional, online study, we recruited 1,186 Turkish-speaking adults (68.1% female; $M_{\text{age}} = 25.51 \pm 8.10$) who completed self-report measures assessing SNA, OGA, SI, and loneliness. Results indicated that both SNA and OGA directly affected loneliness and SI. Loneliness directly impacted SI and partially mediated the correlation between SNA, OGA, and SI. Furthermore, loneliness moderated the effects of both SNA and OGA on SI, with these effects being more significant in individuals experiencing high levels of loneliness. These findings suggest that reducing SNA and OGA could be important for decreasing SI, particularly by addressing loneliness, which intensifies the impact of SNA and OGA on SI when elevated.

Keywords Social network addiction, Online gaming addiction, Suicide ideation, Loneliness, Turkish adults, Mediation-moderation analysis

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Introduction

Suicide represents a serious public health issue, closely intertwined with feelings of hopelessness, helplessness, and existential questioning. Suicide, a major global public health concern, is often perceived as an escape from intense emotional, physical, or social distress. Suicidal ideation affects millions annually, with higher prevalence in low- and middle-income contexts likely due to reduced access to mental health support, greater loneliness, and heightened psychosocial stressors [48, 61]. These conditions create an environment where early intervention is often unavailable, and emotional suffering goes unaddressed. As a result, many individuals progress from



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ideation to action, contributing to the global scale of the issue. According to the World Health Organization [70], approximately 800,000 people die by suicide every year, with one person taking their life every 40 s [58]. Millions more struggle with suicidal ideation annually, a number that continues to rise.

Based on these explanations, suicidal ideation is a globally prevalent phenomenon, and although rates vary by region, research shows that low- and middle-income societies report higher rates of suicidal ideation than those with higher socioeconomic status [27, 61]. These disparities suggest that economic, social, and psychological factors significantly shape suicide vulnerability. Given this, the present study controls for socioeconomic status while examining the psychological mechanisms linking social network addiction, online gaming addiction, and suicidal ideation. Prior studies have shown that lower socioeconomic status is correlated with greater loneliness, higher psychological distress, and reduced access to social support [39, 54], all of which are relevant to suicide risk.

Besides these, loneliness has emerged as a key psychological mechanism linking behavioral addictions to suicidal ideation [25]. Defined as a subjective experience of social disconnection, loneliness is understood to be closely associated with emotional vulnerability and reduced mental well-being [7]. Because excessive engagement in digital environments such as social networking platforms and online games can displace real-world social interactions, intensifying feelings of loneliness [30]. In this context, loneliness may function both as a mediating factor, explaining how social network addiction and online gaming addiction contribute to suicidal ideation, and as a moderating factor, amplifying the psychological impact of these addictions. This dual role is grounded in the Interpersonal Theory of Suicide (ITS), which identifies thwarted belongingness, a conceptual cousin of loneliness, as a key driver of suicidal ideation. By disrupting individuals' sense of connection and emotional security, loneliness may act both as a consequence of digital overuse and a vulnerability that magnifies its effects [4, 62]. These two domains—one socially oriented and feedback-driven, the other immersive and performance-based—represent distinct yet complementary digital behaviors, both of which are especially relevant to emotional detachment and mental health risks [6, 40]. In this context, loneliness may function both as a mediating factor, explaining how social network addiction and online gaming addiction contribute to suicidal ideation, and as a moderating factor, amplifying the psychological impact of these addictions.

The role of loneliness may also be shaped by socio-cultural context. Especially in Turkish society, collectivist values and family-centered norms emphasize social

cohesion, mutual obligation, and relational interdependence. When individuals perceive a loss of connection or fail to meet relational expectations, the psychological burden of loneliness may be particularly acute [5, 63]. Moreover, when digital interactions substitute face-to-face relationships, this may further erode traditional support structures, making loneliness more salient and distressing [28]. Considering these dynamics, understanding how cultural dynamics affect the pathways of social network addiction to suicidal ideation and online gaming addiction to suicidal ideation is thought to be important in terms of contextualizing the findings and developing culturally sensitive interventions.

At this point, suicidal ideation may be triggered by a range of psychological, relational, and behavioral factors, including mood disorders, social isolation, family stress, economic hardship, and addictive behaviors [17, 68]. While digital platforms offer convenience and connectivity, they may also foster perfectionism, unrealistic comparisons, and social withdrawal. Exposure to idealized content on social media, for example, can lead to feelings of inadequacy, low self-worth, and loneliness [14, 29], particularly in individuals prone to overuse. Similarly, competitive and immersive online gaming environments may disrupt real-world responsibilities and relationships, elevating suicidal ideation [8]. These risks highlight the need to evaluate the mental health impacts of digital behavior comprehensively. Indeed, also stigma surrounding mental health, loneliness, and suicide continues to be prevalent in Turkish society [24, 52]. In this context, individuals may use social networks or online games as emotional escape mechanisms. However, these platforms often lack the depth and authenticity of real-life social bonds, which can compound loneliness [28] and even increase suicidal ideation [50]. Identifying culturally specific drivers of digital overuse and understanding their psychological effects is essential for informing prevention strategies and public health initiatives targeting suicidal ideation among Turkish adults.

Theoretical background

As partially mentioned above, the ITS, which emphasizes that suicide arises from the interplay of personal and social factors, identifies two core psychological states as precursors to suicidal ideation: perceived burdensomeness and thwarted belongingness. Perceived burdensomeness refers to the belief that one is a burden to others and lacks value, while thwarted belongingness captures a subjective sense of alienation or lack of meaningful social connection. When both states co-occur, the risk of suicidal ideation increases significantly [22, 62].

