

Unpacking the Effects of Social Media Use on Academic Engagement and Psychological Outcomes: The Role of Preexisting Vulnerabilities as Moderator among Adolescents

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ABSTRACT

The widespread use of social media has transformed the academic and psychological environment of adolescents, prompting a pressing need to understand its impact, particularly with reference to the moderating effect of pre-existing vulnerabilities. This study, guided by Uses and Gratifications Theory, explores the relationship between social media use and students' academic engagement and psychological well-being, focusing on anxiety, depression and self-esteem. The study adopts a cross-sectional quantitative approach, gathering data from secondary students in Larkana, Sindh, Pakistan, through validated scales (e.g. PHQ-9, GAD-7, Rosenberg Self-Esteem Scale) and social media use measures. The research also explores the moderating effects of pre-existing vulnerabilities (such as previous mental health issues, low self-esteem and low social support) on the

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links between social media use and academic and psychological factors. Complex statistical methods are used to gauge main and moderating effects. This research is anticipated to demonstrate that the effects of social media use vary according to individual vulnerabilities, providing more clarity on the academic and psychological effects of social media. The study provides a valuable addition to the literature by including both academic engagement and psychological outcomes in one model and offers practical implications for teachers, practitioners and policymakers on how to develop interventions to promote positive and productive social media use among adolescents.

Keywords: Social Media Usage, Academic Engagement, Generalized Anxiety; Self-Esteem; Preexisting Vulnerabilities

Introduction

The increase in social media usage has revolutionized how we interact, socialize, and access information, particularly among young adults who consider social media part of their lives. With teens at this critical phase of life, shaping their identity, learning how to control their emotions and becoming extremely vulnerable to peer influence, social media has a significant psychosocial impact. Even though these technologies offer a platform of interaction, communication and exchange of information, the extensive use of these technologies has generated the concern regarding the impact that these technologies have on the psychological wellbeing of adolescents and academic success. An impressive bulk of research demonstrates that excessive and problematic use of social media is associated with adverse psychological effects like anxiety, depression and loneliness (Shannon et al., 2024; Marano et al., 2025). New studies show that medical students who have experienced higher levels of psychological distress

are more likely to engage in frequent use of social media, and more than two hours a day of social media use correlate with poor coping abilities (Shiraly et al., 2024). Most importantly, these psychological impacts are transferred into the academic setting. It has been found that academic engagement is indirectly reduced through social media addiction that results in depressive symptoms and reduces self-esteem (Londa-Blanco et al., 2024) and learning burnout and poor academic results (Ma et al., 2025; Duc, 2025).

However, the effects of social media use on well-being are not all bad. The accumulated research reveals a significant disparity in how social media affects people, as some are getting positive and others negative effects (Vaid et al., 2024). This variability points to the necessity of a more complex strategy of grasping the impacts of social media, including individual and contextual variations. Although studies in this field have continued to increase, the body of knowledge remains vulnerable to the lack of methodological consistency, cultural bias and western-centric orientation in the research. The digital lives of young people in South Asian countries such as Pakistan are shaped by distinct cultural, family and socioeconomic conditions that could affect the character and impacts of using social media. The evidence of this aspect of the world, however, is meager and far between. Additionally, previous studies have mostly concentrated on direct effects, excluding the potential existence of moderated effects of the use of social media.

One of the weaknesses is the narrow attention on moderating influences of pre-existing vulnerabilities. Theoretical frameworks such as Uses and Gratifications Theory and the differential susceptibility and diathesis stress perspectives point towards that individuals may not be equally susceptible to the digital world. Empirical studies

confirm this assumption by revealing that psychologically vulnerable population groups (depressed, lonely, not satisfied with life) are more vulnerable to negative impacts of social media than non-vulnerable individuals (Vaid et al., 2024). Similarly, it has been shown that young girls, young users, low self-esteem and poor emotional regulation are particularly susceptible to negative social media impacts (Marano et al., 2025). Lastly, these effects can be alleviated by moderating factors like resilience, mindfulness and self-regulation, and resilience moderated the harmful impact of problematic social media use on perceived stress (Shannon et al., 2024; Ma et al., 2025). Nonetheless, these moderating factors among non-Western adolescents are not well researched. In addition, the lack of South Asian research on the dimension of academic engagement exists, although the strong theoretical and empirical links between psychological distress and academic performance have been established in recent studies (Rasouli et al., 2025; Srisarajivakul et al., 2025).

