

Between likes and lows: Exploring how social networking, privacy, and loneliness shape college students' satisfaction

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Abstract

Introduction: The rise of online social networking has transformed how individuals interact, raising concerns about its impact on privacy, loneliness, and life satisfaction. This study explores the direct and indirect relationships among these variables, with a focus on institutional (vertical) and peer (horizontal) privacy concerns, social and emotional loneliness, and overall satisfaction among college students.

Methods: This study analyzed A sample of 778 college students 39.7% are females participated in this study. A conceptual model was tested to examine the effects of social networking use on privacy concerns, loneliness, and life satisfaction. Structural equation modeling was used to analyze the relationships among these variables.

Results: Findings revealed that increased social networking use was positively associated with privacy concerns at the institutional level ($\beta = -.242, p < .01$) and peer level ($\beta = -.205, p < .001$). Institutional privacy concerns uniquely mediated life satisfaction, highlighting their relevance in structured settings like universities. Furthermore, social networking use predicted higher emotional loneliness and lower life satisfaction, indicating that online interactions may fail to address deeper emotional needs. However, no significant relationship emerged between social networking use and social loneliness, suggesting that broader social needs may depend on offline interactions.

Discussion: These results demonstrate the role of social networking in shaping college students' well-being. While online platforms offer connections, they may also heighten privacy concerns and emotional loneliness, impacting life satisfaction. Institutional privacy concerns play a critical mediating role, highlighting the importance of privacy in academic settings.

Take-home message: This study highlights the importance of effective privacy management, particularly at the institutional level, in enhancing students' well-being. Additionally, fostering meaningful offline connections is crucial to mitigate emotional loneliness and improve life satisfaction. A balanced approach to digital and offline interaction is essential for students' overall satisfaction and wellbeing.

Keywords: College students; emotional loneliness; life satisfaction; social networking; privacy concerns; well-being.

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INTRODUCTION

In the digital age, rapid technological advancements have fundamentally transformed communication through online social networks. Platforms like Facebook, Instagram, and TikTok have become integral to modern life, particularly among college students. These networks provide instant connections, and access to vast information, supporting both personal and academic development. Social connectedness facilitated by these platforms can reduce stress, anxiety, and loneliness while boosting self-esteem, comfort, and joy [1]. However, online social networks cannot fully replace face-to-face interactions, which trigger hormonal responses that reduce stress and enhance overall well-being [2-4]. Excessive use of these social networks, despite their role in fostering closeness, may lead to loneliness, social isolation, and dissatisfaction [5]. The term "social network" refers to web-based and mobile platforms that enable virtual interactions and content sharing, such as messages, images, and videos [6, 7]. Research has shown a notable rise in mental health issues associated with social network use across various age groups [8-10]. In some cases, excessive use of these platforms may contribute to the development of obsessive-compulsive disorder [11], while others may turn to these networks for mental health support [10,12].

The Uses and Gratifications Theory (UGT) explains social network use by suggesting that individuals actively engage with these platforms to fulfill specific needs, such as entertainment, social interaction, or information-seeking [13,14]. Users are often motivated by desires to maintain social connections, seek validation, or combat boredom, highlighting the diverse reasons behind social networking behaviors. Prior research has investigated the influence of social network use on well-being and satisfaction [15]. However, the debate continues over the benefits and risks of social networks on mental health and satisfaction, as well as how to balance these concerns. A recent study by Rizzo et al. [16] found that social media has a mixed effect on how people view mental illness. It can help reduce stigma by sharing personal stories and increasing awareness, but it can also spread harmful stereotypes and false information, which can negatively affect mental health. Beyond mental health, privacy issues also arise. This study aims to explore the effects of online social networks on Saudi students' privacy and mental health and the potential impact on their own future perspectives [17].

The hidden cost of online social networking: Online privacy at risk

One of the most essential concerns surrounding social network usage is the issue of online privacy. Online privacy includes individuals' fears regarding the collection, storage, and use of their personal information by various entities, including corporations, governments, and other individuals [18,19]. These concerns arise from the potential misuse of personal data, unauthorized access, and identity theft, which have far-reaching implications for an individual's security, autonomy, and trust in digital environments [20].

Several theoretical frameworks attempt to explain the nature of online privacy concerns. Altman's Privacy Regulation Theory [21] suggests that privacy is a dynamic process wherein individuals regulate their boundaries to manage social interactions and protect personal space [21,22]. In online environments, individuals continuously manage their privacy to shield themselves from unwanted access [23]. However, the common collection and analysis of personal data in digital spaces make this regulation difficult, amplifying concerns about privacy.

Another relevant framework is the Communication Privacy Management (CPM) Theory, developed by Sandra Petronio [24]. CPM posits that individuals perceive privacy as control over their personal information and use specific rules to manage the flow of this information in various contexts. Petronio [24] argues that individuals balance the risks and benefits of sharing information, and violations of privacy lead to disruptions, increasing their concern and prompting protective measures [24].

