International Journal of Mental Health and Addiction
https://doi.org/10.1007/s11469-024-01375-0

ORIGINAL ARTICLE

The Associations Between the Problematic Social Media and Smartphone Use, Social Phobia, and Self-Esteem: A Structural Equation Modeling Analysis

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Accepted: 17 August 2024

Abstract
Social phobia has often been associated with problematic social media use (PSMU) and problematic smartphone use (PSU). Studies have also shown an association between social phobia and self-esteem. However, no studies have analyzed the relationship between social phobia, self-esteem, PSMU, and PSU in an integrated model. The present study hypothesized that social phobia may influence PSMU and PSU through the role of self-esteem. A cross-sectional study comprising 400 Italians (74.75% female) with a mean age of 37.11 years (SD = ± 10.83) participated in the study that included Rosenberg's Self-Esteem Scale, Bergen Social Media Addiction Scale, Severity Measure for Social Phobia Disorder, and Smartphone Application-Based Addiction Scale. The results indicated direct positive associations between social phobia and both types of problematic technology use (PSMU and PSU). The results also indicated that self-esteem was a partial mediator in this complex relationship, suggesting that excessive technology use could be a way to compensate for low self-esteem among individuals with social phobia. The present study contributes to the understanding of the psychological mechanisms underlying the relationship between social anxiety, self-esteem, and problematic technology use.

Keywords Problematic smartphone use · Problematic social media use · Self-esteem · Social phobia

Social networking sites (SNSs) are fundamentally designed to provide users with a platform for facilitating communication between individuals. Originally, they facilitated users in establishing personalized profiles, curating a roster of contacts, disseminating personal content, and perusing the contributions of others within their network (Griffiths, 2022; Kuss & Griffiths, 2017; Moretta et al., 2022). SNSs have advanced considerably in their functionality, offering benefits beyond interpersonal communication. Currently, they are also used for professional purposes such as job hunting and personal promotion. (Kuss & Griffiths, 2017; Pantic, 2014).

Several studies have shown that active use of social media can produce many benefits, contributing to improved quality of human interaction and psychological

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well-being. (Kuss & Griffiths, 2017). In contrast, increasing academic research has demonstrated harmful aspects associated with the problematic use of social media use (PSMU). This is highlighted by studies which suggest that problematic engagement with social media can have detrimental consequences in psychological, physiological, and social domains (Griffiths et al., 2014; Kuss & Griffiths., 2017).

More specifically, such negative effects of PSMU include elevated levels of depression, anxiety, and stress, sleep disturbances, decreased psychological well-being, reduced life satisfaction, increased loneliness, impaired real-life interactions, poor educational performance, and increased social phobia (e.g., Kuss & Griffiths, 2017; Soraci et al., 2023; Yin et al., 2024; Zhao et al., 2024). A meta-analysis by Cheng et al. (2021) involving 32 countries (63 studies, $N = 34{,}798$) reported a prevalence of 24% for PSMU worldwide, ranging from 14% in individualist nations to 31% in collectivist cultures. However, prevalence rates may vary depending on the population sample and screening instruments used (e.g., Servidio et al., 2024). These findings emphasize the importance of further investigating the risk factors related to PSMU.

Problematic smartphone use (PSU) is often referred to as smartphone addiction in its most extreme form (Montag et al., 2024; Odaci & Kalkan, 2010; Servidio, 2021). PSU can occur when individuals spend extended periods on their smartphones and experience discomfort and agitation in the temporary absence of the device (Odaci & Kalkan, 2010; Servidio, 2021). Regarding the worldwide prevalence of PSU, a recent systematic review estimated that approximately 51.75% of young people (36.5%-67%) are affected (Candussi et al., 2023). Similar to the PSMU, prevalence rates may vary depending on the population sample and screening instruments used, and needs further scientific research (e.g., Servidio et al., 2024).

The impact of PSU on individuals' lives can be extremely serious (D'orta et al., 2015; Fineberg et al., 2022; Servidio et al., 2021; Soraci et al., 2020; Vahedi & Saiphoo, 2018). Research has identified characteristics of PSU among adolescents and young adults, including obsession with the smartphone, decreased academic performance (Cataldo et al., 2021), peer interaction anxiety (Odaci & Kalkan, 2010), and negative effects on everyday life and habits (Fineberg et al., 2022). A strong association exists between PSU and the intensity of SNS use, because individuals spending excessive time on their smartphones are more likely to engage in SNS activities (e.g., Servidio et al., 2022b). Individuals affected by PSU may connect with the online world as an adaptive reaction to cope with adverse life events (Soraci et al., 2020; Yin & Shen, 2023). The negative impact of PSU is partially alleviated when social media use is balanced with real-life interpersonal interactions (e.g., Yuan et al., 2022).

For a more nuanced understanding of the causes and consequences of PSU and PSMU, the Interaction of Person-Affect-Cognition-Execution model (I-PACE) has proved to be an invaluable theoretical framework (Brand et al., 2019). The I-PACE model integrates research on internet use disorders, including problematic smartphone use (PSU) and problematic social media use (PSMU), which involves psychopathological characteristics and dysfunctional personality traits. Factors such as personal characteristics, media content consumption, and rewards obtained are crucial in the development of PSU and PSMU according to this model, emphasizing the importance of investigating risk factors such as personality traits, anxiety levels, and smartphone usage patterns (Brand et al., 2019).