In this study, we focus on thwarted belongingness, which aligns conceptually with loneliness, the main construct in our proposed model. Loneliness is understood as a subjective experience of social disconnection, emotional isolation, or unfulfilled interpersonal needs [69]. While perceived burdensomeness is acknowledged in ITS, it is not directly modeled or assessed in our current research and is therefore not included in our structural model. We conceptualize loneliness as both a mediator and a moderator in the relationship between social network addiction, online gaming addiction, and suicidal ideation. Theoretically, this dual role is grounded in ITS: loneliness, reflecting thwarted belongingness, can emerge as a consequence of addictive digital engagement (mediation) or act as a psychological vulnerability that shapes the strength of the relationship between behavioral addictions and suicidal ideation (moderation).

As a mediator, loneliness may develop due to excessive or compulsive use of social networks or online games, which replace real-life interactions and reduce emotional closeness [55]. Over time, this emotional disconnection may increase suicidal ideation. As a moderator, loneliness may intensify the impact of social network addiction or online gaming addiction on suicidal ideation by reducing coping resources and emotional resilience, making already vulnerable individuals more susceptible to suicide-related thoughts [43, 71]. Despite this theoretical justification, we recognize that assigning both roles to the same construct introduces complexity, especially within a cross-sectional design. Mediation assumes temporal sequencing i.e., that social network addiction/online gaming addiction leads to loneliness, which in turn leads to suicidal ideation. Moderation, on the other hand, assumes that loneliness is a pre-existing individual difference that influences the strength of the social network addiction–suicidal ideation or online gaming addiction–suicidal ideation relationship.

To address these concerns, we interpret the model as a theoretically driven exploratory framework, not a definitive causal structure. We employed statistical safeguards to mitigate overlap such as centering interaction terms and checking variance inflation factors to reduce multicollinearity. By focusing explicitly on thwarted belongingness and situating loneliness as its empirical proxy, our model presents a focused and theory-consistent application of ITS. This perspective is further supported by recent findings that link digital behavioral addictions to social disconnection and increased suicide risk [16]. Understanding loneliness as both an outcome of and amplifier for problematic digital engagement allows for a richer conceptualization of suicide pathways in digital-age contexts.

Digital behavioral addictions and suicidal ideation

With the growing popularity of social networking platforms and online games, concerns about their mental health impacts have intensified. Recent studies show that excessive or problematic engagement with these digital platforms known as social network addiction and online gaming addiction is linked to increased risk of psychological distress and suicidal ideation [47, 67]. Individuals immersed in these platforms may experience heightened exposure to idealized representations of others' lives, leading to feelings of inadequacy, diminished self-esteem, and emotional distress [64]. Both social network addiction and online gaming addiction may foster isolation from real-life relationships, thereby reducing protective social bonds and increasing vulnerability to suicidal ideation [8]. These relationships warrant serious consideration in light of ITS, which posits that disrupted belongingness is a proximal cause of suicidal thoughts. Understanding how addictive digital behaviors influence emotional well-being and suicide risk is vital for developing early intervention strategies, particularly among youth and emerging adults who represent the highest-risk groups for these behavioral patterns.

Digital behavioral addictions and loneliness

While digital tools can facilitate connection, excessive use, particularly through social networks and online games can paradoxically lead to greater loneliness. Research indicates that social network addiction and online gaming addiction are both associated with reduced real-life social interaction, lower emotional intimacy, and increased social isolation [21, 38]. Individuals who rely on virtual interactions may develop superficial or transient connections that do not fulfill deeper emotional needs. This may especially affect users who substitute digital platforms for in-person relationships, weakening their sense of social integration and increasing their vulnerability to loneliness [45]. Within the ITS framework, this dynamic reflects the experience of thwarted belongingness, which is directly tied to suicidal ideation. Our model posits that social network addiction and online gaming addiction can increase loneliness, which either mediates the relationship to suicidal ideation or exacerbates it as a moderator. This dual conceptualization highlights the emotional risks posed by problematic digital behavior in socially vulnerable populations.

Loneliness and suicidal ideation

Loneliness is a powerful predictor of psychological distress and is often implicated in the emergence of suicidal ideation. In a digitally connected world, individuals may find themselves physically surrounded but emotionally

isolated, especially when online relationships fail to provide genuine support or belonging [53]. Emotional loneliness, in particular, contributes to feelings of worthlessness and meaninglessness two well-known cognitive precursors to suicidal ideation [41]. Moreover, loneliness can impair coping resources, trigger negative self-appraisals, and lead to depressive symptoms [19], all of which increase psychological vulnerability. We position loneliness as a consequence of digital overuse (via social network addiction and online gaming addiction) that contributes to the development of suicidal ideation. While loneliness is shaped by both internal and external factors [37], its role in suicide risk is magnified in contexts where social comparison, emotional isolation, and perceived disconnection prevail. Consistent with ITS, our study targets thwarted belongingness as the active mechanism through which loneliness may lead to suicidal thoughts. By focusing on this single, theory-consistent pathway, we offer a model that is both theoretically sound and empirically actionable.

Current study

This study aims to investigate how common digital behavioral addictions, particularly social network addiction and online gaming addiction, affect suicidal ideation. For this purpose, the model shown in Fig. 1 was designed to examine both the potential mediating and moderating roles of loneliness in the relationship between social network addiction and online gaming addiction on suicidal ideation. Specifically, this study explores the influence of social network addiction and online gaming addiction on suicidal ideation, focusing on the mediating and moderating roles of loneliness. While this dual-role approach may appear conceptually ambitious, it is grounded in the ITS, which positions

loneliness as a manifestation of thwarted belongingness, a main factor influencing suicidal thoughts.