Philipp K. Masur [25] further categorizes online privacy into two dimensions: vertical and horizontal privacy concerns. Vertical concerns relate to apprehensions about how data is handled by entities with hierarchical power, such as corporations and governments, focusing on risks like data breaches and surveillance [26,27]. Horizontal concerns, on the other hand, involve threats from peers or strangers, such as unauthorized sharing or identity theft [27]. Masur's Online Privacy Concerns Scale (OPCS) provides a comprehensive framework for understanding these dimensions and is a crucial tool in assessing how privacy concerns shape user behavior, trust, and engagement with online platforms [25].

The increasing integration of social networks into everyday life has intensified privacy concerns, particularly among adolescents. Sarikakis and Winter [28] emphasize that despite greater awareness of privacy issues, many users for digital platforms feel powerless to manage their privacy effectively, relying on self-regulation without fully understanding legal protections. This sense of powerlessness is heightened by the social rewards derived from platforms, as users often overlook privacy risks in favor of the enjoyment they experience, as highlighted by Church et al. [29].

The complexity of the privacy paradox is further explored in Baruh et al's [30] meta-analysis, which reveals that while privacy concerns reduce information sharing, they have minimal impact on social media usage. This paradox persists due to the perceived benefits of digital social engagement, even among users with higher privacy literacy. Hofstra et al. [31] investigate adolescent privacy behaviors on Facebook, noting the influence of peer behavior, popularity, and trust. Adolescents tend to adopt privacy settings like their peers, with more popular individuals opting for public profiles to maintain social status.

James et al. [32] contribute to this understanding with their dual privacy decision model, which captures the balance between privacy concerns and the desire to socialize and express oneself online. Their research highlights the importance of privacy controls in fostering active participation in online social networks (OSNs). Pierson [33] examines the duality of empowerment and vulnerability in social networking, noting that while users are empowered to communicate, they are simultaneously exposed to privacy breaches due to the commodification of personal data, which Pierson identifies as an "architectural vulnerability."

Child et al. [34] offer insights into privacy management in blogging, identifying different privacy rule orientations—self-centric, planner, protector, and unworried—that guide disclosure practices. Their research shows that privacy management is not static; rather, it evolves over time based on factors like conflict management, protection of identity, and emotional regulation. These findings highlight the dynamic and multifaceted nature of privacy management in the digital age, shaped by a complex relationship of social, psychological, and technological factors.

Shoeb & Mohamed [35,36] examined the effects of online social networks like Twitter, Snapchat, and TikTok on privacy, security, and mental health among Saudi university students. Using a sample of 700 students, the results revealed significant correlations between social network use and factors such as privacy concerns, security issues, and mental health. Gender differences were observed in terms of privacy and security, while variations in privacy and mental health were linked to different academic majors. These findings emphasize the influence of online social networks on students' mental health and their perceptions of privacy and security.

As online privacy concerns grow, the integration of AI in healthcare and occupational settings introduces similar challenges. AI's use in managing health data and improving diagnostics highlights the importance of safeguarding personal information, with ethical issues like data protection and accountability paralleling those seen in social media privacy concerns [37].

In conclusion, the existing literature highlights the dynamic relationship between privacy concerns, user behavior, and the broader social environment in online networks. While users continue to engage with social media and other digital platforms for the benefits they offer, the potential risks to privacy remain significant. This paradox highlights the ongoing need for effective privacy management strategies, user education, and more robust regulatory frameworks to better protect personal information in the ever-evolving digital landscape.

Social networks and mental health: Risks, challenges, and impacts

It has been debated in the literature whether social media networks can be used to provide psychological support for their users [38,39]. Trefflich et al. [40] found that half of the psychiatric patients sampled in their study used social networks, with younger individuals showing higher usage rates. Similarly, among patients with schizophrenia, 47% reported using social networks, with 79% accessing them at least once a week [40], that required intervention such as mindfulness techniques [41].

The way individuals engage with social networks can impact their mental health, either positively or negatively. For example, during the COVID-19 pandemic, anxiety related to the virus was shown to reduce life satisfaction by increasing loneliness and diminishing meaning in life [42]. Adolescents, who are already navigating identity formation, are particularly susceptible to the challenges that are corresponding to the digital life [43]. Promoting social-emotional learning has proven essential for supporting their mental well-being and addressing sleep disturbances linked to excessive digital engagement [44,45]. Online platforms like Reddit also function as spaces where individuals with mental health conditions such as ADHD and anorexia nervosa can exchange experiences and seek mental health support [46]. Tarchi et al. [46] highlighted unique linguistic patterns in these online communities, noting higher word counts and a more frequent use of rare terms compared to general online discussions. Conversations in these groups often focus on psychopathological themes rather than conventional social interactions, reflecting how digital platforms amplify the psychological experiences of individuals with mental health challenges. These findings emphasize the value of psycholinguistic tools in gaining deeper insights into the struggles expressed within such online spaces. However, excessive engagement with social networks can also lead to addictive behaviors such as deficit in information processing [47]. A

study by Biolcati et al. [48] reported that 3.3% of Italian Facebook users were addicted to the platform. This is consistent with earlier findings by Vangeel et al. [49], who reported a Facebook addiction rate of 7.1% among Belgian secondary school students. Other studies have identified similar rates in different countries, with 26.2% of users in the United States, 29.4% in Singapore, and 44.5% in China exhibiting signs of social network addiction [50]. Researchers have linked this addiction to health problems, intellectual challenges, and interpersonal difficulties, suggesting that it is driven by factors like personality traits, self-esteem, and unmet psychological needs [51-53]. However, socio-cultural and behavioral reinforcement aspects of this addiction remain under-investigation.