Social Phobia, Problematic Social Media and Smartphone Use

Social phobia, also known as social anxiety, refers to the strong desire that individuals must make a positive impression in social situations despite feeling uncertain about their ability to do so (Morrison & Heimberg, 2013). The cognitive-behavioral model of social phobia highlights three tendencies: setting excessively high standards for social performance, anticipating negative evaluations from others, and believing others' evaluations are accurate (Rapee & Heimberg, 1997). Consequently, socially anxious individuals often experience fear or anxiety about being negatively judged in social interactions (O'Day & Heimberg, 2021). Among such individuals, there is often heightened fear of subpar social performances which further diminishes the likelihood of establishing new interpersonal relationships and harming existing ones (Foroughi et al., 2021; Morrison & Heimberg, 2013; O'Day & Heimberg, 2021; Rapee & Heimberg, 1997). Despite the adverse effects of social phobia on the development of regular social interaction, symptoms of anxiety are commonly observed among non-clinical samples, and a significant proportion of individuals experience varying degrees of social phobia in their daily lives (McCarthy et al., 2020). Previous research (e.g., Freitas-Ferrari et al., 2010, Murad, 2020; Soraci et al., 2022a, 2022b; Zahran, 2010) has noted that individuals with social phobia demonstrate different behavioral aspects such as nervousness, apprehension, fear, and concern that negatively affect their self-esteem.

Research has consistently shown a substantial association between social phobia, PSU and PSMU (e.g., Liu et al., 2024; Sun, 2023). One of the similar characteristics between social phobia, PSU and PSMU is the lack of face-to-face interactions, so relationships being computer-mediated (e.g., via smartphone) can be important in alleviating social anxiety (e.g., Liu et al., 2024; Stănculescu & Griffiths, 2022, 2023; Sun, 2023). The possibility for individuals not to exhibit their physical appearance also makes it possible to avoid the aesthetic judgment that often hampers the initiation of a relationship (Bonetti et al., 2010). Since online communication is usually asynchronous and does not always involve others perceiving the user, some users state that such relationships can be a helpful factor in preserving, at least in part, the social skills of those who live in isolation or social withdrawal (O'Day & Heimberg, 2021; Wu-Ouyang & Hu, 2023). In fact, SNSs can provide a temporary respite for individuals affected by a social phobia disorder, alleviating the feelings of embarrassment and self-consciousness typically experienced in face-to-face interactions (e.g., O'Day & Heimberg, 2021). However, despite engaging with others through a screen (e.g., smartphone) providing a sense of comfort for individuals with higher levels of social phobia, it may concurrently impede their capacity to interact with others face-to-face (Alvi et al., 2022; Single et al., 2022; Svicher et al., 2021; Swathi et al., 2023).

Interestingly, research has shown that, in line with the compensatory internet use theory (CIUT; Kardefelt-Winther (2014), individuals may engage in excessive internet, smartphone or social media use as a form of self-medication following stressful or highly anxious life events to alleviate the resulting negative emotions. CIUT aligns with negative reinforcement models of addiction, such as 'self-medication' or 'affect regulation,' which highlight substance use as a strategy to mitigate negative emotions (Elhai et al., 2019; Vahedi and Saiphoo, 2018).

Self-Esteem, Social Phobia, Problematic Social Media and Smartphone Use

Self-esteem is defined as an individual's positive or negative evaluation of themselves (Rosenberg, 1965; Smith et al., 2014). In exploring the relationship between social media use and self-esteem, many studies have examined the impact of these platforms on individuals' self-perception (e.g., Colak et al., 2023; Hawi & Samaha, 2017; Samra et al., 2022; Soraci et al., 2022a, 2022b). Research suggests that engaging in social media use can lead to either an augmentation or a reduction in self-esteem (Jiang & Ngien, 2020). More specifically, higher levels of self-esteem act as a protective shield against negative experiences that may arise in social media interactions (e.g., individuals with higher self-esteem are often more resilient in the face of potential criticism or adverse online encounters) (e.g., Wang, 2024). However, those with lower levels of self-esteem may be more vulnerable to negative experiences in social media interactions, facing challenges related to personal insecurity, social phobia, and susceptibility to criticism or judgment from online platforms (e.g., Jiang & Ngien, 2020; Servidio et al., 2024).

The level of self-esteem also appears to play a pivotal role in shaping the dynamics of how individuals navigate and utilize social media platforms (e.g., Colak et al., 2023). Research has indicated a tendency for those with lower self-esteem to exhibit more extensive use of social media applications and its possible problematic use (PSMU e.g., Soraci et al., 2023). For instance, individuals with low self-esteem may find solace in platforms such as *Facebook*, investing more time in these virtual spaces because they perceive them as safe environments for self-expression and social interaction (e.g., Soraci et al., 2023). The findings of other studies have consistently reported an association between individuals with low self-esteem and a greater tendency to engage in social media use (e.g., Andreassen et al., 2016).

In examining the relationship between problematic smartphone use (PSU) and self-esteem, numerous studies have investigated the influence of excessive smartphone engagement on individuals' self-perception (e.g., De-Sola Gutiérrez et al., 2016; Elhai et al., 2017; Longstreet & Brooks, 2017; Thomée et al., 2018). The extant literature indicates that PSU can either exacerbate or decrease self-esteem (e.g., Horwood & Anglim, 2019). In particular, higher levels of self-esteem may act as a protective buffer against the negative effects associated with PSU. Individuals with greater self-esteem may be more resilient to problems such as addiction or anxiety resulting from excessive smartphone use (e.g., De-Sola Gutiérrez et al., 2016). Conversely, individuals with lower self-esteem may be more susceptible to the negative effects of PSU, experiencing difficulties such as social anxiety, greater sensitivity to criticism, and greater reliance on smartphones for emotional regulation (e.g., Elhai et al., 2017; Panova & Lleras, 2016).