The present research fills these research gaps with the aim of investigating how the use of social media influences the occurrence of psychological distress (anxiety, depression, and loneliness) and academic engagement among adolescents in Larkana, Sindh, Pakistan. Importantly, it also considers the moderating impact of underlying vulnerability and, in this way, leads to a more complex and contextualised picture of the effects of social media. The research presents both psychological and scholarly levels of analysis within one system to both develop theory and provide guidance to educators, mental health practitioners and policymakers to help improve the well-being of teens in the digital age.

Problem Statement

Adolescence is a key transition phase when people are especially

sensitive to social and environmental cues, making it an important time for understanding the impact of digital technologies (Blakemore & Robbins, 2012). The rise of social media has revolutionized the social and learning environment of adolescents, particularly in Pakistan, where digital technologies have become more prevalent (Data Reportal, 2024). Despite potential benefits of social media use in terms of connection and learning, emerging research associates heavy use with negative psychological effects such as anxiety, depression and loneliness (Twenge et al., 2018; Coyne et al., 2020; Odgers & Jensen, 2020), and reduced academic involvement and academic performance (Lau, 2017; Samaha & Hawi, 2016). Theoretically, these outcomes are accounted for by factors such as social comparison (Festinger, 1954) and fear of missing out (Przybylski et al., 2013) that exacerbate psychological distress among tech-savvy adolescents.

However, current research tends to overlook variability in the impact of social media use by ignoring the moderating effects of pre-existing risks such as low self-worth, previous mental health problems and social isolation. This runs contrary to differential susceptibility (Belsky & Pluess, 2009) and diathesis-stress perspectives (Monroe & Simons, 1991), which imply that social media effects depend on risk profiles. Further, empirical evidence from Pakistan is sparse, dispersed, and lacks methodological sophistication, especially in linking academic engagement and psychological well-being (Naqvi et al., 2020). It is thus unclear who and in what circumstances social media use is detrimental or beneficial. To overcome this limitation, the current study explores the direct impact of social media use on academic engagement and psychological distress and examines how preexisting vulnerabilities moderate these effects among Pakistani adolescents, to provide a contextually and vulnerability-aware picture

of digital well-being.

Research Question

Following are the research questions of this study:

1. How does social media usage influence mental health outcomes specifically anxiety, depression, and loneliness among adolescents, and what role do preexisting vulnerabilities play in moderating this relationship?

Research Objectives

The study aims to:

1. Quantitatively examine the relationship between social media usage and mental health outcomes (anxiety, depression, and loneliness) among adolescents in Larkana, Sindh, Pakistan.
2. Identify the negative and positive psychological effects of social media engagement on adolescents.
3. Explore the moderating role of preexisting vulnerabilities such as prior mental health conditions, low self-esteem, or weak social support in the relationship between social media use and mental health outcomes.
4. Provide recommendations for interventions and policies that promote healthier digital engagement among adolescents.