A meta-analysis by Marino et al. [54,55] found clear links between compulsive social network use and mental health issues, including psychological disorders and overall well-being. While these studies have expanded our understanding of social media addiction's impact on mental health, further research is needed to explore the problematic use of platforms like Twitter, Instagram, and TikTok among Saudi College's students.

To assess the effects of online social networks on Saudi society, it is essential to consider Saudi culture, where Islam forms the foundation of strong familial bonds. The family unit is central in Saudi life, and social connections are traditionally prioritized with relatives over strangers [56,57]. However, rapid modernization and increased exposure to global trends have reshaped societal dynamics in Saudi Arabia, influencing individual behaviors and future perspectives [17].

These cultural shifts, fueled by rising education levels and widespread internet use, have led to new patterns of behavior, particularly among Saudis engaged in IT and technology. While some individuals approach social media with caution due to potential risks, others are intrigued by its possibilities, especially in relation to advancements in artificial intelligence on platforms like TikTok. As a result, many young Saudis have become increasingly reliant on online social services, raising concerns about the long-term effects on their mental health and satisfaction.

Purpose of the current study

The purpose of this study is to explore the complex relationships between online social networking, privacy concerns, loneliness, and satisfaction among college students. Specifically, this research seeks to investigate how the use of online social networks influences individuals' concerns about online privacy and how these concerns may, in turn, affect their levels of loneliness. Additionally, the study aims to examine the direct relationship between online social networking and both loneliness and satisfaction in social and life contexts. To provide a more comprehensive understanding, the study will also explore the potential mediating role of privacy concerns in the connection between social networking use and loneliness, as well as the mediating effect of loneliness on the relationship between social networking and overall satisfaction. Furthermore, the moderating role of privacy will be analyzed to determine whether it strengthens or weakens the associations between online social networking, loneliness, and satisfaction. By addressing these relationships, the study seeks to contribute to a deeper understanding of the psychological and social implications of online social networking in the digital age. To test these relationships the following model is suggested to test the direct and indirect effects of online social networking and satisfaction and focus on the mediating roles of online privacy and loneliness (Figure 1).

Research hypothesis

Direct relationship hypothesis

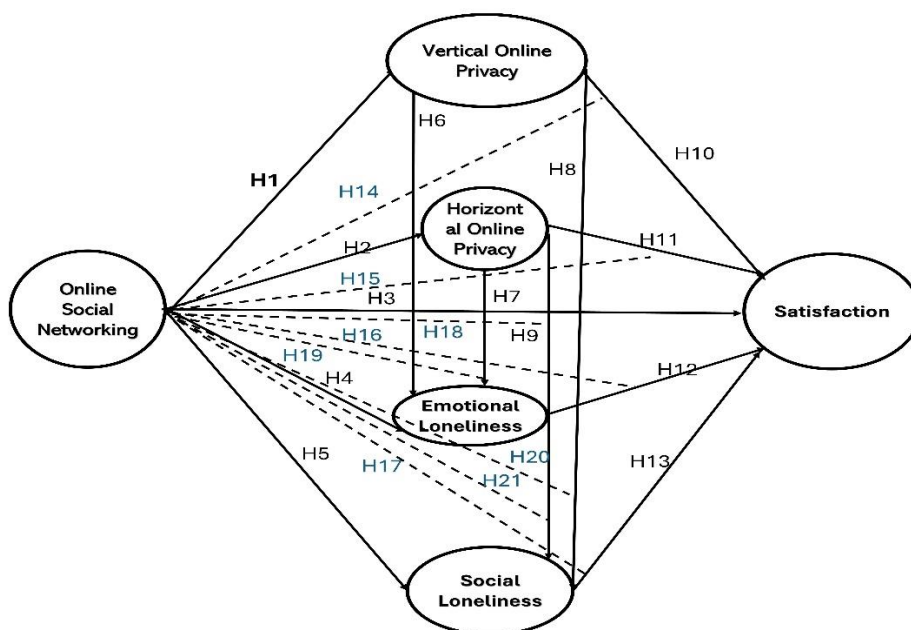
- Hypothesis 1: Increased time spent on online social networking is negatively associated with online vertical privacy.
- Hypothesis 2: Increased time spent on online social networking is negatively associated with online horizontal privacy concerns.
- Hypothesis 3: Increased time spent on online social networking is negatively associated with Satisfaction
- Hypothesis 4: Increased time spent on online social networking is positively associated with emotional loneliness.
- Hypothesis 5: Increased time spent on online social networking is positively associated with social loneliness.
- Hypothesis 6: Vertical online privacy is positively associated with emotional loneliness.
- Hypothesis 7: Horizontal online privacy is positively associated with emotional loneliness.
- Hypothesis 8: Horizontal online privacy is positively associated with social loneliness.
- Hypothesis 9: Vertical online privacy is positively associated with social loneliness.
- Hypothesis 10: Vertical online privacy concerns are positively associated with satisfaction.
- Hypothesis 11: Horizontal privacy concerns are positively associated with satisfaction.
- Hypothesis 12: Emotional loneliness is positively associated with satisfaction

- Hypothesis 13: Social loneliness is positively associated with satisfaction.