Additionally, research suggests that an individual's level of self-esteem may significantly impact their relationship with and reliance on smartphones (Horwood & Anglim, 2019). The extant literature indicates that individuals with lower self-esteem are more prone to PSU (e.g., Elhai et al., 2018). For instance, those with low self-esteem may turn to their smartphones as a means of escape or comfort, spending more time on their smartphones as they perceive them to be a safe environment for distraction and avoidance of real-life challenges (Longstreet & Brooks, 2017). Other studies have consistently reported an association between low self-esteem and an increased probability of engaging in problematic smartphone behaviors (e.g., Thomée et al., 2018).

Finally, the association between social phobia and self-esteem has been the subject of several studies (e.g., Calin et al., 2021; Väänänen et al., 2014). Social phobia is caused by factors such as the fear of being criticized by others, fear of being evaluated improperly, feelings of shame, and being in the presence of strangers. When an individual experiences social phobia, they may manifest a series of fears and worries about the judgment of others, the fear of being criticized or evaluated negatively, and the fear of making mistakes or making a wrong impression in social situations (Väänänen et al., 2014). These worries can gradually erode confidence among individuals and their abilities, leading to a deterioration of self-esteem. In addition, social phobia can also affect the way individuals perceive themselves in relation to others, causing a distorted perception of themselves and their social skills. Therefore, social anxiety can cause a variation in self-esteem, leading a person to perceive themselves negatively and doubt their abilities in the social context (Väänänen et al., 2014). However, other studies point to self-esteem as an antecedent of social phobia (Calin et al., 2021). Individuals with low self-esteem are more prone to perceive themselves unable to deal with situations considered difficult and therefore to develop social anxiety symptoms. In sum, previous research has shown that social phobia and self-esteem are two variables negatively associated with each other.

The Present Study

Although there are various studies in the literature analyzing the association of the variables of the present study (e.g., Annoni et al., 2021; Bae & Nam, 2024; Casale et al., 2022; Gori et al., 2023; Mohamed et al., 2023; Mohd Salleh Sahimi et al., 2022: Liu et al., 2024; Wang, 2024), to the best of the authors' knowledge, none of them analyses the relationship between social phobia, self-esteem, PSU and PSMU in a comprehensive model. For example, Mohd Salleh Sahimi et al. (2022) examined the relationship between excessive smartphones, social phobia, and quality of life, without taking into account self-esteem and the PSMU, while Casale et al. (2022) performed a meta-analysis on the association between self-esteem and problematic smartphone use, without taking into account social anxiety and the PSMU. Annoni et al. (2021) instead examined the relationship between social anxiety, smartphone use, dispositional trust, and problematic smartphone use, without considering PSMU and self-esteem. Bae and Nam (2024) studied PSU and self-esteem in addition to mother's time spent with their child, they did not study social anxiety and PSMU. Mohamed et al., (2023), also examined PSU in relation to social phobia, but did not consider PSMU and self-esteem. Liu et al. (2024) examined the relationship of PSU and social anxiety in a comprehensive model that also included smartphone use and rumination but did not include PSMU and self-esteem in their model. Moreover, while Edwards et al. (2022) used regression analyses to predict PSU and nomophobia with depression, social anxiety, and self-esteem as predictor variables, they did not study PSMU. Gori et al. (2023) proposed a path analysis model that included PSMU, self-esteem, time spent on social media, fear of missing out (FoMO), as well as both preoccupied and fearful attachment. However, they did not consider the influence of PSU or social anxiety. Lastly, while Wang (2024) found cross-lagged associations between self-esteem and PSMU, they did not study social anxiety or PSU.

Therefore, to address this gap and taking the aforementioned theories into account, the present study investigated the relationship between social phobia, PSU and PSMU, considering the mediating role of self-esteem. Investigating the relationship between

social phobia, problematic use of social media and smartphones is important, and the mediating role of self-esteem may provide valuable information for developing targeted interventions to improve the mental health and psychological well-being of individuals with social phobia. Therefore, the study's primary objectives were to test the mediating effect of self-esteem on social phobia, PSMU, and PSU. The research objective is based on a mediation model (i.e., how social phobia is associated with PSMU and PSU) to explore the role of self-esteem in the relationship between social phobia and PSMU use and PSU.

The following hypotheses (H_s) were formulated drawing upon both theoretical foundations and empirical evidence. More specifically, it was hypothesized that (i) social phobia would be directly associated with both problematic social media use and smartphone use (H_1), (ii) self-esteem would mediate the association between social phobia, PSU, and PSMU (H_2), and (iii) self-esteem would be negatively associated with both problematic social media use and problematic smartphone use (H_3). Given that gender has been the subject of mixed results regarding its association with both PSMU and PSU (e.g., Huang, 2022; Stănculescu & Griffiths, 2024; Wang et al., 2022), it was included as a covariate in the SEM model (dummy coded as 1 = male, 2 = female). The hypothesized model is shown in Fig. 1