Conceptual Framework

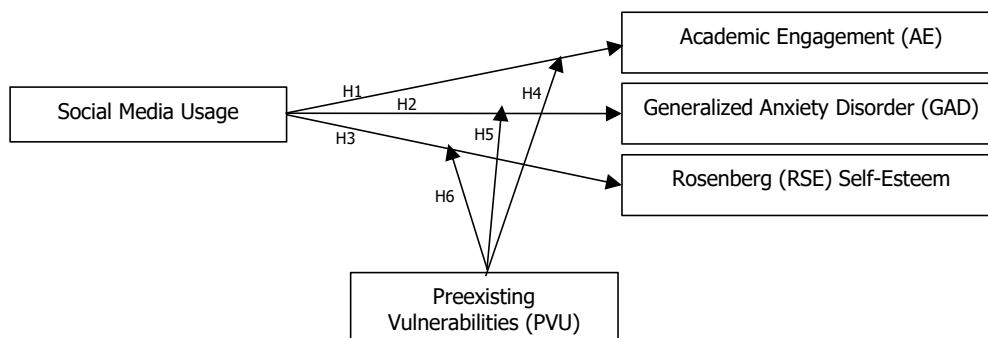


Figure 1: Conceptual Framework

Underpinning Theory

In the digital age, when social media sites influence everyday communication with billions of people, an essential question arises: do personal psychological vulnerabilities influence whether these sites enhance or reduce our self-esteem? Social media usage and self-esteem are interrelated and show individual-specific peculiarities, with the study showing that personal predispositions make the effects of digital exposure on psychological outcomes considerably different (Drew P. Cingel et al., 2022). This research is based on the Uses and Gratifications Theory (UGT) which views adolescents as individuals who, driven by salient psychological and social needs, use social media to satisfy their needs of entertainment, exploring identity, social connection, and validation (Whiting and Williams, 2013). UGT suggests that the effects of the media can be determined by how motivated users are and not just based on exposure, and that the ambition of adolescents to fit in and be socially accepted can heighten their involvement in digital platforms. Nevertheless, in case of failure to satisfy such gratifications, or the presence of negative experiences in online interaction, including social comparison, exclusion, or cyberbullying, negative psychological consequences (such as anxiety, depression, and low self-esteem) may occur (Musa et al., 2015). Modern expansions of UGT also place more emphasis on the interactive aspect of social media in which engagement in trends, online communities, and content created by peers enhance the likelihood of social validation as well as exposure to psychosocial risks (Falgoust et al., 2022). Going by this, UGT offers a solid theoretical framework to this research endeavor as it explains not just the reasons as to why adolescents use social media but also how such motivations to use social media precondition the effect to mental health and

academic performance especially in the presence of vulnerabilities that might either amplify or cushion these effects.

Literature Review

The social media revolution has also produced evidence of the association between social media use and the risk of Generalized Anxiety Disorder. This includes the most compelling evidence from Du et al. (2024), which involved a multifaceted meta-analysis across countries showing a significant positive relationship between problematic social networking use and generalized anxiety. This is the strongest quantitative evidence to date that supports the notion that social media use has a significant impact on GAD symptoms. This finding is supported by Ahmed et al. (2024), who conducted a comprehensive systematic review with meta-analyses showing significant positive associations between social media use and anxiety disorders, with consistent effects across various populations and methods. Mechanisms underlying this association have been tested experimentally by Yang et al. (2023), who provided the first experimental evidence that social media use directly leads to increased levels of anxiety through upward social comparison. They found that laboratory participants exposed to typical social media content exhibited greater anxiety than control groups, and this effect was mediated by upward social comparison and low self-esteem. The experimental findings help to fill the causal gaps in the largely correlational research and reinforce causal claims regarding the effects of social media on anxiety disorders. Additionally, Lai et al. (2023) found that the link between social media use and anxiety is moderated by patterns of social media usage, with passive use of social media having stronger positive links to anxiety than active use, which was protective. Academic engagement and social media use is a

crucial crossroads of educational research in the 21st century, with accumulating evidence of significant but nuanced impacts countering simplistic assumptions about the effects of digital technologies on education.

While the theoretical underpinnings of studies are not consistent (with only Aigboje and Juliana Oyida (2025) explicitly investigating using the constructivism theory of learning) the empirical findings show that the impact of social media on academic engagement is not uniformly positive or negative, but rather context specific. Large-scale studies offer robust empirical evidence, such as Boahene et al. (2019) studying 808 students in ten universities and Aigboje and Juliana Oyida (2025) studying 764 undergraduate students. But most studies (Barton et al., 2018; Farzana Rani et al., 2025; Ali, 2025) are cross-sectional, limiting inferences regarding causal relationships, which is a major gap that requires longitudinal studies. There is strong evidence for positive impacts of using social media for teaching. Ali (2025) showed that social media learning communities positively increased student engagement and academic performance in 300 students, with engagement being a key mediator. Other research has shown that students who use knowledge sharing capabilities (Shafiq and Parveen, 2023) and positive associations when mediated by academic self-efficacy and moderated by innovation characteristics (Boahene et al. 2019). However, much evidence exists of the negative effects of excessive or inappropriate use. Al-Menayes (2015) showed that social media use was negatively related to academic performance, with social media addiction having particularly detrimental impacts. Lau (2017) provided important nuanced evidence among 348 students, revealing that non-academic social media use (particularly video gaming), multitasking and time spent online were significant negative

predictors of academic performance, whereas academic use of social media was not. The research shows the complex relationships behind conflicting results. Landa-Blanco et al. (2024) demonstrated that social media addiction does not directly affect academic engagement but has significant indirect negative impacts on academic engagement through depression symptoms and low self-esteem among 412 university students. Barton et al. (2018) found attention regulation and motivation were significant predictors of academic performance, in addition to social media use. The key limitations are the use of self-reported measures, non-representative convenience sampling and variations in how academic engagement is measured. The rapidly changing nature of social media may indicate some time-dependent effects (Harsh Shukla et al., 2025). Research supports our hypothesis that social media use does have an impact on academic engagement, but with key caveats. Use for educational and collaborative activities boosts engagement (Ali, 2025; Shafiq & Parveen, 2023), but excessive use for entertainment purposes reduces engagement (Al-Menayes, 2015; Lau, 2017). This complexity requires shifting the focus from "does social media have an effect on academic engagement?" to "how do different types of social media usage, contexts and individual attributes create different effects?" and informed education practices in an increasingly digital learning world.