Mediating effects hypotheses:

- Hypothesis 14: Vertical Privacy concerns mediate the relationship between online social networking and satisfaction.
- Hypothesis 15: Horizontal Privacy concerns mediate the relationship between online social networking and satisfaction.
- Hypothesis 16: Social loneliness mediates the relationship between online social networking and satisfaction.
- Hypothesis 17: emotional loneliness mediates the relationship between online social networking and satisfaction.
- Hypothesis 18: Vertical Privacy concerns mediate the relationship between online social networking and Emotional loneliness.
- Hypothesis 19: Horizontal Privacy concerns mediate the relationship between online social networking and emotional loneliness.
- Hypothesis 20: Vertical Privacy concerns mediate the relationship between online social networking and social loneliness.
- Hypothesis 21: Horizontal Privacy concerns mediate the relationship between online social networking and social loneliness.

Figure 1. Proposed structural equation model illustrating all hypothesized relationships. Solid lines represent direct effects, while dashed lines denote indirect effects.



Significance and advantages of our work

This study highlights the complex relationship between social networking use, privacy concerns, loneliness, and life satisfaction among college students. It reveals that increased social networking use enhances privacy concerns, particularly at the institutional level, which mediates life satisfaction. While online interactions may reduce social loneliness, they tend to increase emotional loneliness, negatively impacting overall satisfaction. The study highlights the need for effective privacy management in academic settings and emphasizes the importance of fostering offline connections to mitigate emotional loneliness, offering practical insights for improving student well-being through balanced digital and offline engagement.

METHODS

Study procedure and data collection

Participants

Data were collected from 778 participants (39.7% female) from various public Saudi universities (Mean age = 21.8, SD = 0.9). Participants were from different academic levels (freshmen to seniors) and participated during the winter semester of 2020–2021.

Procedures

For the target participants who were students studying at universities in Saudi Arabia, the research team collected data in four different stages: Stage I: Social Network Form was distributed to the full study sample via a Microsoft Forms link. Participants from various public universities across Saudi Arabia received an invitation to participate in this stage, with instructions to generate a unique code for future follow-up communications. This code allowed the research team to match responses without collecting identifiable information, thus maintaining participant anonymity.

The form included a detailed introduction that outlined the study's purpose and instructions for completion, and participants were encouraged to use personal email addresses rather than university-provided emails. This choice minimized any potential biases related to institutional affiliations and helped further protect participants' privacy. Stage II: After completing the Social Network Form, participants were sent a second link to access the Online Privacy concerns Questionnaire. A follow-up reminder was also sent to ensure that the maximum number of participants completed both instruments. Stage III: After completing the online privacy Questionnaire, participants were sent a third link to access the loneliness survey. In stage V: those who completed the three previous tools were invited to complete the satisfaction survey. Table 1 shows the demographic information of all participants who completed all stages successfully.

Table 1. Demographic characteristics.

	Total (n = 778)	Privacy concerns		Lonliness		Satisfactions	
	n (%)	M ± SD	p	M ± SD	p	M ± SD	p
<i>Gender^a</i>			.108		.529		.284
Female	309 (39.7)	57.10 ± 6.31		37.55 ± 6.15		32.48 ± 6.09	
Male	469 (60.3)	58.05 ± 6.69		37.86 ± 6.07		33.05 ± 5.97	
<i>Academic Level^b</i>			.134		.745		.081
Freshmen	49 (6.20)	55.39 ± 7.89		38.39 ± 6.47		31.57 ± 5.82	
Sophomore	57 (7.30)	56.66 ± 8.19		37.74 ± 6.69		32.33 ± 5.61	
Junior	216 (27.7)	58.24 ± 8.72		37.48 ± 5.84		33.43 ± 6.46	
Senior	456 (58.61)	57.79 ± 8.43		37.79 ± 6.12		32.73 ± 5.87	

Note: a. Mann-Whitney test, b. Kruskal-Wallis test n = the participants numbers, M= Mean, SD= Standard division

Study instruments

Social networking Form (SNF):

The authors have developed a form consisting of two questions. Question 1: Screening time on social networking: This question asks participants to report the average amount of time they spend on social media every day. Participants are provided with a range of time intervals to select from, ensuring that responses are standardized and easily comparable. The intervals include the following options: Less than 1 hour; 1-3 hours; 3-5 hours; More than 5 hours. The purpose of this question is to understand the daily social media consumption of each participant. Question 2 focuses on the number of Social Media Platforms Visited. This question inquiries about the number of different social media platforms the participant visits daily. Participants are asked to select the number of platforms from a set of options, such as: 1 platform; 2 platforms; 3 platforms; 4 platforms; 5 or more platforms. This question is designed to capture the breadth of social media usage, providing insights into the variety and potential multitasking behaviors of participants across different platforms.