From a theoretical perspective, loneliness may function as a mediator when it is understood as an emotional consequence of excessive engagement in social networking platforms or online games, which may displace real-world social interactions and ultimately increase suicidal ideation. Conversely, loneliness may function as a moderator when considered a pre-existing vulnerability that magnifies the psychological impact of digital behavioral addiction on suicidal ideation. This moderating role is especially relevant for individuals whose heightened loneliness amplifies their sensitivity to the emotional disruptions caused by social network addiction and online gaming addiction. Mediation analysis assumes temporal ordering (i.e., social network addiction/online gaming addiction loneliness suicidal ideation), while moderation assumes that loneliness is a stable trait influencing the strength of the social network addiction/online gaming addiction-suicidal ideation relationship. By examining these correlations, the research seeks to clarify how digital behavioral addictions in the digital age may contribute to suicidal ideation, providing evidence for preventive mental health strategies. Past studies have consistently found that social network addiction and online gaming addiction are correlated with increased feelings of loneliness and, subsequently, with suicidal ideation [21, 36]. Based on this literature, the following hypotheses were developed:

H₁. Both social networking addiction and online gaming addiction have positive direct effects on loneliness and suicidal ideation.

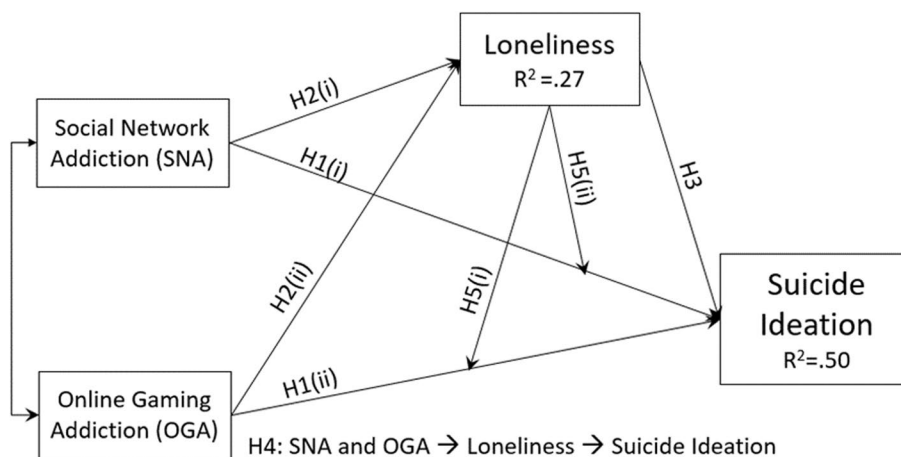


Fig. 1 Conceptual model of the research

H₂. Loneliness partially mediates the positive relationships between social networking addiction, online gaming addiction, and suicidal ideation.

H₃. Loneliness moderates the associations between social networking addiction and suicidal ideation, as well as between online gaming addiction and suicidal ideation, such that these associations are stronger at higher levels of loneliness.

Method

Participants and procedure

A total of 1,186 participants contributed to the research. Of these, 68.1% were female and 31.9% were male, with an average age of 25.51 years ($SD=8.10$). In terms of education, 22.6% had a high school education or below, while 77.4% held a university degree or higher. Reflecting a high proportion of students in our sample, 57% were not employed, and 43% were employed. Regarding family income, 12.5% reported low income, 22.2% below medium, 25.3% medium, 20.6% above medium, and 19.1% high. The average household size was 4.65 members ($SD=1.99$). The sample was recruited through convenience sampling within university networks, which resulted in a higher representation of younger adults and students.

Data collection occurred online with support from university students. The survey began with a clear explanation of the study's purpose and methodology, and participant consent was obtained before participation. Respondents were informed of their right to withdraw at any point, and no private or ID information was collected or stored. The average survey completion time was ~9 min. Initially, data were collected from 1,290 individuals, but 104 participants were excluded based on data quality criteria, including substantial missing data (more than 20% of items), failure on attention check items, or uniform response patterns (e.g., straight-lining). The final sample included 1,186 participants. This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of İstanbul University-Cerrahpasa (reference number: E-74555795–050.04–1149683), which reviewed and approved all research procedures.

Research design and data analysis

We employed a quantitative, cross-sectional study design and collected data via Google Forms. Data processing included numerical coding and redundant data cleaning in Excel, followed by importing the data into SPSS (v.23), where variables were recoded as needed. To assess construct validity and model fit, we conducted confirmatory factor analysis using AMOS (v.23). Next, we applied data imputation based on the

identified factor structure, creating a new SPSS dataset for frequency, reliability, mean, standard deviation, and correlation analyses.

For hypothesis testing, we applied structural equation modelling (SEM) with 5,000 bootstraps and a 95% confidence interval (CI) to estimate total, direct, and indirect effects. Mediation was tested using SEM pathways to assess whether loneliness explained the relationship between digital addictions (social network addiction and online gaming addiction) and suicidal ideation. To examine moderation, we used the SPSS Process Macro (Model 1) by Hayes [18], which allows for the assessment of interaction effects between digital addiction variables and loneliness on suicidal ideation. Given that loneliness serves both as a mediator and a moderator in our conceptual model, we took precautions to minimize potential multicollinearity and model instability. All interaction terms (e.g., social network addiction \times Loneliness) were mean-centered prior to multiplication to reduce collinearity. Variance inflation factors (VIFs) were examined and remained within acceptable thresholds ($VIF < 5$), suggesting that multicollinearity was not a major concern [35]. Nonetheless, we caution that some degree of statistical overlap between the loneliness main effect and its interaction term is inherent and may impact interpretability.