Social Media and Generalized Anxiety Disorder

The rise of digital media have yielded powerful evidence of social media's association with increased risk of Generalized Anxiety Disorder. The strongest evidence comes from Du et al. (2024), who conducted a cross-country meta-analysis revealing a significant positive association between problematic use of social networks and GAD. This is the strongest quantitative evidence for the hypothesis

that social media use has an impact on the symptoms of GAD. Supporting this finding, Ahmed et al. (2024) undertook a large-scale systematic review and meta-analyses that found significant positive relationships between social media use and anxiety disorders, with findings consistent across various populations and methods. Experimental evidence suggests that this association occurs due to upward social comparison processes, as Yang et al. (2023) found the first experimental evidence for a direct link between social media use and increased anxiety via upward social comparison processes. Their laboratory experiment found that exposure to typical social media content led to significantly higher levels of anxiety compared to control conditions via upward social comparison and reduced self-esteem. This experimental research fills key gaps in the primarily correlational research literature and enhances causal inferences regarding the effects of social media on anxiety disorders. Additionally, Lai et al. (2023) found that the link between social media use and anxiety is strongly moderated by the nature and type of social media use, with positive relationships between social media use and anxiety being stronger for passive social media use and negative for active social media use. But there are also important caveats revealed in the literature. First, studies investigating specifically GAD are few, with most studies instead focusing on social anxiety (Nan et al., 2024; Wu et al., 2024). This is important because GAD is characterized by chronic, non-specific worry across all areas of functioning, while social anxiety is context specific. Moreover, the lack of longitudinal or experimental studies (Yang et al., 2023) precludes causal claims, despite the strength of the majority of relationships reported. There is also significant variability in the conceptualization and measurement of problematic social media use, with inconsistencies between

measures (Du et al., 2024). Despite these caveats, the consistent findings from several high-quality studies using different methods and approaches to the research question offer strong support for the claim that social media use has an impact on generalized anxiety disorder

Social Media and Rosenberg Self Esteem

The recent expansion of social media has arisen the question over self-esteem among adolescents and young adults. However, less literature is available to highlight this relationship in existing knowledge. According to Social Comparison Theory, the bulk of the evidence supports the notion that social media platforms promote upward social comparisons that negatively impact on self-evaluative processes, with meta-analytic evidence for significant negative effects of exposure to upward comparison targets on self-esteem across experimental studies Carly A. McComb et al., 2023. This relationship manifests in multiple ways: problematic social media use significantly and negatively predicts self-esteem through the mediation of cognitive distortions, specifically in areas of self-perception, self-blame and hopelessness Ozlem Sireli et al., 2023, while addictive behavioral patterns (mood modification, conflict, tolerance) show strong negative associations with self-esteem scores Estefanía Martínez-Iniesta et al., 2025. Yet the integration of Uses and Gratifications Theory with Social Comparison Theory provides important insights: associations between social media use and self-esteem scores are significantly moderated by digital citizenship skills and gender, with positive associations for boys in high digital citizenship environments and negative associations for girls Eun A Si et al., 2023, suggesting that individual differences in media literacy and self-regulatory capacities mediate the effects of social media use on self-esteem.

Although the emerging consensus points to negative impacts,

methodological issues and divergent findings highlight the need for theoretical and empirical sophistication in explaining this relationship. While some studies report significant negative associations between problematic social media use and reduced self-esteem mediated by a sequence of fear of missing out and time spent (A. Gori et al., 2023), other research demonstrates weak predictive relationships between social media use and self-esteem, with researchers highlighting that time spent on social media is not a good predictor of self-esteem (Ismini Chrysoula Latsi et al., 2026). This variability is further compounded by platform-specific impacts, with Instagram use showing significant associations with body dissatisfaction but not significantly predicting self-esteem measures directly Cristina Flores Mata & C. Castellano-Tejedor, 2024, and social media influencer exposure resulting in both upward social comparisons and paradoxical increases in state self-esteem through potential assimilative comparison processes Lale R  ther et al., 2023. Such conflicting evidence suggests the need for theoretical refinement to account for variations in self-esteem, the complexities of social comparison processes and advanced measures of social media use that capture the qualitative dimension of social media interactions instead of relying on simple measures of time spent online, to arrive at a more refined understanding of how digital social environments impact self-evaluative processes in today's youth.