Online Privacy concern scale (OPCS):

The OPCS, developed by Philipp K. Masur [25], was used to assess online privacy concerns. It includes 15 items across two dimensions: vertical privacy (concerns about data misuse by institutions) and horizontal privacy (concerns about unauthorized access, sharing, and identity theft). Participants rated items on a 5-point Likert scale (1 = not at all concerned, 5 = very concerned), with higher scores indicating greater concern. The scale was translated into Arabic through back translation to ensure linguistic and cultural equivalence. The Arabic version demonstrated good reliability (Cronbach's α = .866, McDonald's ω = .856), with interclass correlation reported in table (2). Additionally, Confirmatory Factor Analysis (CFA) was conducted to validate the proposed two-factor structure of the scale. The goodness-of-fit indices indicated an acceptable fit: χ^2 = 188.57, p < .001 CMIN/DF. = 2.300; NFI = .943; CFI = .967; IFI = .935; TLI = .957 GFI = .968; RMSEA = .041. These findings highlight the psychometric goodness and validity of the Arabic version of the OPCS (15 items) scale within the studied population.

Table 2. Intraclass correlation coefficient for Online Privacy Concern Scale.

	95% confidence intervals			F Test with True Value 0			
	Intraclass Cor.	Lower Bound	Upper Bond	Value	df1	df2	significant
Single Measure	.301	.277	.327	7.463	777	10878	.000
Average Measure	.866	.852	.879	7.463	777	10878	.000

Emotional and Social Loneliness Scale (ESLS)

The ESLS, developed by De Jong Gierveld and Van Tilburg [58], measures two dimensions of loneliness: emotional (lack of intimate relationships) and social (lack of a broader social network). The 11 items are rated on a 5-point Likert scale (1 = never, 5 = always), with higher scores indicating greater loneliness. The scale was translated into Arabic through back translation for cultural and linguistic equivalence. The Arabic version showed good reliability (Cronbach's $\alpha = .803$, McDonald's $\omega = .804$), with interclass correlation reported in table (3). Additionally, Confirmatory Factor Analysis (CFA) was conducted to validate the proposed two-factor structure of the scale. The goodness-of-fit indices indicated an acceptable fit: $\chi^2 = 148.89$, $p < .001$ CMIN/DF. = 2.545; NFI = .911; CFI = .934; IFI = .935; TLI = .914 GFI = .966; RMSEA = .057. These findings highlight the psychometric goodness and validity of the Arabic version of the ESLS (11 items) scale within the studied population.

Table 3. Intraclass correlation coefficient for Emotional and Social Loneliness Scale.

	95% confidence intervals			F Test with True Value 0			
	Intraclass Cor.	Lower Bound	Upper Bond	Value	df1	df2	significant
Single Measure	.271	.246	.297	5.082	777	7770	.000
Average Measure	.803	.782	.823	5.082	777	7770	.000

A modified Life satisfaction scale (LiSat-9)

A modified version of the LiSat 11 scale, excluding two items on sexual life and partnership, was used to assess personal and social life satisfaction. Originally adapted from Fugel-Mayer et al. [59], the scale uses a 5-point Likert scale (very dissatisfying to very satisfying). It was translated into Arabic through a back translation for linguistic and cultural equivalence. The Arabic version demonstrated good reliability (Cronbach's $\alpha = .787$, McDonald's $\omega = .789$), with interclass reliability reported in Table (4).

Table 4. Intraclass Correlation Coefficient for life satisfaction scale.

	95% confidence intervals			F Test with True Value 0			
	Intraclass Cor.	Lower Bound	Upper Bond	Value	df1	df2	significant
Single Measure	.291	.264	.320	4.698	777	6216	.000
Average Measure	.787	.764	.809	4.698	777	6216	.000

Data analysis

The data for this study were coded, cleaned, and exported using Microsoft Excel, while data analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 22.0. Descriptive statistics were employed to summarize participants' characteristics. The research utilized a quantitative approach with path analysis performed through partial least squares structural equation modeling (PLS-SEM).

This method was chosen to validate the study's hypotheses, assess the effects of independent variables on dependent variables, and examine mediation hypotheses. A comprehensive PLS-SEM analysis, including path coefficients, p-values, specific direct and indirect effects, and total effects, was conducted using 5,000 bootstrap samples.

Ethical aspects

The present study adhered to the Declaration of Helsinki [60] and followed the principles set forth by the American Psychological Association [61] regarding research on human participants. Participants were informed about the study's purpose through an online survey, and informed consent was obtained. They were given the option to either agree or decline participation.

RESULTS

Measurement model (Outer model)

The outer model was evaluated to determine measurement adequacy (Table 5a). All measuring items had a variance inflation factor (VIF) of less than 1. The remaining outer loadings ranged between .713 and .980; all were significant ($p < .001$). Cronbach's Alpha values for the three constructs ranged from .787 to .866, indicating good internal consistency. All constructs' average variance explained (AVE) was greater than .60, and the heterotrait-monotrait ratios (HTMT) (Table 5b) were all less than .80. As a result, the model's discriminant validity was established as well.

Table 5a. Mean, standard deviation, construct correlations, reliability, and validity.