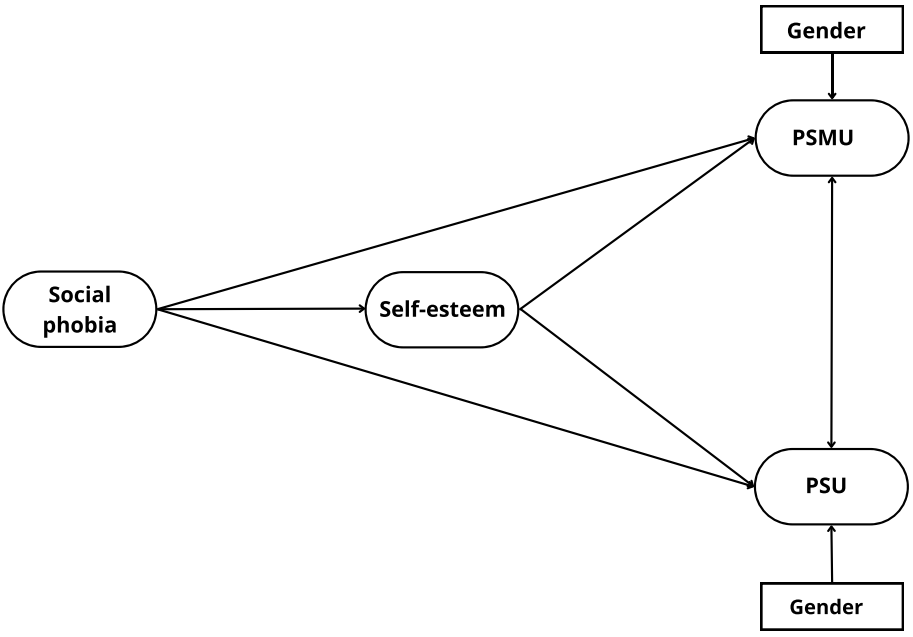

Fig. 1 Hypothesized research model. PSU = problematic smartphone use. PSMU = problematic social media use

Methods

Participants and Procedure

Participants were recruited through several online forums and social media communities in Italy (e.g., *Facebook, WhatsApp, Telegram, Instagram*) via a link advertising a survey hosted on *Google Forms*. The research team shared the link, inviting individuals to participate voluntarily and anonymously. No reward was offered to participants. The inclusion criteria required participants to be (i) over 18 years old, (ii) owners of a smartphone, (iii) in possession of an active account on one or more social networks, and (iv) Italian speaking-citizens. All participants completed the survey anonymously after providing informed consent. During a period of one year (February 2022 to February 2023), 415 volunteers began the online survey, which took approximately 20–25 min to complete, but only 400 completed all questions. Regarding gender, 74.75% identified as female ($n = 299$) and 25.25% as male ($n = 101$). The mean age of the participants was 37.11 years (SD = ± 10.83). Regarding the level of education, 60.50% of the sample had a university degree or higher ($n = 242$), 37.25% had a high school diploma ($n = 149$), and 2.00% had a secondary school diploma ($n = 8$). Half of the participants were employed (50.75%, $n = 203$). On average, the participants spent 4.90 h per day using a smartphone and 3.10 h per day on social media sites. See Table S1 (Supplementary materials) for details.

Measures

Socio-demographics, life habits, and general questions related to social media/smartphone use: Several demographic variables were assessed, including gender, age, level of education and occupation. In addition, participants were asked about the number of daily hours they spent on both SNSs and smartphones.

Rosenberg's Self-Esteem Scale (RSES; Rosenberg, 1965; Italian version: Prezza et al., 1997). The 10-item RSES was used to assess self-esteem. The scale contains statements such as *"Overall, I am satisfied with myself"*, and participants rate their agreement on a four-point Likert scale ranging from 0 (*strongly disagree*) to 3 (*strongly agree*), with total scores ranging from 0 to 30. A higher score indicates higher self-esteem. In the present study, the internal consistency of the RSES was excellent (Cronbach's $\alpha = 0.91$). This scale was used because it has exhibited good psychometric properties (i.e., reliability and validity [both convergent and discriminant]) in both the Italian (e.g., Prezza et al., 1997; Soraci et al., 2023) and international (e.g., García et al., 2019; Rosenberg, 1965) contexts in adequately assessing the construct of self-esteem.

Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2016; Italian version: Monacis et al., 2017)**.** The six-item BSMAS was used to assess the risk of PSMU over a 12-month period, based on the addiction components model (Griffiths, 2005). The scale contains statements such as "*In the past year, have you spent a lot of time thinking about social media or planning to use it?*"), and participants rate items on a Likert scale from 1 (*never*) to 5 (*very often*), with total scores ranging from 6 to 30. A higher score indicates a higher risk of PSMU. In the present study, the internal consistency of the BSMAS was excellent (Cronbach's $\alpha = 0.91$). This scale was used because it has exhibited good psychometric properties (i.e., reliability and validity [both convergent and discriminant]) both in the Italian (e.g., Monacis et al., 2017; Soraci et al., 2020, 2023) and international (e.g.,

Andreassen et al., 2016; Chen et al., 2020; Stănculescu, 2023; Yue et al., 2022) contexts in adequately assessing the risk of PSMU construct.

Smartphone Application-Based Addiction Scale (SABAS; Csibi et al., 2018; Italian version: Soraci et al., 2020). The six-item SABAS was used to assess risk of PSU. The scale contains such items as "*When I cannot use or access my smartphone when I feel like it, I feel sad, irritable or moody'*) and participants rate items on a five-point Likert scale from 1 (*strongly disagree*) to 6 (*strongly agree*), with total scores ranging from 6 to 36. A higher score indicates a greater risk of PSU. In the present study, the internal consistency of the SABAS was excellent (Cronbach's $\alpha = 0.92$). This scale was used because it has exhibited good psychometric properties (i.e., reliability and validity [both convergent and discriminant]) in both the Italian (e.g., Marengo et al., 2022; Soraci et al., 2020) and international (e.g., Chen et al., 2020; Csibi et al., 2018) contexts in adequately assessing the construct of risk of PSU.

