Exploration of Digital Health Technologies

Open Exploration

Open Access Original Article

From scrolling to spiraling: exploring the mediation role of self-esteem between social media rumination and internalizing symptoms

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Academic Editor: Mirko Casu, University of Catania, Italy; Atanas G. Atanasov, Medical University of Vienna, Austria
Received: June 26, 2025 **Accepted:** August 25, 2025 **Published:** October 14, 2025

Cite this article: Chen S, Jeong R, Fellows M, Sibenaller I, Demaray M. From scrolling to spiraling: exploring the mediation role of self-esteem between social media rumination and internalizing symptoms. Explor Digit Health Technol. 2025;3:101164. https://doi.org/10.37349/edht.2025.101164

Abstract

Aim: Given the ubiquitous use of social media among young adults, understanding its impact on their psychological well-being is increasingly important. Research has identified negative associations between social media use and internalizing problems, such as depression and anxiety. Building on the previous research, the current study explored the mediating role of self-esteem in the associations between social media rumination (SMR) and symptoms of depression and anxiety in college students. Additionally, the study investigated the moderating role of gender in these associations.

Methods: The study sample consisted of 551 college students (mean age = 19 years; 36% men, 23.8% White) from a diverse midwestern university. The participants completed measures of depression (PHQ-9), anxiety (GAD-7), self-esteem (RSES), and SMR (Social Media Rumination Scale [SMRS]). An exploratory factor analysis was performed on the SMRS and supported a one-factor structure for the measure. Main analyses were conducted in R using PROCESS Model 4 and examined the associations between SMR and symptoms of depression and anxiety, with self-esteem as a mediator, and gender as a moderator. Additionally, time spent on social media and the number of posts per week were included as covariates in the analyses.

Results: Results indicated that SMR, above and beyond time spent on social media and type of engagement, was indirectly associated with depression and anxiety through self-esteem, and gender did not moderate these associations.

Conclusions: The study's findings contribute to our understanding of the mechanisms linking social media use to internalizing problems, highlighting the crucial role of self-esteem in this process. Moreover, the study offers valuable insights for developing targeted interventions aimed at mitigating the negative effects of social media use on mental health by addressing SMR and bolstering self-esteem in young adults.

Keywords

social media, rumination, depression, anxiety, self-esteem

Introduction

Social media has become an integral part of young adults' daily lives. An overwhelming 74% of individuals aged 18 to 29 in the United States engage with five or more social media platforms, according to a recent Pew Research Center report [1]. This widespread adoption is accompanied by daily engagement reported by 63% of youth and an average daily usage of 70 minutes on social media activities [2, 3]. The use of social media is not inherently positive or negative. Research on the adverse effects of social media use in young adults has yielded mixed results, but several studies have identified potential negative impacts. A systematic review by Keles et al. [4] found associations between social media use and depression, anxiety, and psychological distress in adolescents and young adults. Twenge and Campbell [5] reported that adolescents who spent more time on social media and electronic devices had lower psychological well-being. Additionally, a study by Vannucci et al. [6] found that greater social media use was associated with increased anxiety symptoms in young adults.

Recent research has also increasingly focused on identifying which aspects of social media use are associated with internalizing disorders such as depression and anxiety. For instance, past research has examined both the amount of time spent on social media and the nature of engagement—distinguishing between active use (e.g., posting, commenting, or messaging) and passive use (e.g., browsing or viewing others' posts without interacting)—in relation to adverse mental health outcomes [7–10]. Notably, past research found that, after adjusting for baseline mental health and demographic factors, time spent on social media was not significantly associated with later depression or anxiety symptoms, nor was self-esteem found to mediate this relation [8]. Similarly, the extent to which people use social media actively or passively was not strongly related to most aspects of well-being [11]. Building on these findings, the current study sought to advance our understanding of the mechanisms underlying the association between social media use and internalizing symptoms by examining a more nuanced cognitive process: rumination about social media interactions. By including time spent on social media and active posting as covariates, the current study aimed to isolate the unique contribution of social media rumination (SMR) to depression and anxiety symptoms among college students while also exploring whether self-esteem mediates these associations. The approach taken by the current study addresses the growing recognition that it is not merely how much or how actively one uses social media but how individuals cognitively and emotionally process their online experiences that may be most relevant for mental health outcomes.

The current study is grounded in Bronfenbrenner's ecological model, which posits that human development arises from dynamic interactions between individuals and their multi-layered environmental contexts [12]. This model offers a robust framework for examining the intricate interplay between social media use, psychological processes, and mental health outcomes in young adults. At the core of this framework, social media platforms can be viewed as a component of a young adult's microsystem, directly influencing their daily experiences and interactions. Beyond the microsystem, the mesosystem highlights how social media use interacts with other aspects of young adults' lives, such as family relationships or academic performance, potentially affecting self-esteem and mental health. The influence of social media extends further through the exosystem, which includes external factors such as platform algorithms and content moderation policies that indirectly shape users' experiences and subsequent rumination patterns. At a broader level, the macrosystem reflects societal attitudes toward social media and mental health, influencing individual behaviors and perceptions. Finally, the chronosystem emphasizes the evolving nature of social media's impact over time, accounting for both individual maturation and the continuous evolution of platforms. By applying this ecological perspective, the current study explores how social media use and rumination are embedded within and influenced by these interconnected systems and gains a more comprehensive understanding of the potential pathways through which social media engagement may affect self-esteem and, ultimately, depressive and anxiety symptoms in young adults.

Rumination

Rumination is a complex and multidimensional construct that has been widely studied throughout the past few decades [13]. It is commonly defined as repetitive and passive thinking about a distressing topic, including its potential causes and consequences [14]. Brooding and reflective pondering are two subtypes of rumination with differing cognitive and emotional implications. Brooding involves passive, repetitive fixation on negative emotions and their causes, often characterized by judgmental comparisons between one's current state and unachieved standards [15, 16]. Brooding is strongly associated with maladaptive outcomes, including heightened risk for depression, anxiety, and suicidal ideation [16–18]. In contrast, reflective pondering refers to purposeful, inward-focused cognitive efforts to understand and resolve distressing feelings, which may initially resemble problem-solving but can become maladaptive if solutions are not found [15, 19]. While early studies suggested reflection might reduce depressive symptoms [15, 19], later research indicates it can still predict suicidal ideation over time, particularly when problem-solving fails [18].