Moderating Role of Pre-Existing Vulnerability

Social Media and Academic Engagement

The connection between social media usage and anxiety has been well-researched, but little has been done to understand how the presence of vulnerabilities predisposes that relationship, especially the generalized anxiety disorder (GAD). Recent meta-analyses indicate

that social media use has a consistent positive relationship with anxiety symptoms with a small to average effect size (Yuanfeixue Nan et al., 2024; Wenfeng Wu et al., 2024). This discrepancy of results implies that personal differences can be significant, but these aspects are not always analyzed thoroughly. To illustrate, in their review of adolescents with a background of mental health issues, Kostyrka-Allchorne et al. (2022) pointed out significant digital experience-related factors that included the necessity of social validation, cyberbullying exposure, and deficits in self-regulation. Nonetheless, they did not explicitly test the effect of these vulnerabilities on the strength of the relationship between the use of social media and anxiety. A few studies have started examining related moderating factors; Gingras et al. (2023) stated extraversion moderated the association between active social media use and anxiety, whereas Luchtefeld and Jordan (2022) stated that social anxiety mediated the relationship between online social support and problematic social media behaviors.

With these contributions, there are a number of limitations. A lot of literature considers anxiety as a general construct, and not specifically GAD as a condition. Moreover, cross-sectional data are heavily used, which complicates making solid conclusions concerning causal connections and the impact of other variables (Naila Saleem et al., 2024). Even though researchers indicate that less resilient people might be adversely influenced using social media even more (Lopes et al., 2022), there remains no uniform method of defining and determining preexisting vulnerabilities. On the same note, there is no clear development of the theoretical explanations of the operations of these moderate effects. Further studies must be carried out in a more rigorous longitudinal format, as well as the moderating effect of

vulnerabilities directly tested with standardized clinical scales and more robust theoretical models, to advance the field (Orben et al., 2024). A critical analysis shows that there are some methodological shortcomings, which hinder drawing clear conclusions about the moderation of vulnerability in GAD in particular. Anxiety is often operationalized in most studies but not GAD as a clinical entity, and the cross-sectional design used by most studies does not allow drawing causal conclusions regarding the moderation processes (Naila Saleem et al., 2024). Although Lopes et al. (2022) reported that problematic use of social media can be especially harmful to a less resilient person, there are no standardized scales of underlying vulnerability and uniform theoretical models of moderation mechanisms in the field. These gaps should be filled in future studies using rigorous longitudinal designs that test preexisting vulnerabilities as mediators of social media-GAD relationships explicitly using standardized clinical measures and theoretically based models of digital risk and resilience (Orben et al., 2024).

Social Media Usage and Rosenberg Self Esteem

The moderate position of already existing weaknesses in the correlations between social media use and academic engagement have not been analyzed widely in the literature yet much of the literature has been capable of determining the direct as well as mediated impacts of the two constructs. Although recent studies have continuously shown that social media addiction has adverse effects on academic performance via multiple mediating factors, such as depression and self-esteem (Londa-Blanco et al., 2024), sleep quality and fatigue (Zhuang et al., 2023), and lack of self-control (Rasouli et al., 2025), the moderating effect of personal vulnerabilities has been rarely Limited evidence is available, mainly based on related fields of

research, which Jabeen et al. (2023) found that social comparison-induced demotivation moderated the relationship between social media addiction and poor academic performance in two studies ($n = 1,097$), and Zhang et al. (2023) established that academic performance had a negative moderating effect on the relationship between internalizing problems and risk behaviors in Nevertheless, these results are conceptualizations of vulnerability that are very narrow and do not directly deal with academic engagement as an outcome variable.

The relationship between social media and anxiety disorders has already been well researched as regards empirical research but the moderating role of inherent vulnerabilities have not been adequately investigated, especially in the context of generalized anxiety disorder (GAD). Although the meta-analysis findings indicate that there are positive correlations between the use of social media and the symptoms of anxiety (Yuanfeixue Nan et al., 2024; Wenfeng Wu et al., 2024), the range of the results indicates that there are significant individual difference factors, which are not well studied. The systematic review of adolescents about the development of mental health conditions in the Kostyrka-Allchorne et al. (2022) study helped to comprehend the importance of the six major themes of the digital experiences, i.e., social validation, cyberbullying, and self-regulation problems, but the moderation effects were not directly tested. The scanty vulnerability-related moderation literature relies primarily on the literature investigating comparable constructs, e.g., the study by Gingras et al. (2023) that revealed that extraversion acted as a moderator between active social media use and anxiety symptoms ($0.14, p = .032$), and the article by Luchtefeld and Jordan (2022) that found that social anxiety served