Severity Measure for Social Phobia Disorder–Adult (SMSPD; LeBeau et al., 2016; Italian version: Fossati et al., 2015). The 10-item SMSPD) was used to assess the severity of symptoms associated with social phobia over the past seven days. The scale contains statements such as "*During the past 7 days, I have been distracted to avoid thinking about social situations*" and participants rate items on a five-point Likert scale from 0 (*never*) to 5 (*always*), with total scores ranging from 1 to 40. A higher score indicates more severe symptoms of social phobia. In the present study, the internal consistency of the SMSPD was excellent (Cronbach's $\alpha = 0.90$). This scale was used because it has exhibited good psychometric properties (i.e., reliability and validity [both convergent and discriminant]) in both the Italian (e.g., Fossati et al., 2015; Soraci et al., 2022a, 2022b) and international (e.g., Kaloeti et al., 2021; LeBeau et al., 2016) contexts in adequately assessing the construct of social phobia. Moreover, this measure has also been used successfully in the non-clinical population (e.g., Rice et al., 2021; Soraci et al., 2022a, 2022b). Furthermore, the scale reflects the diagnostic criteria of the DSM-5.

Data Analysis

First, the data were checked by exploring univariate (skewness and kurtosis) and multivariate normality. Second, descriptive statistics and Pearson's *r* correlations were computed to explore the variables' properties and to evaluate their relationships, respectively. The multivariate normality of the data was assessed by computing Mardia's (1970) index (K) and inspecting asymmetry and kurtosis (Hair et al., 2010). Mardia's skewness for the current data was $K = 436.78$, ($p < 0.001$), and the Mardia's kurtosis was $K = 4.80$ ($p < 0.001$), indicating a deviation from multivariate normality. The violation of multivariate normality suggests the use of robust estimators (Li, 2021). However, when examining skewness and kurtosis, none of the measures used had a skewness greater than ± 2 (min = 0.34, max = 1.28, in absolute value) or kurtosis greater than ± 7 (min = 0.30, max = 1.27, in absolute value), suggesting a non-excessive violation of normality (Hair et al., 2010; Kim, 2013), therefore remaining adequate values for structural equation modelling (SEM) (Griffin & Steinbrecher, 2013; Hair et al., 2010; Kim, 2013). See Table S2 (Supplementary Materials) for details.

No other issues were detected after screening the data. Therefore, no participants were excluded from the analyses. Third, structural equation modeling (SEM) was carried out. In the first step of SEM, the measurement model for latent variables was

tested. Furthermore, the full model (measurement and structural) was tested. Finally, to test if self-esteem mediated the relationships between social phobia, problematic social media use, and problematic smartphone use, a mediation analysis was performed. To assess the model's adequacy, a number of fit indices were used including chi-square test (χ^2, the ratio of χ^2 to degrees of freedom [df] should be less than 3 to ensure an acceptable fit of the model to the data; however, χ^2 is very sensitive to sample size [i.e., > 200], so additional model fit indices were used [Kenny, 2020; Kline, 2016]), the comparative fit index (CFI), Tucker-Lewis's index (TLI), and root-mean-square error of approximation (RMSEA). Consistent with Kline's (2016) recommendations, the following were deemed as being indicative of a well-fitting model: CFI values ≥ 0.95, TLI values ≥ 0.95, and RMSEA values ≤ 0.08. The SEM and mediation analyses were conducted using *lavaan* (Rosseel, 2012), employing a mean-adjusted maximum likelihood (MLM) estimator. The sample size was considered sufficient to ensure an accurate data analysis (a priori sample size calculation for SEM analysis, recommended a minimum sample size of $n = 207$, with statistical power of 0.95, $p = 0.05$, effect size = 0.3, for the present study [Soper, 2024]).

Results

Preliminary Analyses

Descriptive statistics and bivariate correlations among the measured variables can be found in Table 1 and Table S2 and S3 (in Supplementary Materials). Problematic smartphone use, social phobia, and problematic social media use were all positively correlated, and they were all negatively associated with self-esteem, gender, and age.

Table 1 Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4	5
1. PSU	12.74	7.19	-				
2. Social phobia	8.59	10.02	0.73***				
			[0.68, 0.77]	-			
3. PSMU	11.87	5.84	0.85***	0.74***			
			[0.82, 0.88]	[0.69, 0.78]	-		
4. Self-esteem	20.70	7.15	-0.58***	-0.66***	-0.58***		
			[-0.64, -0.51]	[-0.72, -0.61]	[-0.64, -0.51]	-	
5. Gender	1.75	0.44	-0.20***	-0.18***	-0.15**	0.11*	
			[-0.29, -0.10]	[-0.28, -0.09]	[-0.25, -0.05]	[0.01, 0.21]	-
6. Age	37.14	10.88	-0.46***	-0.47***	-0.47***	0.37***	0.13**
			[-0.54, -0.38]	[-0.55, -0.40]	[-0.54, -0.39]	[0.28, 0.45]	[0.04, 0.23]

M and *SD* are used to represent means and standard deviations, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. PSU = problematic smartphone use. PSMU = problematic social media use. Gender (1 = male, 2 = female). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