Rumination also differs from worry, which is defined as a chain of negative thoughts that are typically uncontrollable [20]. While rumination and worry share certain characteristics, such as negative, uncontrollable, and repetitive thought patterns, they remain distinct constructs with important differences. The primary distinction lies in their temporal orientations and focus. Rumination is characterized by persistent, inward-focused attention on one's current or past symptoms of distress, focusing on negative emotions and their possible causes and consequences. Rumination is typically introspective and abstract, often centering on "why" questions, such as "Why did this happen?" or "Why do I feel this way?" In contrast, worry is predominantly future-oriented, consisting of a chain of uncontrollable thoughts about potential threats or problems that may arise [21]. Worry often revolves around "what if" scenarios, such as "What if this goes wrong?" or "What if I cannot handle it?" Unlike the self-focused nature of rumination, worry tends to encompass a broader range of potential outcomes, emphasizing situational uncertainty. Furthermore, worry is more verbal-linguistic in nature and generally more concrete than rumination, as it often seeks to predict or problem-solve potential future challenges [21]. These distinct characteristics highlight the unique mechanisms underlying each construct and underscore the need for differentiated therapeutic approaches to address their associated psychological distress [22].

Social media rumination

Extending rumination to the digital landscape, social media has introduced a new domain for ruminative behavior. Research has shown that one harmful effect of the frequent use of social media is rumination [23]. A relatively newer construct, SMR, has been of interest to researchers more recently. SMR has been defined as thinking repeatedly about one's social media posts, situational factors, and the consequences [23]. Parris and colleagues [23] developed a measure to examine SMR. Some examples from Parris and colleagues' [23] Social Media Rumination Scale (SMRS) are: "I spend several minutes deciding what to post on social media," "I feel jealous about other people's posts on social media," and "I obsess over what I am going to post on social media."

SMR constitutes a distinct subtype of rumination. Despite its specific focus on digital interactions, SMR shares the fundamental characteristics of rumination, which involves repetitive and negative thinking patterns. Much like traditional rumination, SMR may also lead to anxiety and depression for several reasons. The constant contemplation of one's social media presence and the scrutiny of others' posts can magnify negative emotions and insecurities, akin to the "emotional magnifier" mechanism described in general rumination [20]. Specifically, comparing oneself to curated online personas can foster feelings of inadequacy and jealousy, further intensifying emotional distress. In addition, SMR has the potential to hinder engagement in enjoyable offline activities, as individuals' quality of life may be negatively impacted by their online experience. For example, research showed that problematic social media use led to sleep problems and reduced physical activities, which then reduced participants' perceived happiness [24]. In summary, while SMR primarily centers on online interactions, it shares the core characteristics of traditional rumination and, thus, may also lead to symptoms of anxiety and depression, much like traditional rumination.

Rumination, depression, and anxiety

Research over the years has consistently demonstrated an association between rumination and depressive symptoms across various age groups and populations. For instance, Dancho [25] identified a significant correlation (r = 0.59) between the two variables. Likewise, Grant et al. [26] observed a comparable pattern (r = 0.48) among African-American girls. In addition, longitudinal studies have revealed that rumination is not only contemporaneously linked with depressive symptoms but also predicts their future onset, a trend observable in both children and adolescent samples [27–29]. For instance, Grabe et al. [30] illustrated that rumination in third and seventh graders was significantly associated with depressive symptoms two years later.

Along this line of research, literature has also elucidated the association between rumination and anxiety. Specifically, emotion-focused rumination is particularly associated with anxiety, as supported by several studies [22, 26, 31–34]. Further, Rickerby et al. [35] concluded that this association holds true for both subtypes of rumination (brooding and reflective pondering). Likewise, research that examines SMR and internalizing symptoms has found a significant and positive correlation between SMR and both depression and anxiety symptoms [36]. However, more research is needed in this area.

The associations between rumination and depressive and anxiety symptoms are influenced by several factors, with gender emerging as a significant moderator, especially in samples with major depressive disorder (MDD) [35]. Gender differences in rumination are reported to emerge during adolescence, with the earliest gender differences noted at age 12 years old [37, 38]. Jose and Brown [37] reported that when comparing females to males in adolescence, females self-reported higher levels of rumination. Nolen-Hoeksema and Jackson [14] also reported that when faced with distress, females engaged in rumination more than males. These findings indicate that females ruminate more often than males, leading to heightened depressive and anxiety symptoms. This hypothesis has been supported across both adolescent and adult studies [39–42].

Specifically in adolescents, the "brooding" subtype of rumination is more influential on depressive symptoms in females, perpetuating depression over time. As evidence, initial brooding levels in adolescent girls have been shown to correlate with current depressive symptoms and provide predictions into their future trajectory, including an elevated risk of major depressive episodes [43]. The gender-based moderation may be explained by the response style theory (RST), which posits that adolescent girls are more inclined towards rumination, whereas boys typically adopt distractive responses [40]. However, several other studies failed to find gender-based differences in rumination [27, 25, 44, 45]. For example, Chen et al. [46] found that gender did not moderate the association between SMR and depression or anxiety symptoms, a result that may be attributable to the developmental stage of their participants (i.e., middle school students). At this age, adolescents may not yet have fully developed consistent response styles. As Hampel and Petermann [47] suggest, rumination evolves as a coping strategy from late childhood into adolescence. Thus, in younger samples, such as those in Abela et al. [27, 44] and Rood et al. [43], rumination may not yet be a stable, trait-like response, which could explain the absence of gender differences. Taken together, although research has found gender differences in traditional rumination, much less is known about SMR, and future research is needed.

Self-esteem

Self-esteem, a crucial aspect of psychological well-being, evolves throughout adolescence and into adulthood and is shaped by a myriad of life experiences. Rosenberg [48], the creator of the Rosenberg Self-Esteem Scale (RSES), defines self-esteem as an individual's positive or negative perception of themselves, reflecting the intrinsic value they assign to their own worth. Research has demonstrated that rumination, particularly self-critical rumination, plays a significant role in predicting levels of self-esteem. A study by Kolubinski et al. [49] found that self-critical rumination was a strong predictor of self-esteem, even when controlling for other factors such as age, levels of self-criticism, stress, anxiety, and depression. The study proposed that prolonged exposure to self-critical rumination, activated and maintained by metacognitive beliefs, can negatively impact one's overall self-evaluation [49]. Further, research indicated that low self-

esteem is highly correlated with increased depression and anxiety symptoms [50]. According to the vulnerability model, a diminished self-concept may serve as a risk factor for both the onset and persistence of depression [51]. Specifically, individuals who are more susceptible to ruminating on their perceived negative attributes may experience a decline in self-esteem, leading to more depressive symptoms [51]. Similarly, the associations between self-esteem and anxiety mirror those observed in depression, partly due to the comorbidity of risk factors for both disorders [51].

Adolescence is a particularly critical period, marked by significant developmental and psychological changes as individuals begin to form their sense of self-worth [52]. In today's digital era, the rapid growth of social media platforms introduces adolescents to algorithm-driven content that can profoundly shape their self-perceptions. This exposure can lead to a range of outcomes: While some youth experience increased connection and a sense of belonging online, others may face negative encounters, including exposure to "cyberhate" [53]. Moreover, the substantial time youth spend on social media may heighten their tendency to ruminate, potentially intensifying its psychological effects [2, 3].