Importantly, we acknowledge that the cross-sectional design limits the ability to establish temporal precedence, which is a critical assumption in mediation models. While moderation does not require strict temporal ordering, the co-occurrence of both mediation and moderation paths for the same variable may reflect endogeneity, wherein unmeasured third variables (e.g., depression, emotional trauma) could confound both relationships. Besides, moderator analyses were performed, and two-way interaction effects were demonstrated using simple slope templates. To assess multicollinearity between predictors, particularly given the high correlation between suicidal ideation and online gaming addiction ($r=0.593$), we calculated VIFs, all of which fell below the threshold of 2.5, confirming that multicollinearity was not problematic.

Measures

In the personal information form, participants provided details on gender, age, educational status, marital status, employment status, current work status, family income, parental educational levels, and the number of family members. Family income and parental educational status were measured using a 5-point Likert scale. We then calculated the means of these three variables to create a socioeconomic status scale, which was included in our model.

The technology addiction scale

Aydın [2] includes 24 items divided into four sub-factors: social network addiction, instant messaging addiction, online gaming addiction, and website addiction. For this study, we focused solely on the social network addiction and online gaming addiction sub-factors. Sample items include statements like, “There are nights when I lose sleep to play online games” and “When I connect to social networks, I stay there longer than planned.” Responses were recorded on a 5-point Likert scale ranging from never (1) to always (5). The exploratory factor analysis conducted by the original author supports the structure of both subscales. The eight-item social network addiction subscale had an eigenvalue of 3.529, explaining 44.11% of the total variance, while the eight-item online gaming addiction subscale yielded an eigenvalue of 5.276, accounting for 65.94% of the variance. In terms of reliability, Aydın [2] reported Cronbach’s α coefficients of 0.79 for the social network addiction subscale and 0.90 for the gaming addiction subscale. In the present study, internal consistency was comparable, with Cronbach’s $\alpha=0.77$ for social network addiction and $\alpha=0.91$ for online gaming addiction, indicating strong reliability for both constructs.

The UCLA loneliness scale

Russell et al. [51] measures the degree of loneliness perceived by individuals, comprising 20 items on a 4-point Likert scale. Higher scores indicate higher levels of loneliness. The Turkish adaptation, with validation and reliability studies, was conducted by Demir [12]. For this study, we used the short form of the scale developed by Doğan et al. [13], which includes items such as “I have no friends” and “I am unhappy being so introverted.” Responses were recorded on a 5-point Likert scale ranging from never (1) to always (5). Cronbach’s α for the adaptation study was 0.72, indicating acceptable internal consistency reliability. The α value for the scale in this study was 0.84, indicating good internal consistency. To optimize model parsimony and fit in SEM, we used factor-based item parceling for the 20-item loneliness scale. A unidimensional CFA supported parceling, and items were grouped into three parcels based on factor loadings to represent the latent construct reliably.

The suicide probability scale

Cull & Gill [11] assesses suicide risk through 36 items. Responses are rated on a 4-point Likert scale: Never or rarely (1) to Most of the time or always (4), with higher scores indicating an increased likelihood of suicide risk. The scale comprises four factors: hopelessness (12 items), suicide ideation (8 items), negative self-evaluation

(9 items), and aggression (7 items). It has high internal consistency, with a Cronbach’s α of 0.93, and strong test–retest reliability ($r=0.92$). The Turkish adaptation and validation of the scale were performed by Batıgün and Şahin [3], who revised the suicide ideation factor to seven 7-item. Cronbach’s α values for the factors were as follows: 0.81 for negative self-evaluation, 0.71 for aggression, 0.73 for hopelessness, and 0.75 for suicidal ideation. In this study, we used this 7-item suicide ideation factor, achieving a Cronbach’s α of 0.89.

Although self-report measures inherently carry potential biases, such as social desirability and recall bias, steps were taken to maximize the reliability and validity of these data. The scales used in this study are well-established, widely validated instruments with strong psychometric properties. Each measure demonstrated high internal consistency in the current study and has shown acceptable test–retest reliability in prior research. To minimize social desirability bias, the survey was administered online, and participants were assured of anonymity and confidentiality, encouraging honest responses without fear of judgment. Moreover, the instructions emphasized that there were no right or wrong answers, reducing the pressure to respond in a socially desirable way. Given the short time frame required to complete the survey, recall bias was also minimized, as participants could answer quickly based on recent experiences or general feelings.

Results

Preliminary findings

We conducted a confirmatory factor analysis (CFA) to test the measurement model’s fit and assess construct validity. Subsequently, we applied SEM to analyze total,

Table 1 Measurement model and SEM path analysis values

Measure	Measurement model (CFA)	Structural model (SEM)	Recommended cut-off
CMIN/DF	2.968	3.025	< 5
CFI	.967	.959	> .90
SRMR	.042	.044	< .08
RMSEA	.041	.041	< .08
NFI	.951	.939	> .90
GFI	.952	.943	> .90
IFI	.967	.959	> .90
AGFI	.938	.928	> .90
TLI	.961	.951	> .90

Note. “Measurement Model (CFA)” values refer to fit indices for the confirmatory factor analysis, assessing the adequacy of the latent construct measurement. “Structural Model (SEM)” values represent fit indices for the structural equation model, evaluating the hypothesized paths between latent variables. All indices meet recommended thresholds, indicating acceptable to excellent model fit

direct, and indirect effects. As shown in Table 1, the measurement model demonstrated a good fit, with the following indices meeting established cut-off values: CMIN/DF=2.968, CFI=0.967, SRMR=0.042, RMSEA=0.041, NFI=0.951, GFI=0.952, IFI=0.967, AGFI=0.938, and TLI=0.961. For the SEM, the fit indices were similarly acceptable, with values of CMIN/DF=3.025, CFI=0.959, SRMR=0.044, RMSEA=0.041, NFI=0.939, GFI=0.943, IFI=0.959, AGFI=0.928, and TLI=0.951, all meeting Kline’s recommended cut-off criteria [26].