SEM and Mediation Model

The measurement model results, which include variables such as social phobia, self-esteem, problematic social media use, and problematic smartphone use, aligned well with the data, robust $\chi^2(447, N=400)=931.43$ ($p<0.001$, $\chi.^2/df=1.12$), CFI = 0.947, TLI = 0.941, RMSEA = 0.06, 90% CI [0.05, 0.06], SRMR = 0.047. Given the acceptable result of the measurement model, the effects were modeled among the latent variables to test the study's hypotheses. The results of the SEM analysis (measurement and structural model were merged) are shown in Fig. 2

The tested model, controlled for gender, fitted the data sufficiently well: robust $\chi^2(477, N=400)=1021.38$ ($p<0.001$, $\chi^2/df=2.14$), CFI = 0.942, TLI = 0.935, RMSEA = 0.06, 90% CI [0.05, 0.06], SRMR = 0.06.

The results shown in Fig. 2 suggest that social phobia was directly positively associated with both problematic smartphone use ($B=0.73$, β = 0.63, SE = 0.09, Z = 8.20, $p<0.001$, 95% CI [0.45, 0.80]), and with problematic social media use, ($B=0.58$, β = 0.71, SE = 0.06, Z = 9.93, $p<0.001$, 95% CI [0.59, 0.82]) (therefore H_1 was supported), and negatively associated with self-esteem, ($B=-0.37$, β = -0.72, SE = 0.05, Z = -7.92, $p<0.001$, 95% CI [-0.78, -0.66]). Self-esteem was negatively associated with both problematic social media use, ($B=-0.20$, β = -0.13, SE = 0.01, Z = -2.02, $p<0.05$, 95% CI [- 0.14,—0.11]), and problematic smartphone use, ($B=-0.38$, β = -0.17, SE = 0.04, Z = -2.46, $p<0.05$, 95% CI [-0.24, -0.09]) (therefore H_3 was supported).

Regarding the results of the mediation analysis, it was found that social phobia had a significant indirect effect on problematic social media use ($B=0.08$, β = 0.09, SE = 0.04, Z = 2.08, $p<0.05$, 95% CI [0.01, 0.18]) of the total effect ($B=0.65$, β = 0.80, SE = 0.04,

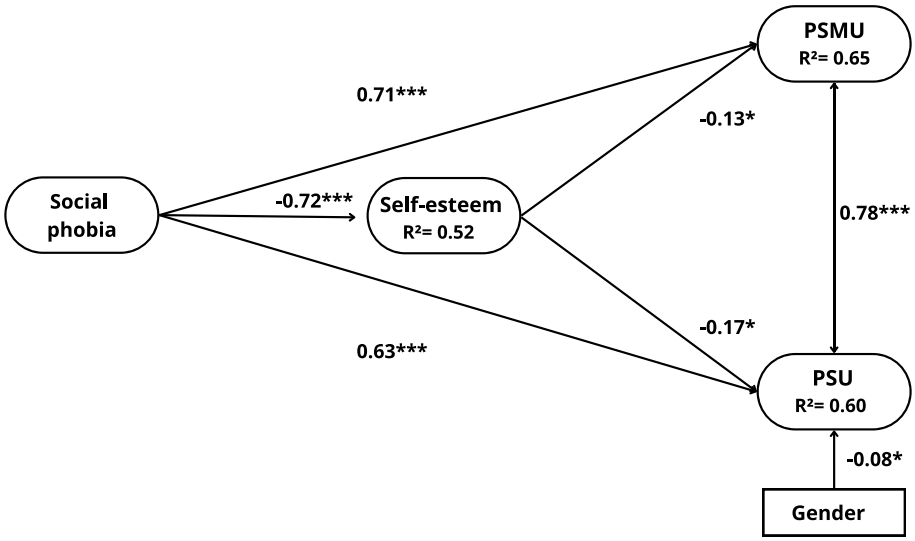

Fig. 2 Standardized results of the SEM model. The latent factors are presented in an oval. Covariate (Gender dummy coded – 1 = male, 2 = female) is represented in a rectangle. Item factor loadings, significant at $p<0.001$, are omitted. PSU = problematic smartphone use; PSMU = problematic social media use. Non-significant path is omitted. *$p<0.05$, **$p<0.01$, ***$p<0.001$

Z = 14.95, $p < 0.001$, 95% CI [0.74, 0.86], $p < 0.001$), and problematic smartphone use ($B = 0.14$, β = 0.12, SE = 0.05, Z = 2.62, $p < 0.01$, 95% [CI 0.03, 0.22]) of the total effect ($B = 0.87$, β = 0.76, SE = 0.07, Z = 13.21, $p < 0.001$, 95% CI [0.69, 0.82]) through self-esteem, respectively. The results of the mediation analysis are shown in Table 2. Problematic social media use explained 65% of the variance and PSU explained 60% of the variance. The results indicated that self-esteem had a partial mediating effect on the relationship between social phobia and problematic social media use (therefore, H_2 was partially supported). Finally, being male was associated with PSU ($B = -0.04$, $\beta = -0.08$, Z = -2.46, $p < 0.05$, 95% CI [-0.343, -0.039]), but there was no gender association with PSMU ($B = -0.03$, $\beta = -0.06$, Z = -0.83, $p = 0.40$, 95% CI [-0.160, 0.065]).