Current study

The current study aimed to address significant gaps in the literature concerning the interplay between social media use, rumination, self-esteem, and internalizing symptoms. Specifically, the current study focused on the understudied construct of SMR and aimed to investigate its associations with depression and anxiety. Additionally, the study assessed the mediating role of self-esteem and the moderating role of gender in these relations while controlling for both time spent on social media and number of posts per week as covariates.

Despite growing recognition that the cognitive and emotional responses individuals have toward their social media experiences may be more consequential for mental health than simple measures of use or engagement style, research that integrates all of these variables within a comprehensive framework remains limited. Likewise, prior studies have demonstrated associations between SMR and internalizing symptoms such as depression and anxiety, but the psychological mechanisms underpinning these relations, especially the mediating role of self-esteem, are not well understood [46]. Additionally, while gender differences are well-documented in traditional forms of rumination, much less is known about their presence and effects in the context of SMR. Furthermore, most previous research has focused on adolescents or clinical samples, with relatively little attention paid to how these dynamics manifest in young adult populations such as college students [36, 46].

By employing a comprehensive, theory-driven approach, grounded in Bronfenbrenner's ecological model, the current study directly addressed these aforementioned critical gaps in research. In doing so, the current study aimed to advance literature by enhancing our understanding of not only if, but also how, SMR contributes to adverse mental health outcomes. Given the rapid convergence of online and offline experiences that profoundly shape young adults' well-being, the findings from the current study have important implications for developing more effective prevention and intervention strategies targeted at promoting mental health and overall well-being among this population.

In particular, the four research questions and predictions of the current study were:

Research question 1: What is the association between SMR and depressive symptoms among college students, and does gender moderate this association?

Prediction 1: There will be a significant and positive association between SMR and depressive symptoms, and gender will moderate this association.

As aforementioned, research consistently shows a strong association between rumination and depressive symptoms across diverse populations and age groups [25, 26]. Longitudinal findings further demonstrate that rumination predicts the future onset of depressive symptoms in children and adolescents [27, 28, 30]. This robust evidence suggests that SMR is likely to exhibit a positive association with depressive symptoms, potentially moderated by gender [35].

Research question 2: Does self-esteem mediate the association between SMR and depressive symptoms?

Prediction 2: Self-esteem will mediate the association between SMR and depressive symptoms.

The vulnerability model posits that a diminished self-concept increases the risk for both the onset and persistence of depression, often exacerbated by rumination on perceived negative attributes, which undermines self-esteem and heightens depressive symptoms [51]. These findings suggest that self-esteem is a critical mechanism through which rumination influences depressive symptoms, supporting the hypothesis that self-esteem mediates the relationship between SMR and depression.

Research question 3: What is the association between SMR and anxiety symptoms among college students, and does gender moderate this association?

Prediction 3: There will be a significant and positive association between SMR and anxiety symptoms, and gender will moderate this association.

Research has also consistently highlighted a strong association between rumination and anxiety, particularly with emotion-focused rumination [22, 26, 31–34]. These findings suggest that SMR is likely to exhibit a positive association with anxiety symptoms, potentially moderated by gender [35].

Research question 4: Does self-esteem mediate the association between SMR and anxiety symptoms?

Prediction 4: Self-esteem will mediate the association between SMR and anxiety symptoms.

Given the many shared risk factors between depression and anxiety, the evidence supporting prediction 2 also serves to support prediction 4.

Materials and methods

Participants

The study sample comprised 551 college students from a diverse midwestern university. The mean age of the participants was 19.14 years (SD = 1.54), ranging from 17 to 30 years. The majority of participants were freshmen, accounting for 60.8% of the sample, followed by 17.1% sophomores, 6.2% juniors, and 1.3% seniors (with 14.6% "preferred not to say"). Gender distribution included 36% identifying as men, 61.9% as women, and 2.1% as non-binary or other gender identities. Racial and ethnic composition was also varied, with 30.3% identifying as Black or African American, 23.8% as White, 16.9% as Hispanic/Latinx, 5.4% as Asian, and 23.6% reporting other or multiple racial/ethnic backgrounds.

Measures

Patient Health Questionnaire-9 (PHQ-9)

PHQ-9 [54] was used to screen for depression symptoms in the study participants. The PHQ-9 is a self-report measure that includes 9 items, each assessing one of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for depression. Participants were asked to indicate how often they experienced each symptom over the past two weeks, with response options ranging from 0 = not at all to 3 = nearly every day. The total score, ranging from 0 to 27, is calculated by summing the responses, with higher scores indicating greater severity of depressive symptoms.

The PHQ-9 has demonstrated high reliability and validity in various populations. Studies have shown that it effectively identifies individuals with major depression and distinguishes them from those with other diagnoses. For instance, a PHQ-9 score ≥ 10 is highly predictive of major depression, with robust sensitivity and specificity (Kroenke et al., 2001 [54]). The internal consistency of the PHQ-9 is excellent, with Cronbach's alpha values typically exceeding 0.80 [54]. In the current study, the scale demonstrated excellent internal consistency with a Cronbach's alpha of 0.92.

Generalized Anxiety Disorder-7 (GAD-7)

The GAD-7 [55] was used to assess anxiety symptoms in the study participants. The GAD-7 is a self-report measure comprising 7 items, each reflecting one of the criteria for GAD as outlined in the DSM-IV.

Participants were asked to rate how often they experienced each symptom over the past two weeks, using a scale from 0 = not at all to 3 = nearly every day. The total score, which ranges from 0 to 21, is obtained by summing the scores for each item, with higher scores indicating greater severity of anxiety symptoms.

The GAD-7 can be used as both a screening tool and a measure of symptom severity. A cut-off score of 10 on the GAD-7 has been found to have good sensitivity (89%) and specificity (82%) for identifying GAD [55]. The measure's internal consistency is excellent, with Cronbach's alpha values typically exceeding 0.90 [55]. In the current study, the scale demonstrated excellent internal consistency with a Cronbach's alpha of 0.93.

Rosenberg Self-Esteem Scale (RSES)

The RSES [48] was employed to measure self-esteem levels in the surveyed participants. The RSES is a widely used self-report instrument consisting of 10 items that assess global self-worth by measuring both positive and negative feelings about oneself. Participants are asked to respond to each item using a 4-point Likert scale ranging from 0 = strongly disagree to 3 = strongly agree. The total score is calculated by summing the responses to all items, with higher scores indicating higher self-esteem. The scale includes items such as "I feel that I am a person of worth, at least on an equal plane with others" and "All in all, I am inclined to feel that I am a failure" (reverse-scored). The RSES provides a comprehensive measure of an individual's self-esteem by capturing a broad range of self-perceptions.