To examine the correlations between variables, we conducted a Pearson correlation analysis, as presented in Table 2. We found a strong and significant positive correlation between SNA and OGA ($r=0.59, p<0.01$). SNA was also moderately and significantly correlated with loneliness ($r=0.52, p<0.01$), and with SI ($r=0.52, p<0.01$). Furthermore, we found a moderate positive correlation between OGA and SI ($r=0.44, p<0.01$) and a strong positive correlation between loneliness and SI ($r=0.71, p<0.01$). OGA also showed a moderate, significant correlation with loneliness ($r=0.34, p<0.01$). Finally, we observed a modest but significant positive correlation between SES and education level ($r=0.13, p<0.01$).

SEM path analyses

To evaluate our research model, we performed a SEM path analysis. Results are presented in Table 3. All indirect effects were tested using bias-corrected bootstrapping with 5,000 resamples, and 95% CIs were computed to assess statistical significance. This analysis allowed to examine statistically significant direct, indirect, and total effects among the variables.

SNA had a significant positive effect on loneliness ($\beta=0.427, p<0.001$), while OGA also showed a smaller but still significant effect ($\beta=0.088, p=0.015$). Education and SES were both negatively associated with loneliness ($\beta= -0.116, p=0.001; \beta= -0.104,$

Table 3 Direct, total and indirect SEM analyses

Effects	Path	β	SE	CR	p
Direct effect	SNA → Loneliness	.427	.056	8.993	***
	OGA → Loneliness	.088	.033	2.439	.015
	Education → Loneliness	-.116	.03	-4.031	***
	SES → Loneliness	-.104	.021	-3.701	***
	Loneliness → SI	.504	.034	12.449	***
	OGA → SI	.15	.024	4.884	***
	SNA → SI	.177	.037	4.735	***
	Education → SI	-.086	.021	-3.557	***
	SES → SI	.013	.015	.549	.583
Total effect	Path	β	SE	95% CI	
	SNA → SI	.392	.044	.304—.485	
	OGA → SI	.194	.044	.112—.280	
Indirect effect	Path	β	SE	95% CI	
	SNA → Loneliness SI	.215	.024	.17—.264	
	OGA → Loneliness SI	.044	.022	.002—.084	

SNA Social Network Addiction, OGA Online Gaming Addiction, SI Suicide Ideation, SES Socioeconomic Status. Confidence intervals (CI) for indirect effects are based on 5,000 bootstrap samples at the 95% confidence level

$p=0.001$, respectively). Loneliness, in turn, positively predicted SI ($\beta=0.504, p<0.001$). Direct effects of SNA and OGA on SI were significant as well ($\beta=0.150$ and $\beta=0.177$, respectively, both $p<0.001$), while education negatively affected SI ($\beta= -0.086, p=0.002$). We also observed significant total effects of SNA and OGA on SI ($\beta=0.392, p<0.01; \beta=0.194, p<0.01$, respectively), and indirect effects mediated by loneliness: SNA SI ($\beta=0.215, p<0.01$), and OGA SI ($\beta=0.044, p<0.05$). These results support H₁, confirming that both SNA and OGA have significant positive direct effects on loneliness and SI. Moreover, they also support H₂, indicating that loneliness partially mediates the relationships between both addictions and SI.

Table 2 Correlations, means, standard deviations

Variables	1	2	3	4	5	6
1.SNA	1					
2.OGA	.593**	1				
3.Loneliness	.515**	.344**	1			
4.SI	.552**	.443**	.711**	1		
5.SES	-.019	.044	-.114**	-.059*	1	
6.Education	-.168**	-.111**	-.209**	-.230**	.128**	1
Mean	1.4717	1.3391	1.5099	1.279	2.4295	3.86
SD	.5116	.6913	.6391	.545	.90129	.645

SNA Social Network Addiction, OGA Online Gaming Addiction, SI Suicide Ideation, SES Socioeconomic Status

* $p<.05$; ** $p<.01$

Interaction analyses

To examine the moderating role of loneliness, we conducted moderation analyses by creating interaction terms (SNA×Loneliness and OGA×Loneliness). Results indicated that loneliness significantly moderated the relationship between SNA and SI ($B=0.117$, $p<0.001$) and between OGA and SI ($B=0.061$, $p<0.01$). These findings suggest that the effects of both SNA (a) and OGA (b) on SI were stronger at higher levels of loneliness, supporting H_3 and showed that the effects of both SNA and OGA on suicidal ideation were stronger at higher levels of loneliness. The interaction patterns are shown in Fig. 2.

Discussion

This study aimed to explore the correlations between social network addiction, online gaming addiction, loneliness, and suicidal ideation among young adults. Using a cross-sectional approach, we examined both the direct and indirect effects of these forms of digital addiction on suicidal ideation, considering loneliness as a potential mediator and moderator. The findings provide evidence about how loneliness may amplify or mediate the psychological impact of digital addiction, especially regarding risks related to suicidal thoughts. Below, we discuss each hypothesis in light of the results, highlighting implications and potential interventions.