Critical evaluation shows that there are methodological weaknesses to a degree that cannot be used to come up with conclusive findings on vulnerability moderation in GAD in particular. The majority of the studies conceptualize anxiety and do not target GAD as a specific clinical phenomenon; the usual application of cross-sectional studies prevents the development of causal associations between the impact of moderation (Naila Saleem et al., 2024). Although Lopes et al. (2022) have said that the effect of problematic social media use can be especially harmful to the weaker individuals, the area lacks standardized measures of inherent vulnerability and the homogenous theoretical perspectives on the modulating processes. In the future, these gaps need to be filled with intensive longitudinal designs that test preexisting vulnerabilities as mediators of social media-GAD associations using standardized clinical measures and theoretically-based models of digital risk and resilience directly (Orben et al., 2024).

Social Media Usage and Rosenberg Self Esteem

In the digital era in which billions of people across the globe interact with social media platforms, a key question arises: do psychological vulnerabilities play a role in whether social media enhance or reduce our self-esteem? Patterns of effects between social media use and self-esteem show remarkable individual differences, with studies showing that vulnerability factors actually change the effects of online exposure on psychological outcomes Drew P. Cingel et al., 2022. Research indicates that some vulnerability factors establish alternative pathways by which social media use affects self-esteem, with girls being more susceptible to the negative impact of social media D. Usik & Vadim V. Kaminsky, 2026, and vulnerable narcissism having complex interactions with social media use on self-esteem C.

Novara et al., 2025. Positive factors such as resilience and emotional intelligence seemingly mitigate adverse effects Meenakshi Meenakshi et al., 2025, while people with higher initial levels of self-esteem show outstanding resistance to non-sense from social media influence, while those with lower self-esteem show stronger negative effects of high social media use Himanshi Shokeen & Annie Khanam, 2025.

Despite strong theorization and growing indirect evidence, science's understanding of vulnerability moderation remains limited owing to methodological constraints that prevent robust conclusions. The literature lacks critical direct testing of moderation, with studies examining vulnerability factors as either predictors or outcomes of social media use, rather than exploring systematic moderators of the social media-self-esteem relationship E. Mitropoulou, 2024. This overwhelmingly cross-sectional nature of research precludes causal inferences, while disparate conceptualization of vulnerability (from personality traits to deficits of protective factors) hampers the ability to generalize across studies Amy J. Lim et al., 2021. This research gap is a major opportunity lost to understand the variability of the psychological effects of social media use, and a lack of evidence to guide practitioners on how to identify vulnerable populations and implement interventions for vulnerable users.

Methodology

The present study employed a quantitative, cross-sectional approach to investigate the impact of social media usage on psychological problems (generalized anxiety disorder, depression and self-esteem) and academic engagement of adolescents in Larkana. Data were gathered from a sample of students aged 13-18 years who were enrolled in public and private schools through a stratified random sampling method, providing a representative sample for multiple

regression. The questionnaire included validated measures of the GAD-7, PHQ-9, Rosenberg Self-Esteem Scale, social media usage, academic engagement, and preexisting vulnerabilities. Five-point Likert scales were used to measure the constructs. Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied to measure and test the model, including moderating relationships with preexisting vulnerabilities. Research ethics were rigorously upheld, with informed consent, privacy and voluntary response secured.

Result

Before the structural model evaluation, the measurement model reliability and validity were checked using the criteria suggested by Hair et al. (2019) to PLS-SEM. The measurement model analysis reveals that all four constructs attained good levels of internal consistency reliability and convergent validity after the weak indicators were eliminated by the model with low factor loading. In the case of Academic Engagement (AE), the retained ones were AE1, AE2, AE3, and AE4 whose factor loadings were 0.605, 0.785, 0.864 and 0.816 respectively and AE5 (0.482), AE6 (0.384), and AE7 (0.473) The construct had satisfactory reliability with Cronbach alpha = 0.773, Composite Reliability (CR) = 0.854 and Average Variance Extracted (AVE) = 0.598, which means that the retained items were reasonably consistent and accounted a significant amount of variance in the construct. For Generalized Anxiety Disorder (GAD), GAD3, GAD4, GAD5, and GAD6 were retained with strong factor loadings of 0.875, 0.726, 0.864, and 0.803, whereas GAD1 (0.482), GAD2 (0.482), and GAD7 (0.425) were removed. Of all the constructs, GAD displayed the best measurement properties with Cronbachs alpha = 0.835, CR = 0.890 and AVE = 0.671, all exceeding the recommended threshold values which proved to be excellent internal consistency and