The RSES has demonstrated excellent reliability and validity across diverse populations [56]. It has been extensively validated in studies and is regarded as a reliable measure of self-esteem, with internal consistency typically reported with Cronbach's alpha values exceeding 0.80. The test-retest reliability of the RSES also supports its stability over time [56]. In a sample of 1,083 community adults, confirmatory factor analysis (CFA) suggested that a unidimensional model with method effects due to negatively worded items fit the data best, supporting the use of a total score for the RSES [56]. Furthermore, the RSES has shown strong convergent and discriminant validity, correlating as expected with related constructs such as self-liking, self-competence, depression, optimism, mental health functioning, and narcissism. Additionally, in the current study, the scale demonstrated excellent internal consistency with a Cronbach's alpha of 0.92.

Social Media Rumination Scale (SMRS)

The SMRS [23, 36] was used to assess SMR in the current sample. To enhance the measurement of SMR for the current study, we began with the original SMRS [23], which consists of 12 items assessing the frequency of ruminative thoughts about social media interactions. Recognizing the evolving nature of social media behaviors and the potential for individuals to ruminate about their own and others' posts, we generated additional items reflecting a more comprehensive array of ruminative thoughts. This process resulted in an expanded 22-item scale. We also updated the response format to a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree, to allow for greater sensitivity in responses. Examples of items included are "I worry about what my social media posts say about who I am" and "I repetitively think about how great other people's social media posts are compared to my own." By broadening the content and increasing the number of items, our revised scale aims to provide a more nuanced and reliable assessment of SMR in the current sample.

The current study conducted an exploratory factor analysis (EFA) on the SMRS using the R 4.3.2. statistical software [57]. Sixteen point seven percent of the SMRS item data was missing. Inspection of the missingness pattern revealed that participants tended to either complete all items on the SMRS (458 participants) or leave the scale entirely blank (92 participants; with one participant completed half of the measure), indicating a systematic "all-or-none" response pattern. To examine potential differences between completers and non-completers, the two groups were compared on their age, gender, social media usage time per day, and posting frequency per week. The results indicated that completers were significantly older (mean age = 19.05) than non-completers (mean age = 18.36; $t(12.94) = 3.15$, $p = 0.008$), though the practical difference was small. No significant differences were found for gender ($p = 0.486$), time spent on social media ($p = 0.077$), or weekly posting frequency ($p = 0.23$). Together, these findings suggest that the

missing data may reflect a potential missing not at random (MNAR) mechanism, as non-completers were slightly younger than completers, which could be related to different survey completion behaviors by age group. While full maximum likelihood (FIML) estimation was used to handle the missing data, and time spent on social media was included as a covariate in the main analyses, the observed missingness pattern suggests that slightly younger college students may still be somewhat underrepresented, which could have an impact on the generalizability of findings and the development of the SMRS factor structure.

The SMRS started with 36 items. Initial data screening on outliers using the cut-off values ≥ ± 2 for skewness and ≥ ± 7 for kurtosis, according to Sayers et al. [58], indicated that the score distributions were relatively normal, with 1.09 for the largest skew and 3.49 for the largest kurtosis. The multivariate normality of the sample was tested using Mardia's [59] test, which indicated nonnormality ($p < 0.001$). Principal axis extraction was used, as Briggs and MacCallum [60] suggest this extraction method is better able to recover weak factors and the relative tolerance of multivariate nonnormality. After examining the distribution of the variables, the variables were examined for weak/high correlations and low Kaiser-Meyer-Olkin (KMO) values.

All variables correlated above 0.40, and the sample resulted in an overall KMO factor of 0.97, which indicates the sample is factorable [61]. Parallel analysis [62] and the visual scree test [63] suggested no more than four factors to be considered for retention. Geomin rotation was used according to Schmitt and Sass [64]. Per Wood et al. [65], it is recommended to overfactor rather than underfactor, and thus four factors were extracted. The resulting solution indicated 68% of total variance with a root mean square residual (RMSR) of 0.02. A value less than 0.08 for the RMSR is generally considered a good fit. In examining the factor loadings, only 2% of the variance was under the fourth factor. When three factors were extracted, the solution accounted for 67% of the total variance with the RMSR of 0.03. When two factors were extracted, the total variance explained was 64% with the RMSR of 0.04. In examining the factor loadings of the two-factor solution, four variables had cross-loadings and were removed from the list. When EFA with a two-factor solution was run again without these variables, the loadings mainly loaded on factor one, with three variables cross-loading and four variables that loaded on factor two. Given these statistical considerations, the single-factor solution was determined to be most suited for the current sample. The single-factor solution accounted for 59% total variance with the RMSR of 0.06. After determining the one factor, to reduce the number of variables that were redundant, variables that highly correlated (0.70 and above) with other variables on the correlation matrix were examined. From this procedure, five variables were removed as they were highly correlated with other variables (highly correlated with 5 to 8 other variables). After the removal, the loadings of the variables ranged from 0.64 to 0.81. Using the stringent criteria for the factor loading [66], four variables were removed based on a cut-off of |0.7|. This resulted in a final measure with 22 items and loadings ranging from 0.72 to 0.82. The final measure accounted for 61% of the total variance and the RMSR of 0.05. The internal consistency of the final measure was acceptable with a reliability of $\alpha = 0.97$.

Covariates

The study also included two covariates: (1) time spent on social media per day and (2) the number of posts on social media per week. Time spent on social media per day assessed participants' daily engagement with social media platforms, encompassing both active posting and passive scrolling behaviors. Participants reported their average daily usage by selecting one of six Likert-scale options, ranging from 1 = less than 1 hour to 6 = 5 or more hours. Similarly, the number of posts on social media per week captured participants' frequency of posting content, excluding passive scrolling. Responses were recorded on a six-point Likert scale, ranging from 1 = never to 6 = 8 or more times. As mentioned above, by including time spent on social media and active posting as covariates, the current study aimed to isolate the unique contribution of SMR to depression and anxiety symptoms while exploring the mediating role of self-esteem. Though prior research has highlighted that these two covariates are often weak or inconsistent predictors of psychological outcomes when considered alone [8, 11], statistically controlling for them in the current study helps to account for possible confounding effects, and ensures that the relations observed are not attributable to

overall time spent or general posting activity, thereby strengthening the validity and specificity of our findings.

Procedure

Data collection was conducted among students enrolled in a midwestern university undergraduate Introduction to Psychology course. The study received approval from the university's Institutional Review Board (IRB), ensuring that all ethical guidelines were followed. Prior to participation, informed consent was obtained from all participants, guaranteeing their voluntary involvement and understanding of the study's purpose. Participants were instructed to complete the four survey measures via an online survey hosted on the Qualtrics platform. To reduce potential order effects, the sequence of the measures within the survey was counterbalanced for each participant. Data collection took place over a semester period, with participants completing the survey at their convenience within this timeframe.

Results

Preliminary data analysis

Descriptive statistics and gender differences

The means and standard deviations of all study variables for the total sample by gender are presented in Table 1. In addition, intercorrelations among the variables in the total sample are presented in Table 2.

Table 1. Descriptive statistics of study variables by gender.