Direct effects of digital addictions on loneliness and suicidal ideation

Our findings confirm that both social network addiction and online gaming addiction contribute to increased loneliness and suicidal ideation. Social

network addiction appears to weaken real-world relationships, fostering emotional isolation, while the immersive nature of online gaming addiction may displace meaningful social interaction. Despite presenting virtual companionship, these behaviors often fail to satisfy emotional needs, reinforcing loneliness and elevating suicidal ideation risk. Specifically, social network addiction appears to contribute to social isolation by weakening individuals' connections to the real world [28]. This weakening of real-life relationships likely reinforces feelings of loneliness, which in turn increases the risk of suicidal ideation [9], a finding that aligns with prior research indicating that virtual interactions often fail to fulfil emotional needs [14]. By neglecting face-to-face connections in favor of digital interactions, individuals with social network addiction may experience an intensified sense of social disconnection, leaving them more vulnerable to loneliness and associated suicidal ideation [42].

In parallel, online gaming addiction is significantly linked to increased loneliness among young adults [37, 38]. This finding aligns with previous research suggesting that while online gaming environments facilitate social interaction, they often confine it to virtual spaces, limiting the development of meaningful real-life connections [31]. Our study extends this understanding by illustrating that online gaming addiction's impact on loneliness may, in part, be due to its immersive structure, which encourages players to prioritize virtual interactions over real-world relationships [15]. This immersion likely fosters an addictive cycle where individuals rely increasingly on virtual companionship and

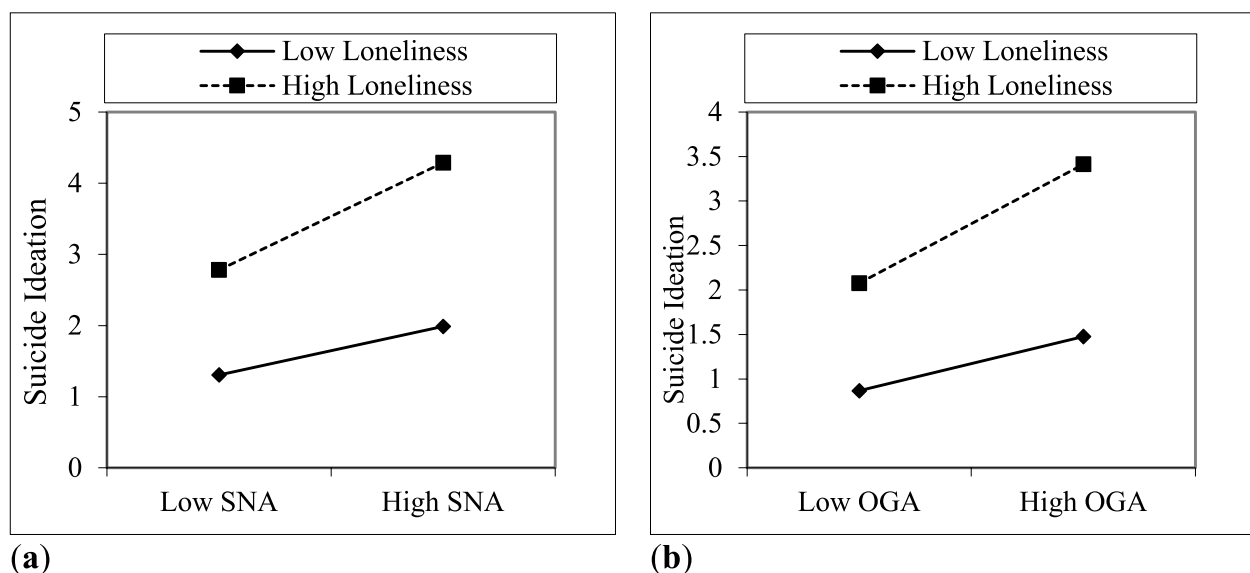


Fig. 2 Moderation role of loneliness between SNA (a), OGA (b) and SI

experience a growing detachment from genuine social support, ultimately heightening the risk of SI [56].

These findings underscore that while social network addiction and online gaming addiction may promote virtual social interaction, they do not adequately meet individuals' emotional needs in real life [32]. Behavioral addictions like social network addiction and online gaming addiction may foster a false sense of social fulfillment, which masks underlying loneliness and leaves individuals especially susceptible to suicidal ideation [25, 46]. By clarifying these pathways, our study contributes to a nuanced understanding of how digital behavioral addictions intersect with loneliness to impact mental health outcomes. At this point, future research may benefit from further investigating how different types of online content and interactions within these platforms specifically drive these observed effects, potentially offering targeted insights for prevention and intervention efforts.

Loneliness as a mediator between digital addictions and suicidal ideation

Our findings provide support for the hypothesis that loneliness mediates the relationship between social network addiction, online gaming addiction, and suicidal ideation, positioning loneliness as a central factor in this pathway. While social networks and online games are often promoted as tools for social connection, our results suggest that their excessive use can weaken real-world relationships and lead to intensified loneliness. This outcome aligns with previous research, which has indicated that high engagement in social networking and online gaming frequently replaces in-person interactions, contributing to a sense of social disconnection [21, 28, 45]. Our findings thus confirm that while virtual connections may temporarily fulfil social needs, they ultimately fail to provide the depth of interaction necessary to alleviate feelings of loneliness fully [4].