Discussion

The main aim of the present study was to examine the mediating role of self-esteem in the relationship between social phobia, problematic social media use (PSMU), and problematic smartphone use (PSU). The mediation analysis indicated that self-esteem was a partial mediator (partially supporting H_2). In understanding this complex relationship. In the present study, individuals with higher levels of social phobia had lower self-esteem, a finding in line with previous research (Holas et al., 2023). This decrease in self-esteem may make these individuals more vulnerable to the attractiveness of digital platforms, which offer a virtual environment in which self-image can be managed in a more controlled and comfortable manner than in face-to-face social interactions, as evidenced by previous research (Colak et al., 2023; Servidio et al., 2021; Soraci et al., 2022a, 2022b).

In this context, the excessive use of smartphones and social media applications can act as a compensatory mechanism for the lack of self-confidence and gratification from offline social interactions. The constant search for validation and gratification through online interactions can feed a negative cycle in which problematic technology use becomes increasingly pronounced as a response to low levels of self-esteem, while inhibiting social anxiety and emotional distress (Xu et al., 2023), in line with I-PACE model, which helps in understanding how various factors interact to influence the problematic use of technology (Brand et al., 2019).

Table 2 Estimates of total, direct, and indirect effects of the model

Pathway	*B*	*SE*	*Z*	*p*	β
Social phobia – > PSMU					
Direct effect	0.58	0.06	9.83	0.000	0.71
Total effect	0.65	0.04	14.95	0.000	0.80
Social phobia – > PSU					
Direct effect	0.73	0.09	8.20	0.000	0.63
Total effect	0.87	0.07	13.21	0.000	0.76
Social phobia– > SE – > PSMU					
Indirect effect	0.08	0.04	2.08	0.037	0.09
Social phobia – > SE – > PSU					
Indirect effect	0.14	0.05	2.62	0.000	0.12

B = standardized beta coefficient, *PSMU* - problematic social media use, *PSU* = problematic smartphone use, *SE* = self-esteem.

In the specific case of the relationship between social phobia, self-esteem, and problematic technology use (i.e., PSMU and PSU), mediation was partial and not total. This can be explained by considering several factors, including: (i) social phobia may directly influence problematic technology use, independent of self-esteem, because individuals may overuse technology to avoid social situations they fear, irrespective of their levels of self-esteem (Ding et al., 2023); (ii) while self-esteem might partially mediate the association between social phobia and problematic technology use, other factors such as past experiences of criticism or bullying can also impact self-esteem and contribute to technology misuse, irrespective of social phobia (Colak et al., 2023); and (iii) the relationship between social phobia, self-esteem, and problematic technology use is intricate, with self-esteem partly mediating the association between social phobia and technology misuse. However, other factors such as general anxiety or stress may independently influence this relationship beyond self-esteem (MacKinnon et al., 2007; Zhou et al., 2023). Therefore, the mediation analyses, although partial, were still significant, supporting the hypothesis that individuals with social phobia may engage in problematic use of technology to compensate for reduced self-esteem (Zsido et al., 2020).

The direct positive associations between social phobia and PSU and PSMU confirm the findings of previous studies (Servidio et al., 2021; Sfeir et al., 2023; Soraci et al., 2022a, 2022b, 2023), reinforcing the hypothesis (and supporting H_1) that individuals with social anxiety may develop a greater tendency for excessive and potentially problematic use of digital platforms. This finding aligns with the CIUT (Kardefelt-Winther, 2014), which posits that individuals with social anxiety may perceive digital platforms as a 'safe haven', escape route and/or coping mechanism from feared social situations. Moreover, constant access to online interactions might offer a sense of control and emotional distance that is reassuring for those uncomfortable in face-to-face interactions (Annoni et al., 2021). However, it should be emphasized that such behavior could contribute to perpetuating the cycle of social anxiety, because over-reliance on digital technologies could limit opportunities for social interaction in real-life situations, further exacerbating social distress.

The present study's results found a significant association between self-esteem and problematic use of both social media and smartphones (supporting H_3). More specifically, it was found that lower self-esteem was associated with greater problematic use of both SNSs and smartphones, aligning with previous studies (Bahrainian et al., 2014; Servidio et al., 2021, 2024; Soraci et al., 2020, 2022a, 2022b; Zeidan et al., 2021). One possible interpretation of this association concerns the role of self-esteem in shaping individuals' online and offline behavior. Individuals with lower self-esteem might use social media and smartphones to seek external gratification or escape from feelings of insecurity or discomfort. In this sense, excessive use of these technologies could be a way of compensating for self-esteem deficiencies (Servidio et al., 2021; Soraci et al., 2020, 2022a, 2022b; Zeidan et al., 2021). On the other hand, it could also be that excessive use of social media and smartphones may contribute to further eroding self-esteem. For example, excessive use of these platforms could result in less participation in offline activities that could help promote healthy self-esteem, such as face-to-face interaction, exercise, or involvement in rewarding social activities.

These findings also suggest the importance of considering self-esteem in prevention and intervention strategies to reduce problematic use of social media and smartphones. Approaches aimed at enhancing individuals' self-esteem may need to be developed as an integral part of treatment to reduce their overuse of these technologies. Therefore, understanding the underlying dynamics of the excessive use of digital devices among individuals

with social phobia may be crucial for developing targeted interventions that can foster a more adequate management of social anxiety and a better overall quality of life.