Variable	Gender	*n*	M	SD
Social media rumination	Total	447	45.95	19.88
	Men	167	41.34	18.65
	Women	280	48.70	20.11
Depression	Total	447	7.76	6.28
	Men	167	5.69	5.84
	Women	280	8.99	6.22
Anxiety	Total	447	7.50	5.89
	Men	167	5.25	5.21
	Women	280	8.84	5.87
Self-esteem	Total	447	14.70	4.04
	Men	167	15.16	4.2
	Women	280	14.42	3.92

n: number of participants; M: mean; SD: standard deviation. The final analytic sample included 447 participants after excluding those with missing data and focusing on binary gender comparisons.

Table 2. Correlation matrix for study variables.

Variable	1	2	3	4
1. Social media rumination	–			
2. Depression	0.40[**]	–		
3. Anxiety	0.37[**]	0.80[**]	–	
4. Self-esteem	–0.39[**]	–0.52[**]	–0.50[**]	–

**: Correlation is significant at the 0.01 level (2-tailed).

To explore variations across the main study variables among college students categorized into different gender groups, independent samples *t*-tests were conducted with gender as the independent variable. The participant numbers for "Nonbinary/third gender" (n = 5), "Transgender" (n = 1), "Another gender identified" (n = 2), and "Prefer not to answer" (n = 2) were too small for meaningful analysis. Therefore, the independent samples *t*-tests were performed by comparing only women and men. Analysis revealed a significant difference in SMRS scores between women and men ($t(445) = -4.40$, $p < 0.001$). Women

reported higher levels of SMR compared to men. There was a significant difference in depression scores between men and women as well ($t(445) = -5.46$, $p < 0.001$); women reported higher levels of depressive symptoms compared to men. Likewise, the analysis showed a significant difference in anxiety scores between men and women ($t(445) = -6.52$, $p < 0.001$), indicating that women reported higher levels of anxiety symptoms compared to men. However, there was no significant difference in self-esteem scores between men and women ($t(445) = 1.93$, $p = 0.06$); although the difference approached significance, with men reporting slightly higher self-esteem levels than women.

Main analyses

The main analyses aimed to examine the associations between SMR and symptoms of depression and anxiety, with self-esteem as a mediator and gender as a moderator. These analyses were conducted using the PROCESS macro Model 4 [67] in R. SMR, measured by the SMRS, was entered as the independent variable, while self-esteem, measured by the RSES, was entered as the mediator. Gender was included as a moderator, and symptoms of depression, measured by the PHQ-9, and symptoms of anxiety, measured by the GAD-7, were entered separately as the dependent variables. The model also included two covariates: (1) time spent on social media per day and (2) the number of posts on social media per week. These variables were included as covariates in the analyses to account for potential confounding effects of social media exposure duration and patterns of social media use on the relations being studied. All variables were converted into *Z* scores for easier comparisons.

Analysis results of research questions 1 and 2 with depression symptoms as the outcome

The proposed model (refer to Figure 1) examined the relation between SMR and college students' symptoms of depression, mediated by self-esteem. In addition, the model evaluates the moderating roles of gender. The results of research questions 1 and 2 are in the context of this specific model.

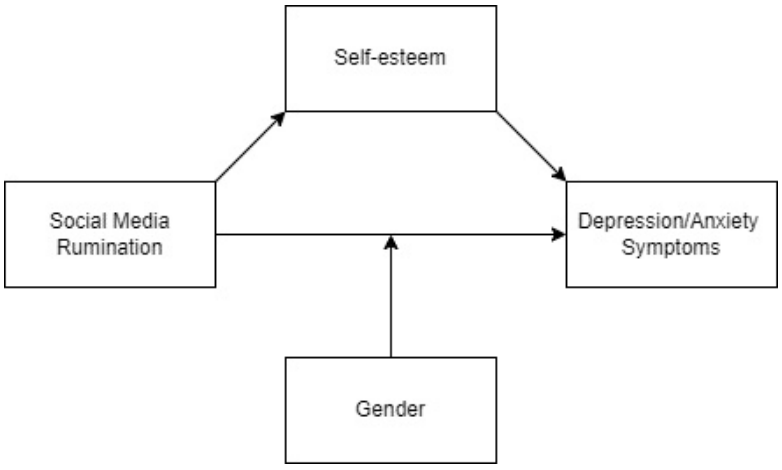

Figure 1. Conceptual model with self-esteem as the mediator and gender as the moderator, and anxiety/depression as the outcome, and moderation with depression as the outcome.

Research question 1: What is the association between SMR and depressive symptoms among college students, and does gender moderate this association?

Prediction 1: There will be a significant and positive association between SMR and depressive symptoms, and gender moderates this association.

Finding 1: As predicted, SMR was positively associated with depression symptoms. The conditional direct effect was significant for both males and females (males $b = 0.18$, SE = 0.06, $t(440) = 2.93$, $p = 0.004$, 95% CI [0.06, 0.30]; females $b = 0.17$, SE = 0.05, $t(440) = 3.81$, $p < 0.001$, 95% CI [0.08, 0.26]). The SMR and gender interaction was not significant ($p = 0.93$), indicating no moderation by gender. Approximately 51% of the total effect was direct (see Figure 2).