More specifically, our study reveals that individuals experiencing heightened loneliness due to social network addiction and online gaming addiction are at greater risk of SI, illustrating that digital addictions may contribute to suicidal ideation indirectly through their impact on loneliness [20]. This supports earlier findings that have noted loneliness as both a consequence of digital addictions and a catalyst for increased engagement in these platforms [36, 45]. While prior research has acknowledged loneliness as a correlate of social network addiction and online gaming addiction, our study extends this understanding by identifying loneliness as a significant mediating factor that can escalate SI risk [65, 66]. This highlights how loneliness not only accompanies digital addiction but actively shapes its psychological consequences. Our results also underscore a paradox within digital

interactions: While social networks and online games provide a form of escape or temporary relief from loneliness, their excessive use can deepen social isolation and exacerbate SI [25]. This duality supports the notion that while individuals may turn to digital platforms to meet immediate social needs, they may inadvertently reinforce patterns of isolation that contribute to long-term mental health risks [23]. Our study's findings suggest that digital addiction does not merely coexist with loneliness but may transform loneliness into a more severe risk factor for suicidal ideation by disrupting meaningful, real-world relationships.

By framing loneliness as a mediating factor, our study contributes to a perspective on the indirect effects of social network addiction and online gaming addiction on suicidal ideation. It suggests that interventions aimed at reducing SI among young adults can consider not only limiting screen time but also actively promoting in-person social engagements that foster genuine connectedness [60]. For example, intervention programs could focus on enhancing social skills, encouraging face-to-face interactions, and developing healthy digital habits that reduce dependence on virtual connections. Given that loneliness can significantly amplify suicidal ideation risk, addressing this mediating role offers a pathway to more comprehensive mental health strategies [34]. So, our findings advance the literature by showing that loneliness is not simply a by-product of digital addiction but a potent mediator in the social network addiction/online gaming addiction—suicidal ideation pathway. While digital platforms may offer short-term social satisfaction, their role in deepening loneliness highlights the need for targeted interventions that address both digital addiction and loneliness as interconnected contributors to suicidal ideation.

The amplifying role of loneliness in the link between digital addictions and suicidal ideation

Our findings support the hypothesis that loneliness moderates the correlation between social network addiction, online gaming addiction, and suicidal ideation, underscoring loneliness as a factor that intensifies suicidal ideation risk in the context of digital addictions. As technological advancements drive increased reliance on digital platforms, individuals may become more vulnerable to social network addiction and online gaming addiction, particularly due to a fear of missing out on social interactions and digital updates [29]. Our study reveals that individuals with heightened loneliness are more inclined to use social media and online games as coping mechanisms. This tendency, however, may increase digital dependence and ultimately elevate suicidal ideation risk [60]. This finding aligns with previous research indicating

that social networks and other online platforms, though designed to foster connection, can paradoxically exacerbate loneliness for some users [33]. Our results suggest that loneliness amplifies the effects of social network addiction by making individuals more susceptible to comparing themselves with idealized portrayals on social media, which in turn may worsen their isolation and heighten their suicidal ideation risk. This intensified social comparison process, driven by loneliness, likely reinforces a cycle of dissatisfaction with one's life, leading to further reliance on social media for validation and social fulfilment [1].

Similarly, our study shows that loneliness also moderates the association between online gaming addiction and suicidal ideation, with individuals experiencing high levels of loneliness being particularly susceptible to negative impacts from excessive gaming. Although online gaming can foster social bonds between players, our findings indicate that these virtual connections may be insufficient to counteract feelings of loneliness in highly isolated individuals [44]. Consistent with previous studies, our results show that individuals with gaming addiction tend to gradually withdraw from real-world relationships, a tendency that is even more pronounced among those who feel socially isolated [57]. For individuals with heightened loneliness, this detachment from real-life connections may deepen their dependency on virtual worlds, thus compounding SI risk [25, 45].

Moreover, our findings extend previous research by demonstrating that loneliness is not merely associated with social network addiction and online gaming addiction but actively enhances the suicidal ideation risk among individuals with high levels of these addictions. This supports the notion that highly lonely individuals may increasingly substitute virtual relationships for real-life connections, creating an addictive cycle where reliance on digital interactions escalates, intensifying both loneliness and suicidal ideation risk [25, 34]. However, our findings suggest that individuals with robust social support systems may experience a less pronounced effect of online gaming addiction on suicidal ideation. This observation implies that social support may buffer the adverse mental health consequences associated with gaming addiction, providing these individuals with resources to maintain real-world relationships and mitigate isolation [25]. To sum up, these findings emphasize the need for intervention strategies that address both digital addiction and loneliness, particularly for individuals at high risk for suicidal ideation. Programs designed to encourage real-life social engagement and build resilience against social comparison on digital platforms may help reduce reliance on social network addiction and online gaming addiction as coping mechanisms. Targeted

interventions that support young adults in forming meaningful offline connections could be a crucial step in reducing suicidal ideation risk among individuals experiencing high levels of loneliness.

Interpretation through the lens of the ITS

ITS identifies three key components that underlie suicidal ideation and behavior: perceived burdensomeness, thwarted belongingness, and suicidal ideation itself. Our findings align with the ITS framework, suggesting that social network addiction and online gaming addiction may contribute to feelings of perceived burdensomeness particularly in young adults. Excessive engagement in social media and gaming can foster feelings of inadequacy, especially when individuals perceive themselves as falling short of virtual standards, such as likes, followers, or in-game performance [64, 71]. These experiences may increase perceived burdensomeness and heighten vulnerability to suicidal ideation [49].