	<i>M</i>	<i>SD</i>	<i>AVE</i>	<i>Cronbach's α</i>	<i>CR</i>
<i>Privacy Concerns</i>	3.10	1.12	.941	.866	.867
<i>Loneliness</i>	4.62	1.30	.783	.803	.806
<i>Satisfaction</i>	2.72	.92	.795	.787	.789

Note: M= Mean, SD= Standard division, AVE= Average, CR= Composite Reliability

Table 5b. Heterotrain-Monotrait (HTMT) ratios.

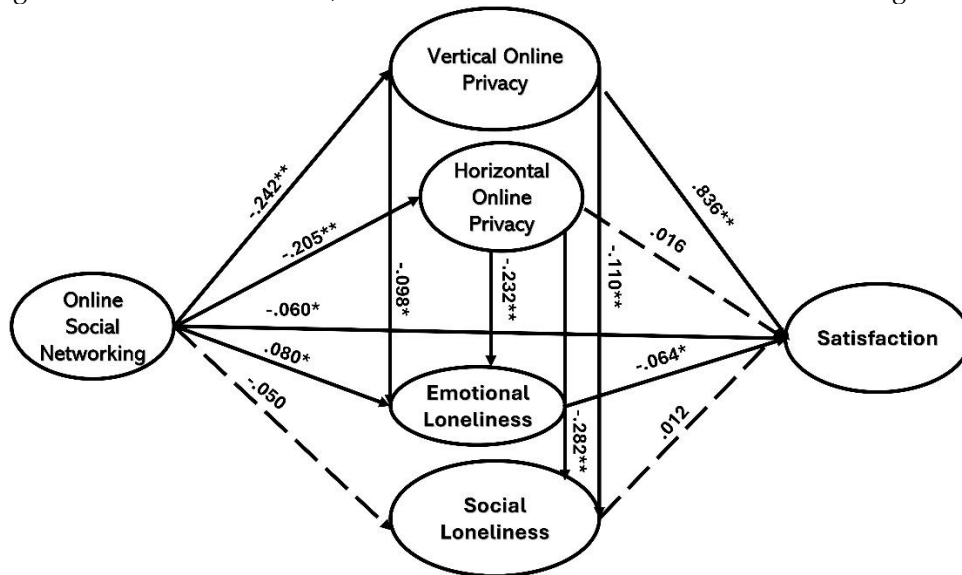
	<i>Privacy concerns</i>	<i>Loneliness</i>	<i>Satisfaction</i>
<i>Privacy Concerns</i>			
<i>loneliness</i>		.750	
<i>Satisfactions</i>		.689	.593

Structural model (Inner model)

The structural equation model demonstrated a strong fit with the data, as indicated by key indices. The average path coefficient (APC) was 0.141 ($p < 0.001$), and the average R-squared (ARS) was 0.217 ($p < 0.001$), explaining 22% of the variance. Other metrics such as the average adjusted R-squared (AARS) of 0.214 and the block variance inflation factor (AVIF) of 1.833 confirmed minimal multicollinearity. The Tenenhaus Goodness of Fit (GoF) of 0.466 suggested a large effect size. Additional metrics, including SPR = 0.822 and RSCR = 0.994, further confirmed model reliability. Most direct hypothesized paths were found to be significant, and the results of the path coefficients are shown in Figure 2. The findings showed that increased social network use negatively impacted both vertical privacy ($\beta = -.242, p < .01$) and horizontal privacy ($\beta = -.205, p < .001$), confirming hypotheses 1 and 2. Social network usage was also directly linked to lower satisfaction ($\beta = -.06, p < .01$) and higher emotional loneliness ($\beta = -.08, p < .01$), supporting hypotheses 3 and 4. However, no direct effect was found between social network use and social loneliness, contradicting hypothesis 5.

Additionally, vertical and horizontal privacy were negatively associated with both emotional ($\beta = -.282, p < .001$; $\beta = -.232, p < .001$) and social loneliness ($\beta = -.110, p < .001$; $\beta = -.098, p < .001$), supporting hypotheses 6 to 9. A significant positive relationship was found between vertical privacy and satisfaction ($\beta = .863, p < .001$), while emotional loneliness negatively impacted satisfaction ($\beta = -.064, p < .001$), confirming hypotheses 10 and 12. However, no significant effect was found between social loneliness and satisfaction, failing to support hypothesis 13.

Figure 2. Partial Least Squares Structural Equation Modeling (PLS-SEM) results. Solid lines represent significant direct effects, while dashed lines indicate non-significant direct effects.



Considering the variation predicted in endogenous constructs, the R² ranged between 16.9% and 42.5%, showing a moderate to substantial level of predictive accuracy. The path coefficients, and the outcomes of the hypotheses are presented in are indicated in Table 6.

Table 6. Direct path coefficients with decisions.