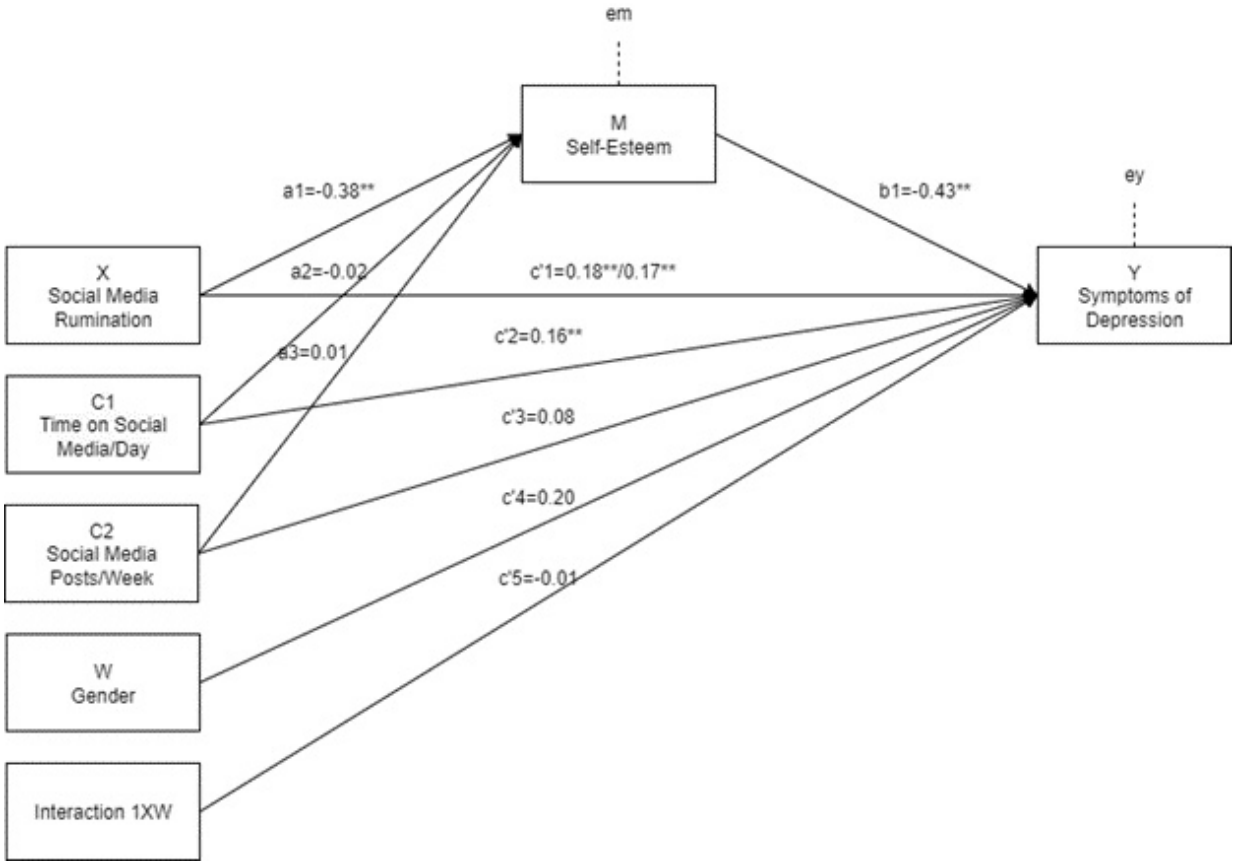

Figure 2. Statistical model of the mediation and moderation with depression as the outcome. $p < 0.01$ (**). X represents the independent variable, M represents the mediator, W represents the moderator, XW represents the interaction between the independent variable and the moderator, and C1 and C2 represent covariates: time spent on social media daily and number of posts per week, respectively. Path labels: a1 = effect of SMR on self-esteem, a2 = effect of time spent on social media daily on self-esteem, a3 = effect of number of posts per week on self-esteem; b1 = effect of self-esteem on depression; c'1 = conditional direct effect of SMR on depression (shown separately for males and females, respectively), c'2 = effect of time spent on social media daily on depression, c'3 = effect of number of posts per week on depression, c'4 = effect of gender on depression, c'5 = effect of the SMR and gender interaction on depression. Indirect effect via self-esteem: a1 × b1 = 0.16. SMR: social media rumination.

Research question 2: Does self-esteem mediate the association between SMR and depressive symptoms?

Prediction 2: Self-esteem will mediate the association between SMR and depressive symptoms.

Finding 2: The mediation hypothesis was confirmed. Self-esteem significantly mediated the association between SMR and depressive symptoms (a1b1 = 0.16, SE = 0.02, 95% CI [0.12, 0.21]). Higher levels of SMR were associated with lower self-esteem, which in turn was associated with increased depressive symptoms. Approximately 49% of the total effect was indirect, suggesting that nearly half of SMR's association with depression operates through lower self-esteem (see Figure 2).

Analysis results of research questions 3 and 4 with anxiety symptoms as the outcome

The proposed model (refer to Figure 1) examines the relation between SMR and college students' symptoms of anxiety, mediated by self-esteem. In addition, the model evaluates the moderating roles of gender. The results of research questions 3 and 4 are in the context of this specific model.

Research question 3: What is the association between SMR and anxiety symptoms among college students, and does gender moderate this association?

Prediction 3: There will be a significant and positive association between SMR and anxiety symptoms, and gender moderates this association.

Finding 3: As predicted, SMR was positively associated with anxiety symptoms. The conditional direct effect was significant for both males and females (males $b = 0.15$, SE = 0.06, $t(440) = 2.36$, $p = 0.02$, 95% CI

[0.02, 0.27]; females b = 0.16, SE = 0.05, $t(440)$ = 3.37, p < 0.001, 95% CI [0.07, 0.25]). The SMR and gender interaction was not significant (p = 0.87), indicating no moderation by gender. Approximately 48–50% of the total effect was indirect, suggesting that nearly half of SMR's association with anxiety operates through lower self-esteem (see Figure 3).