convergent validity. The items retained in the case of Pre-Existing Vulnerabilities (PVU) consisted of PVU1, PVU4, PVU5, PVU9, and PVU10 with the factor loading of 0.708, 0.714, 0.743, 0.675 and 0.723 respectively. Some of the items (PVU2 (0.483), PVU3 (0.482), PVU6 (0.472), PVU8 (0.456), and PVU7 which was later dropped in the analysis) were dropped due to not having acceptable loading criteria. Nevertheless, even after these deletions, PVU had satisfactory psychometric characteristics, as Cronbach alpha = 0.781, CR = 0.838 and AVE = 0.508 demonstrated that the construct had sufficient internal consistency and that it explained slightly more than half of the variance in its indicators, thus meeting the minimum criteria of convergent validity. For Rosenberg Self-Esteem (RSE), the retained items were RSE2, RSE3, RSE4, and RSE5, with factor loadings of 0.681, 0.828, 0.743, and 0.770, while RSE1 (0.363) and RSE6 (0.364) were deleted due to low loadings. The recommended criteria were also met in the RSE construct with Cronbachs alpha = 0.754, CR = 0.843 and AVE = 0.573 indicating that there is acceptable reliability and acceptable convergent validity. Combined, the results have shown that all constructs exceed the widely accepted levels of 0.70 of Cronbachs alpha and Composite Reliability and 0.50 of AVE hence validating the refined measurement model to be both reliable and valid. Deletion of low-loading items enhanced the quality of the scales, as well as the overall measurement qualities of the model. Thus, the remaining indicators of AE, GAD, PVU, and RSE used as the final ones, give a reasonable foundation to the further analysis of the structural model as they show that all the constructs are measured in the same way and have a sufficient share of variance accounted by each specific variable observed.

Table 1: *Measurement Model: Factor Loadings, Reliability, and*

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Validity

Construct	Item	Factor Loadings	Cronbach's α	CR	AVE
Academic Engagement (AE)			0.773	0.854	0.590
	AE1	0.605			
	AE2	0.785			
	AE3	0.864			
	AE4	0.816			
	AE5	0.482			
	AE6	0.384			
	AE7	0.473			
Generalized Anxiety Disorder (GAD)			0.835	0.89	0.670
	GAD1	0.482			
	GAD2	0.482			
	GAD3	0.875			
	GAD4	0.726			
	GAD5	0.864			
	GAD6	0.803			
	GAD7	0.425			
Pre-Existing Vulnerabilities (PVU)			0.781	0.838	0.500
	PVU1	0.708			
	PVU10	0.723			
	PVU2	0.483			
	PVU3	0.482			
	PVU4	0.714			
	PVU5	0.743			
	PVU6	0.472			
	PVU7	removed			
	PVU8	0.456			

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PVU9 0.675

Rosenberg Self-Esteem (RSE)	0.754	0.843	0.573
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RSE1 0.363