Finally, the role of gender appeared significant in the SEM analysis, indicating that female gender may have fewer associations with PSU than male gender. These findings are in line with previous studies (e.g., Claesdotter-Knutsson et al., 2021; Wu and Chou, 2023), although other studies have found that the females have more problems with PSU than males (e.g., Chen et al., 2017; see De-Sola Gutiérrez et al., 2016 for a review). Regarding the association between gender and PSMU, the present study found a non-significant association in SEM analysis, in line with previous studies (see Busch & McCarthy, 2021; Huang (2022) for a meta-analytic review). However, other studies have found a significant association between PSMU and gender, with some finding that the males are more likely to experience PSMU (e.g., Alnjadat et al., 2019), while others have found females more likely to experience PSMU (e.g., Andreassen et al., 2016; Zhao et al., 2022). However, the present study's findings in relation to gender must be interpreted with caution because there was a high proportion of females in the sample (over 70%), which may have biased the results.

Limitations and Future Directions

The present study has several limitations that should be acknowledged. More specifically, the cross-sectional research design, along with the use of a small convenience sample and reliance on self-reported data, introduces the possibility of biased results (e.g., content-sensitive response bias, such as social desirability). Despite the survey's anonymity, participants might have hesitated to openly report their issues due to potential feelings of guilt and/or shame. Moreover, the non-random and self-selecting nature of the sample cannot be deemed representative of the entire population. Consequently, the generalizability of the findings is constrained.

Although the total, direct and indirect effects hypothesized in the present study are plausible, through the theoretical framework provided, using a cross-selection data methodology, the hypothesized association relationships between the study variables cannot be established with any certainty. Furthermore, although mediation analysis using cross-sectional data is a generally accepted methodology that has been used internationally when providing a plausible theoretical framework (e.g., Hu & Zhao, 2024; Servidio et al., 2022a), this practice has received some criticism from the research community (e.g. Maxwell & Cole, 2007; O'Laughlin et al., 2018). Consequently, the data must be read and interpreted with caution. Another limitation was the role of self-esteem in explaining indirect effects. Although it is much used in research as a mediating variable, its role is not well defined in the literature (e.g., independent or dependent variable). A further limitation was that the participants had not been formally diagnosed with social phobia issues or other pathologies. Consequently, the results of the present study should be interpreted with caution. Finally, another limitation is that the gender distribution within the sample was unbalanced, with an over-representation of female respondents, which may have biassed the results.

Future research could benefit from exploring additional characteristics with a more extensive and demographically representative sample of the Italian population, ensuring a more balanced gender distribution. Furthermore, the inclusion of formal clinical assessments for social phobia and other relevant conditions would improve the validity of the results, ensuring that participants' conditions are accurately diagnosed and taken into account in the analyses.

Additionally, exploring potential moderators, such as gender, could provide further insights into the nuanced mechanisms underlying these associations. Future research with a more balanced and larger sample could control for age and education in the analyses performed (e.g., SEM). Future studies should also employ multi-group analysis, to check whether the results are comparable by gender. Furthermore, longitudinal studies would provide a better understanding of the associations between social phobia, self-esteem, PSU, and PSMU.

Finally, a mixed methods approach, combining quantitative methods (e.g., SEM) with qualitative methods (e.g., interviews, focus groups), may provide a deeper understanding of the underlying mechanisms and contextual factors influencing the relationships between the study variables. By employing these methodological approaches and study designs, future research can address current limitations, provide stronger evidence for hypothesized relationships, and offer more comprehensive insights into the dynamics between social phobia, self-esteem, and problematic technology use. Despite the aforementioned limitations, the present study contributes to the growing body of literature on the psychosocial factors influencing technology use patterns, offering implications for clinical practice and intervention development.

Conclusion

The present study examined the association between social phobia, self-esteem, and the problematic use of social media and smartphones. The findings showed a direct relationship between social phobia and excessive use of these technologies. Self-esteem was identified as a key factor that partially explained the indirect effects of these variables, highlighting its role in shaping how individuals engage with social media and smartphones. These findings have important practical implications for mental health interventions. More specifically, they emphasize the need for interventions that not only address the symptoms of social anxiety but also focus on enhancing self-esteem. By improving self-esteem, individuals may become less reliant on digital platforms for validation or as a means of escape, leading to a reduction in problematic technology use and an improvement in overall psychological well-being.

Moreover, the research suggests that educational programs aimed at increasing awareness of the risks associated with excessive smartphone use and social media use, particularly among those with social anxiety and low self-esteem, could be beneficial. Such programs could help promote healthier, more balanced technology use by teaching coping and resilience strategies, and fostering a greater understanding of the psychological risks involved. On a broader scale, the findings call for policymakers and mental health professionals to consider the psychological factors contributing to problematic technology use when designing public health initiatives or digital literacy campaigns. The present study also opens new avenues for future research to explore the complex interplay between psychological factors and problematic technology use. Further research is needed to fully understand the relationship between these variables and develop more effective intervention strategies.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11469-024-01375-0.

Acknowledgements Not applicable.

Funding Not applicable.

Data Availability The research data and the study protocol are available upon reasonable request to the first author via email (e.g. to carry out longitudinal studies and/or replicate this study with larger, more representative populations, or for comparative studies).

Declarations

Ethics Approval and Consent to Participate The present study is part of a larger research project on emerging behavioral addiction, and adhered to the ethical guidelines established by the Italian Psychological Association. The research was conducted according to the Declaration of Helsinki for medical research involving human participants and approved by the Niccolo Cusano University ethics committee. All participants gave their online consent to participate in the study. The identity of the participants was anonymous, and the data were stored in an encrypted online archive, accessible only to the authors of the present study.

Informed Consent Informed consent was obtained from all participants involved in the study.

Conflict of Interest This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors declare that there are no conflicts of interest.

Preregistration None.

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