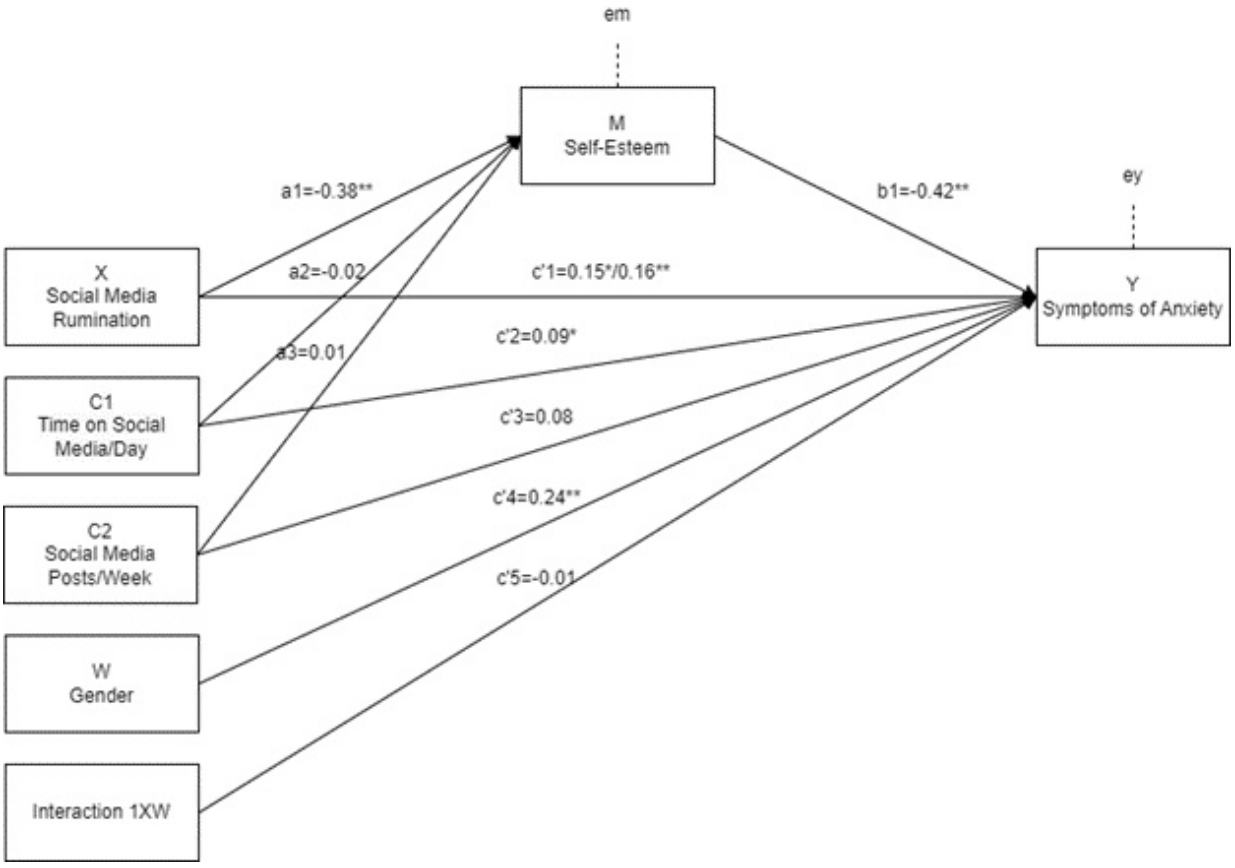

Figure 3. Statistical model of the mediation and moderation with anxiety as the outcome. p < 0.05 (*), p < 0.01 (**). X represents the independent variable, M represents the mediator, W represents the moderator, XW represents the interaction between the independent variable and the moderator, and C1 and C2 represent covariates: time spent on social media daily and number of posts per week, respectively. Path labels: a1 = effect of SMR on self-esteem, a2 = effect of time spent on social media daily on self-esteem, a3 = effect of number of posts per week on self-esteem; b1 = effect of self-esteem on anxiety; c'1 = conditional direct effect of SMR on anxiety (shown separately for males and females, respectively), c'2 = effect of time spent on social media daily on anxiety, c'3 = effect of number of posts per week on anxiety, c'4 = effect of gender on anxiety, c'5 = effect of the SMR and gender interaction on anxiety. Indirect effect via self-esteem: a1 × b1 = 0.16. SMR: social media rumination.

Research question 4: Does self-esteem mediate the association between SMR and anxiety symptoms?

Prediction 4: Self-esteem will mediate the association between SMR and anxiety symptoms.

Finding 4: The mediation hypothesis was confirmed again. Self-esteem significantly mediated the association between SMR and anxiety symptoms (a1b1 = 0.16, SE = 0.02, 95% CI [0.12, 0.21]). Higher levels of SMR were associated with lower self-esteem, which in turn was associated with increased anxiety symptoms. Approximately 50–52% of the total effect was indirect, suggesting that nearly half of SMR's association with anxiety operates through lower self-esteem (see Figure 3).

Overall, the results indicate that SMR is negatively and significantly associated with self-esteem and is also directly associated with depression or anxiety symptoms among college students. Self-esteem plays a significant mediating role in the relations between SMR and both depressive and anxiety symptoms, where higher SMR is associated with lower self-esteem, which in turn is associated with higher symptoms of depression and anxiety. Gender did not significantly moderate these associations, implying that the relations between SMR, self-esteem, and depression or anxiety symptoms are consistent across participants of different genders.

Discussion

Social media is ubiquitous in the lives of young adults. Although social media may have both positive and negative outcomes related to its use, rumination about one's social media interactions is one potential outcome that could lead to mental health concerns. SMR is a relatively new construct that extends traditional models of rumination into the digital context. SMR may be triggered by features unique to online platforms, such as visibility metrics, curated content, and asynchronous feedback, making it a particularly relevant cognitive process in today's digital environment. The current study investigated the associations between SMR and symptoms of depression and anxiety and explored the mediating effect of self-esteem and the moderating effect of gender.

Prior to the main analyses, the study variables were inspected for gender differences. The results showed significant gender differences in levels of rumination, depression, and anxiety, with females scoring higher than males on all three variables. However, there was no significant gender difference in self-esteem. These findings are consistent with prior research indicating that females typically reported more rumination, anxiety, and depression [37, 38, 68]. Although our study did not find gender differences in self-esteem, a meta-analysis found that females report lower self-esteem than males, though the difference was small [69].

The main analyses found significant and positive direct associations between SMR and symptoms of depression and anxiety, consistent with prior findings [36, 46]. Although relatively few studies have focused specifically on SMR, these results also align with a broader body of research demonstrating strong associations between general rumination and internalizing symptoms such as depression and anxiety [22, 26–29, 31–33, 40]. Additionally, the direct negative association observed between SMR and self-esteem mirrors prior findings on general rumination and self-esteem [70, 71]. The current study extends this pattern to the digital context, offering evidence that social media-related rumination may undermine self-esteem in comparable ways to general rumination. Furthermore, the current study found that self-esteem was negatively associated with symptoms of both depression and anxiety [51], supporting its role as a potential mediator in the relation between SMR and internalizing symptoms, and elucidating a plausible psychological mechanism through which SMR may contribute to mental health difficulties. Notably, gender did not significantly moderate the associations between SMR and symptoms of depression or anxiety, suggesting that the psychological processes linking SMR to heightened internalizing symptoms may operate similarly across genders, despite gender differences in rumination, depression, and anxiety as noted in the preliminary analyses. These results point toward the universality of SMR as a risk factor, underscoring its detrimental impact on mental health. Practically, these findings imply that interventions addressing SMR-related depression and anxiety may be broadly applicable across male and female college students, without the need for highly gender-specific adaptations.

It is also important to consider the possibility of reverse causality due to the cross-sectional nature of the study, namely, that low self-esteem may increase vulnerability to engaging in SMR. Individuals with lower self-esteem may be more sensitive to perceived social comparison or negative feedback, prompting them to dwell repetitively on their social media interactions. Likewise, it is equally plausible that individuals with pre-existing internalizing symptoms may be more vulnerable to SMR. For example, youth who already experience depressive or anxious symptoms may turn to social media as a coping mechanism or a source of external validation, which could heighten their likelihood of engaging in ruminative thoughts about their social media interactions. These processes may not be unidirectional; rather, SMR and low self-esteem could operate within a mutually reinforcing cycle, wherein each perpetuates and intensifies the other over time, thereby exacerbating internalizing symptoms. Acknowledging this complexity, it is advisable to interpret the current mediation findings with caution. This highlights the necessity for research designs that can disentangle the temporal ordering of these psychological processes. However, the directionality tested in the current mediation model is theoretically grounded in the vulnerability model of depression [51], which conceptualizes low self-esteem as a precursor to internalizing symptoms. While alternative pathways are plausible, our model aligns with this well-established framework.

Implications

Social media has been linked to many negative outcomes for young adults, including symptoms of depression and anxiety [4]. It is important to note that social media use is not inherently negative and can also have positive implications. The influence of social media is complex and shaped by numerous factors, including individual strengths and vulnerabilities [52]. Understanding these vulnerabilities and resilience factors is crucial for identifying who may be at risk for negative outcomes. For instance, the study's findings indicate that self-esteem partially mediates or explains the relations between SMR and symptoms of depression and anxiety. Self-esteem, therefore, can be considered as either a vulnerability (low self-esteem) or a protective factor (high self-esteem) that influences outcomes associated with social media use.