Hypothesis	β	Hypothesis Accepted/Rejected	f^2	p
<i>Direct effects</i>				
Social Network → Vertical Privacy	-.242	Accepted	.058	< .001
Social Network → Horizontal privacy	-.205	Accepted	.042	< .001
Social Network → Satisfaction	.060*	Accepted	.036	< .05
Social Network → Social loneliness	-.050	Rejected	.007	>.05
Social Network → Emotional loneliness	.080*	Accepted	.010	< .05
Vertical privacy → Emotional loneliness	-.098	Accepted	.025	< .05
Horizontal privacy → Emotional loneliness	-.232	Accepted	.070	< .001
Vertical privacy → Social loneliness	-.110	Accepted	.034	< .001
Horizontal privacy → Social loneliness	-.282	Accepted	.102	< .001
Vertical privacy → Satisfaction	.836	Accepted	.691	< .001
Horizontal privacy → Satisfaction	.016	Rejected	.009	>.05
Emotional Loneliness → Satisfaction	-.064	Accepted	.019	< .05
Social Loneliness → Satisfaction	.012	Rejected	.003	>.05

Note: β : Standardized path coefficient, f^2 : Effect size indicator, p : Probability value (significance level)

Mediation and moderation analysis

As shown in Figure 3 and Table 7, our study found a strong, direct relationship between time spent on social networks and both vertical and horizontal privacy, as well as life satisfaction. Social network use also significantly impacted emotional loneliness and life satisfaction. Mediation analysis showed that only vertical privacy significantly mediated the relationship between social networking and life satisfaction ($\beta = .202$, $p < .001$, $f^2 = .041$), supporting hypothesis 14. No mediation effect was found for horizontal privacy, emotional loneliness, or social loneliness in this relationship. Additionally, the analysis did not find evidence that either vertical or horizontal privacy mediates the relationship between time spent on social networks and either social loneliness or emotional loneliness (see Table 7).

Comparison test

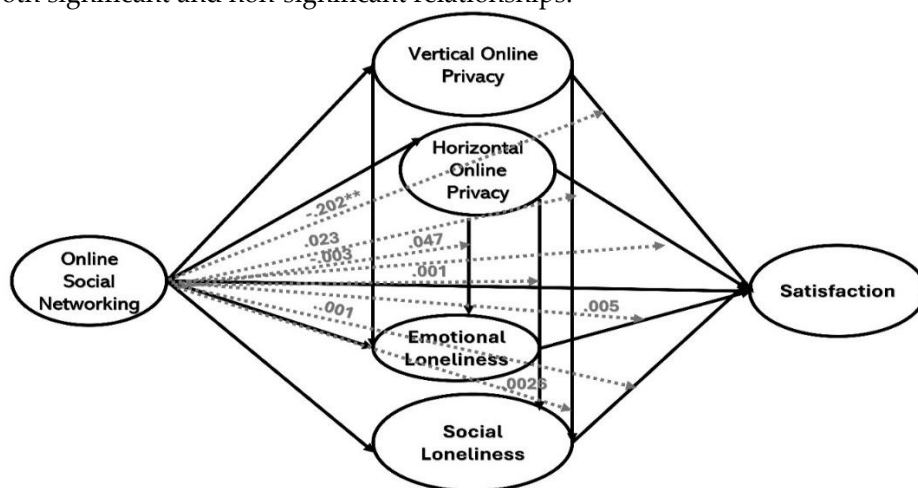
There was no significant difference between gender ($p > .10$), academic level ($p > .10$ in three scales.

Table 7. Indirect path coefficients with decisions.

Hypothesis	β	Hypothesis Accepted/Rejected	f^2	p
<i>indirect effects</i>				
Social Network \rightarrow Vertical Privacy \rightarrow Satisfaction	-.202	Accepted	.041	< .001
Social Network \rightarrow Horizontal Privacy \rightarrow Satisfaction	-.003	Rejected	.006	>.05
Social Network \rightarrow Emotional loneliness \rightarrow Satisfaction	-.005	Rejected	.007	>.05
Social Network \rightarrow Social loneliness \rightarrow Satisfaction	.001	Rejected	.003	>.05
Social Network \rightarrow Vertical Privacy \rightarrow Emotional loneliness	.023	Rejected	.006	>.05
Social Network \rightarrow Horizontal Privacy \rightarrow emotional loneliness	.047	Rejected	.008	>.05
Social Network \rightarrow Vertical Privacy \rightarrow Social loneliness	.026	Rejected	.005	>.05
Social Network \rightarrow Horizontal Privacy \rightarrow Social loneliness	.001	Rejected	.002	>.05

Note: β : Standardized path coefficient, f^2 : Effect size indicator, p : Probability value (significance level)

Figure 3. Partial Least Squares Structural Equation Modeling (PLS-SEM) results for all indirect effects, including both significant and non-significant relationships.



DISCUSSION

This study examined the connection between social networking and college students' experiences of privacy concerns, loneliness, and life satisfaction, presenting a model to explore both direct and indirect relationships. Specifically, it analysed how social networking influences privacy concerns (both institutional and peer-related), loneliness (social and emotional), and satisfaction, while also investigating how privacy concerns and loneliness mediate the relationship between social networking and satisfaction. The study involved 778 participants, 39.7% of whom were female.

The findings revealed that increased time spent on social networking was linked to heightened privacy concerns at both institutional levels ($\beta = -.242, p < .01$) and peer levels ($\beta = -.205, p < .001$), supporting the first and second hypotheses. These results align with the idea that greater online engagement raises awareness of privacy risks, consistent with prior research showing that frequent internet or AI usage amplifies concerns about data exposure [35–37,62]. Many users respond to these risks by adopting strategies like limiting shared information, exemplifying the "privacy paradox"—the tension between valuing privacy and continuing social media use despite recognizing its risks [47,63].