Besides, the study reflects the ITS concept of thwarted belongingness. Our findings suggest that excessive reliance on digital platforms can disrupt real-life interpersonal connections, replacing them with superficial virtual interactions. This dynamic intensifies loneliness and social disconnection, both of which are central to the development of suicidal ideation in the ITS model [10]. The partial mediation effect of loneliness also supports this theoretical pathway, indicating that reliance on online platforms may not alleviate, but rather deepen, emotional isolation. By integrating loneliness as both a mediator and moderator, our model illustrates how digital behavioral addictions may interact with core components of ITS. While digital platforms may offer temporary relief from isolation, their overuse may paradoxically exacerbate the sense of not belonging, reinforcing the psychological mechanisms that lead to suicidal ideation [59].

Although socioeconomic status was included as a covariate in our structural model due to its theoretical relevance to suicide risk, our findings indicated that its direct effects on both loneliness and suicidal ideation were minimal and statistically no significant. This suggests that in this sample of Turkish young adults, psychological and behavioral factors such as digital addiction and loneliness may play a more prominent role than background socioeconomic conditions. However, including socioeconomic status remains critical to ensure a robust and controlled model, especially in isolating the primary pathways of interest. Future research can further examine whether socioeconomic status exerts moderating effects or displays stronger influence in more socioeconomically diverse or cross-cultural populations.

Implications for theory, practice, and future research

Theoretically, this study advances understanding of how digital behavioral addictions intersect with loneliness to impact suicidal ideation. By conceptualizing loneliness as both a mediator and a moderator, we present a detailed application of ITS. As a mediator, loneliness emerges from the social displacement effects of digital overuse. As a moderator, loneliness intensifies the emotional impact of social network addiction and online gaming addiction, highlighting it as a stable vulnerability that amplifies suicide risk. This dual-role formulation reflects contemporary approaches to complex, multidimensional risk models and aligns with emerging trends in suicide research.

Practically, our findings provide actionable insights for clinicians and mental health professionals. Interventions targeting social network addiction and online gaming addiction can explicitly incorporate strategies for reducing loneliness and promoting real-world social connection. Programs focused on building offline relationships, improving social skills, and fostering mindful digital engagement may help mitigate both behavioral addiction and its mental health consequences. Moreover, the differential impact of social network addiction and online gaming addiction warrants tailored intervention strategies. For instance, interventions addressing social network addiction could focus on counteracting social comparison and self-worth issues stemming from idealized online content. Those addressing online gaming addiction might emphasize face-to-face engagement through structured offline activities. In both cases, enhancing social support appears critical to reducing suicide risk. Consequently, the study underscores the importance of loneliness in the behavioral addiction—suicidal ideation pathway. Addressing loneliness as a psychological mechanism not just a symptom offers new avenues for suicide prevention, particularly among digitally connected but emotionally isolated populations.

Limitations and directions for future research

Despite its contributions, this study has several limitations. The cross-sectional design restricts our ability to draw causal conclusions. Although we explored loneliness as both a mediator and a moderator, these roles involve distinct temporal assumptions that cannot be tested within a single time point. Future longitudinal or experimental studies are needed to validate the temporal sequencing and directionality of these relationships. Additionally, modeling loneliness in dual roles introduces potential challenges such as multicollinearity and endogeneity. While we used mean-centering and

checked for acceptable VIF values, some conceptual overlap remains unavoidable.

Unmeasured variables such as depressive symptoms, trauma, or personality traits may also confound associations between loneliness and suicidal ideation. Likewise, although socioeconomic status was included as a covariate in the model, other key demographic variables such as age, gender, and education were not controlled for. While preliminary analyses indicated that their inclusion did not significantly alter model outcomes or improve overall fit, future studies can consider including these factors to enhance generalizability and account for potential demographic moderation effects. Moreover, our sample consisted of Turkish young adults, which may limit generalizability. Cultural norms around technology use and mental health could affect how digital addictions relate to suicidal ideation in other populations. Cross-cultural replications are needed to assess the robustness of our findings. Future research can explore additional factors that moderate or mediate the relationship between behavioral addictions and suicidal ideation, including personality traits, family dynamics, and cultural influences. Quasi-experimental and intervention-based designs could assess the effectiveness of strategies aimed at reducing loneliness and digital overdependence.

Additionally, while mediation analyses were conducted using SEM, moderation analyses relied on regression-based interaction terms using observed variables. This analytic distinction was made to avoid the increased model complexity and power demands associated with latent variable interactions, which can lead to estimation challenges, particularly with moderate sample sizes. Nonetheless, future studies can explore the use of SEM-based moderation models either through non-latent interactions or with sufficient power to support latent interaction terms to provide a more integrated and statistically consistent analytic approach. Programs focused on enhancing offline social connectedness and resilience could be especially impactful for at-risk youth. By addressing these limitations and expanding upon current findings, future work can more precisely identify the psychological and contextual mechanisms linking digital addictions, loneliness, and suicidal ideation ultimately guiding more targeted and effective prevention efforts.

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Authors' contributions

Author Contributions Statement: OK: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing, Visualization, Project administration. MY: Validation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Validation. AK: Writing - Original Draft, Writing and Validation. NAA and AMAA: Writing - Review & Editing, Validation, Resources. MD: Investigation, Project

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Data availability

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study protocol was approved by the Ethics Committee of İstanbul University-Cerrahpaşa (reference number: E-74555795–050.04–1149683). We confirm that all participants provided informed consent before taking part in the study. This ensures that they were fully aware of the study's purpose, procedures, potential risks, and their right to withdraw at any time.

Consent for publication

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Competing interests

The authors declare no competing interests.

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