In addition, our findings underscore the importance of moving beyond strategies that focus solely on limiting the amount of time spent on social media or encouraging more active, as opposed to passive, engagement. While prior research has shown that these factors were not robustly associated with mental health outcomes, after accounting for baseline factors, our results highlight that it is the cognitive process of SMR (i.e., repetitively and negatively dwelling on one's online interactions and comparisons) that was associated with the development of depression and anxiety symptoms among college students.

To address the mental health impacts of rumination, both intervention and prevention approaches should be considered. Regarding interventions, therapies that directly target ruminative thought patterns, such as rumination-focused cognitive behavioral therapy (RF-CBT), have shown greater effectiveness than traditional group CBT formats [20]. However, given the limited research on SMR specifically, it remains important to assess whether interventions developed for general rumination are equally effective across different subtypes, or whether more tailored programs are needed to address the unique features of social media-related rumination.

While interventionists can work with individuals when problems involving social media occur, more preventative measures can be taken by social media companies. Platforms should be aware of the negative effects associated with social media use and design their platforms to mitigate these negative outcomes. For example, they could incorporate advertisements for mental health resources or educational materials about the psychological effects of social media use. Additionally, shifting platform algorithms to prioritize more "realistic" and relatable content, rather than promoting idealized lifestyles, bodies, and imagery, may help reduce comparison-based distress. While some companies have begun implementing user-controlled features such as time limits [71], more comprehensive and systemic changes can be taken to support users' well-being.

Another important avenue for prevention involves promoting digital literacy among youth and young adults. Digital literacy encompasses not only the practical skills needed to navigate digital platforms but also the critical ability to analyze, evaluate, and respond thoughtfully to online content. These skills reflect core aspects of metacognition—monitoring and regulating one's own thinking in relation to digital content—and align with broader digital well-being frameworks that emphasize reflective, intentional, and self-regulated technology use. For instance, the ability to critically interpret media messages, understand the influences of social media algorithms, and recognize potentially distressing or misleading content. By doing so, individuals can better set appropriate boundaries to break the cycles of negative comparison, make more informed choices about their social media use, and thus better regulate their emotional responses. Incorporating digital literacy into school curricula, community wellness initiatives, or online awareness campaigns could serve as an effective proactive strategy.

From a policy perspective, efforts should move beyond simplistic metrics such as screen time and instead promote the integration of digital literacy and metacognitive skills into educational programs. Mental health policies might also prioritize interventions that address maladaptive ruminative thinking patterns in the context of digital media use. At a broader level, policymakers could collaborate with technology companies to encourage the design of platform features that reduce opportunities for harmful social comparison and foster healthier patterns of digital engagement.

Limitations and future research

The current study provides valuable insights into the relations between SMR, self-esteem, and internalizing symptoms among college students. However, several limitations should be considered when interpreting the results. Firstly, the cross-sectional nature of the study limits our ability to draw causal conclusions about the relations between variables. Future research can consider adopting longitudinal and experimental methodologies that allow for stronger inferences about causality and directionality. For instance, longitudinal studies that track individuals over time could examine whether higher levels of SMR predict subsequent declines in self-esteem and increases in depression and anxiety, or vice versa. Additionally, experimental research could manipulate exposure to social media feedback or the opportunity for ruminative processing and observe the downstream effects on self-esteem and emotional functioning. These studies could be further enhanced by incorporating ecological momentary assessment (EMA) methods to capture real-time fluctuations in SMR, mood, and self-esteem within individuals, providing finer-grained insight into short-term dynamics and the immediate psychological impact of social media experiences. Together, these approaches would help clarify the causal pathways among SMR, self-esteem, and internalizing symptoms, ultimately informing more targeted interventions.

In addition, while the study focused on college students, the sample was primarily composed of freshmen (60.8%) from a single university in the Midwest United States. As a result, the findings may not capture the full spectrum of cultural backgrounds and experiences present in broader populations, especially since social media experiences and their effects can vary widely across different cultural, contextual, and socioeconomic groups not assessed in this study. Moreover, these results may not generalize to other populations, such as non-college young adults or individuals with unique social media roles (e.g., social media influencers), whose experiences with SMR and mental health may differ. To enhance generalizability, future research should consider including participants from diverse educational, occupational, and cultural backgrounds, as well as those with varying types and levels of social media engagement.

Further, the current study only investigated the moderating effect of gender, while future research could examine other moderating factors such as social support, mindfulness, or digital literacy skills that may moderate the relations between SMR and internalizing symptoms. Lastly, the SMRS used in this study is a relatively new measure with limited psychometric evidence. While the current study provided additional validation, further research is needed to establish its reliability and validity across different populations and cultural contexts.

Conclusions

This study contributes to the growing body of literature on social media use and mental health by examining the relations between SMR, self-esteem, and symptoms of depression and anxiety among college students. The findings highlight the critical role of self-esteem as a mediator in the associations between SMR and internalizing symptoms, underscoring its importance in understanding the pathways through which SMR may impact mental health outcomes. Contrary to initial predictions, the study did not find the moderating effects of gender in the associations between SMR and symptoms of depression and anxiety. These results have important implications for developing targeted interventions to mitigate the potential negative effects of social media use on young adults' mental health. By focusing on reducing SMR and enhancing self-esteem, mental health professionals and educators may be able to promote more positive outcomes for college students navigating the digital landscape. Future research should build upon these findings by employing longitudinal designs and exploring potential moderating factors.

Abbreviations

CBT: cognitive behavioral therapy

DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition

EFA: exploratory factor analysis

GAD: generalized anxiety disorder

GAD-7: Generalized Anxiety Disorder-7

KMO: Kaiser-Meyer-Olkin

PHQ-9: Patient Health Questionnaire-9

RMSR: root mean square residual

RSES: Rosenberg Self-Esteem Scale

SMR: social media rumination

SMRS: Social Media Rumination Scale

Declarations

Author contributions

SC: Conceptualization, Investigation, Writing—original draft, Writing—review & editing. RJ: Conceptualization, Writing—original draft. MF and IS: Conceptualization, Writing—original draft, Writing—review & editing. MD: Conceptualization, Investigation, Writing—original draft, Writing—review & editing, Supervision. All authors read and approved the submitted version.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical approval

The "From scrolling to spiraling: exploring the mediation role of self-esteem between social media rumination and internalizing symptoms" study was approved by Northern Illinois University's Institutional Review Board. The reference number is: #HS25-0064. The study complies with the Declaration of Helsinki.

Consent to participate

Informed consent to participate in the study was obtained from all participants.

Consent to publication

Not applicable.

Availability of data and materials

The raw data supporting the conclusions of this manuscript will be made available by the authors, without undue reservation, to any qualified researcher.

Funding

Not applicable.

Publisher's note

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