Social networking also showed a direct relationship with life satisfaction and emotional loneliness. Higher engagement was associated with lower satisfaction ($\beta = -.06, p < .01$) and greater emotional loneliness ($\beta = .08, p < .01$). This suggests that while social networks provide convenience in forming

connections, they may fail to fulfil users' deeper emotional needs, creating an "illusion" of connectedness without genuine intimacy [64]. Digital environments often make users feel linked to a broad network but can still leave them without meaningful support, contributing to emotional loneliness. Interestingly, no significant direct link was found between social networking and social loneliness, indicating that while digital interactions may heighten emotional loneliness, social loneliness might depend more on face-to-face interactions [42–45, 65].

The study also identified a negative relationship between privacy concerns and loneliness, particularly social and emotional loneliness, confirming hypotheses 6, 7, 8, and 9. Students with higher privacy concerns tended to form more selective relationships, which appeared to reduce loneliness [43]. Privacy-conscious individuals often focus on building meaningful connections, resulting in smaller but more fulfilling social circles that ease feelings of isolation [66]. This behavior aligns with research showing that selective engagement, especially among individuals with heightened institutional privacy concerns, fosters a sense of belonging and inclusivity through trusted connections [67].

Additionally, a positive relationship was found between institutional privacy and satisfaction ($\beta = .863$, $p < .001$), suggesting that perceived privacy in structured environments like schools promotes greater satisfaction. This finding is consistent with previous research linking privacy to autonomy and personal boundary control, both essential for satisfaction [21,68]. Institutional privacy fosters trust and security, which are critical for satisfaction in educational settings, as these environments are more engaging when students feel their privacy is respected [69].

Emotional loneliness also showed a significant negative relationship with satisfaction ($\beta = -.064$, $p < .001$), emphasizing how emotional isolation can diminish overall well-being. This supports Hypothesis 12 and underscores the importance of intimate connections in enhancing satisfaction. Emotional loneliness deprives individuals of validation and a sense of belonging, often leading to psychological distress and lower life satisfaction [70,71]. In contrast, social loneliness did not significantly impact satisfaction ($\beta = -.012$, $p = .079$), suggesting that broader social networks contribute less to well-being than close, supportive relationships. For many individuals, fewer but deeper connections offer greater satisfaction [71].

The mediation analysis revealed that institutional privacy mediates the relationship between social networking and life satisfaction ($\beta = .202$, $p < .001$, $f^2 = .041$), supporting Hypothesis 14. This indicates that perceived control over personal data in structured environments, such as educational institutions, plays a vital role in shaping life satisfaction. Institutional privacy likely enhances a sense of security and autonomy, enabling students to feel more confident and in control of their personal boundaries. This control is essential in hierarchical settings, where the balance of authority and personal agency significantly impacts well-being. By safeguarding personal information, institutional privacy fosters trust in these environments, contributing to a positive perception of the institution and greater life satisfaction.

In contrast, peer-related privacy did not exhibit a mediating effect, suggesting that while privacy in social interactions is relevant, it is less critical for overall life satisfaction. This may be due to students' ability to actively manage their peer relationships and regulate what personal information is shared, mitigating the potential impact of peer-related privacy concerns. Unlike institutional settings, where individuals have less direct control over privacy policies, interpersonal interactions allow for more immediate and adaptable strategies, reducing their influence on life satisfaction. This distinction emphasizes the unique and context-dependent roles of different types of privacy in shaping students' overall well-being.

Limitations

Several limitations of this study should be considered when interpreting the results. First, the sample consisted of 778 college students, with 39.7% female participants. While the sample size is robust, the findings may not be generalizable to other populations, such as older adults, individuals outside of college settings, or those from varying cultural or socioeconomic backgrounds. This limits the applicability of the results to broader groups. Second, the study's cross-sectional design restricts its ability to establish causality. Although associations between social networking use, privacy concerns, loneliness, and satisfaction were identified, the temporal order and direction of these relationships remain unclear. A longitudinal approach would be necessary to better understand causal dynamics and changes over time. Finally, the study's scope is limited to specific constructs, such as institutional and peer privacy concerns, social and emotional loneliness, and satisfaction. Other potentially influential factors, such as personality traits (e.g., introversion or extroversion), mental health status, or socioeconomic background, were not included in the analysis. These unexamined variables could play a role in shaping the relationships observed in the study and warrant further investigation in future research.

CONCLUSIONS

This study highlights the complex relationship between social networking, privacy concerns, loneliness, and life satisfaction among college students. Increased social networking engagement is associated with heightened privacy concerns, particularly regarding institutional data handling, emphasizing the importance of transparency and user control in fostering satisfaction. The findings also reveal that while social networking expands opportunities for social connections, it often fails to fulfill deeper emotional needs. This can result in a paradox where students feel socially connected but emotionally lonely. Emotional loneliness arises from the lack of meaningful, face-to-face interactions, which digital platforms cannot replicate. These results underscore the importance of balancing online and offline interactions, implementing institutional policies to safeguard privacy, and fostering deeper, authentic connections to support overall well-being and satisfaction, that contribute to the development of future perspectives [72-76].

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