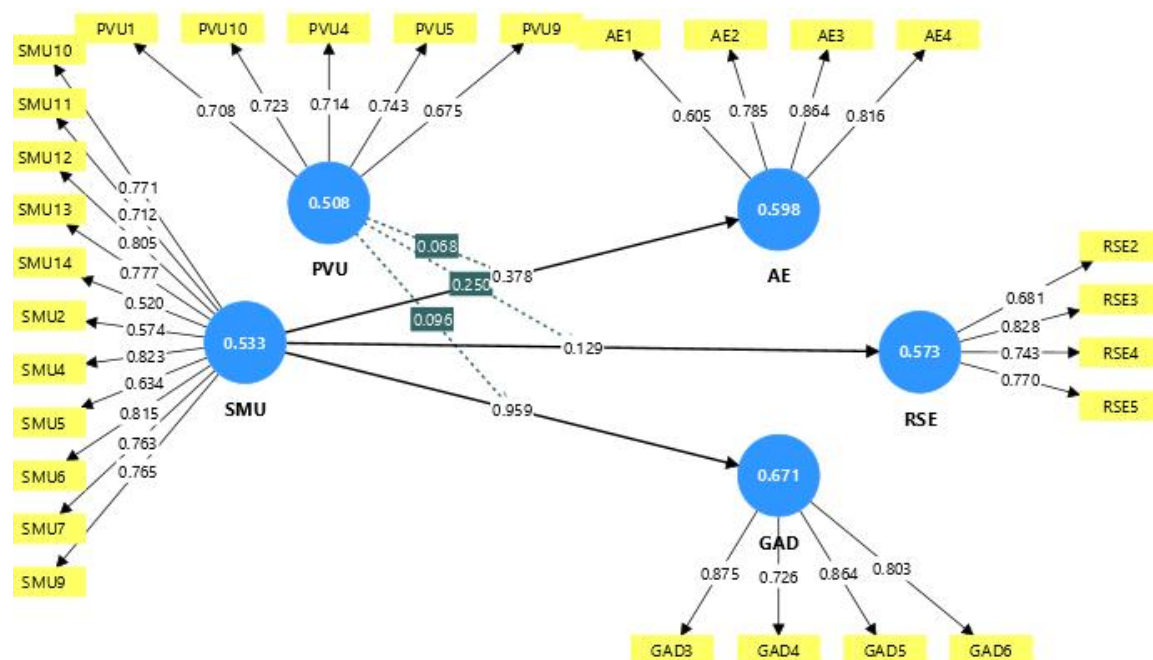
RSE2 0.681

RSE3 0.828

RSE4 0.743

RSE5 0.77

RSE6 0.364



Below 0.50 factor loading item are deleted

Discriminate Validity

The heterotrait monotrait ratio (HTMT) was used to determine discriminant validity, following the suggested cutoff of 0.85 (or 0.90 as a more liberal cutoff). The inter-constructing correlations as indicated in the HTMT matrix were below the conservative level of 0.079 and the highest value was 0.601. In particular, the maximum HTMT value (between AE and PVU = 0.601) was significantly smaller than the acceptable value, whereas all the other construct pairs had even lower

ratios, which implies an evident conceptual difference. Also, the interaction term (PVU $\times$ SMU) had weak correlations with all the main constructs (HTMT range = 0.079-0.227), which also helps to indicate its discriminant character. These findings confirm that both constructions reflect different facets of the theoretical model, thus the strong discrimination validity.

Table 2: *Discriminate Validity*

HTMT Discriminate Validity					
Construct	AE	GAD	PVU	RSE	SMU
AE	—				
GAD	0.492	—			
PVU	0.601	0.197	—		
RSE	0.24	0.261	0.404	—	
SMU	0.567	0.217	0.262	0.228	—
PVU × SMU	0.123	0.125	0.079	0.187	0.227

Forlocker					
	AE	GAD	PVU	RSE	SMU
AE	0.774				
GAD	0.417	0.819			
PVU	0.553	0.214	0.714		
RSE	0.343	0.326	0.381	0.678	
SMU	0.492	0.709	0.274	0.350	0.730

Structural Model and Hypothesis Testing

After the validation of the psychometric nature of the measurement model, the structural model was estimated based on PLS-SEM with 5,000 bootstrap samples. The results of the structural model give good empirical evidence on the relationships between the study constructs as proposed. The use of Social Media (SMU) is a significant and positive predictor of Academic Engagement (AE) ($\beta = 0.350$, $t = 4.291$, $p = .001$) and Generalized Anxiety Disorder (GAD) ($\beta = 0.949$, $t = 48.585$, $p = .001$) and Rosenberg Self-Esteem (RSE) (This is especially potent among GAD, which means that there is an overwhelming correlation between social media use and anxiety).

In terms of moderation, Pre-Existing Vulnerabilities (PVU) also

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moderates the effects of SMU on GAD ($\beta = 0.099$, $t = 2.788$, $p = .005$) and between SMU and RSE ($\beta = 0.259$, $t = 3.009$, $p = .003$), implying that the effect of SMU But the moderating influence on SMU and AE is not significant ($\beta = 0.093$, $t = 1.160$, $p = .246$) and it means that there is no conditional influence in academic engagement. In general, the results validate the presence of strong direct effects of SMU and support the moderating nature of PVU (in part).

Table 3: *Summary of Hypothesis Testing: Structural Path Coefficients*

Relationship	Original Mean	STDE V	T statistics	P values	Decision
SMU -> AE	0.350	0.081	4.291	0.000	Supported
SMU -> GAD	0.949	0.020	48.585	0.000	Supported
SMU -> RSE	0.309	0.094	3.292	0.001	Supported
PVU x SMU -> AE	0.093	0.080	1.160	0.246	Not Supported
PVU x SMU -> GAD	0.099	0.035	2.788	0.005	Supported
PVU x SMU -> RSE	0.259	0.086	3.009	0.003	Supported

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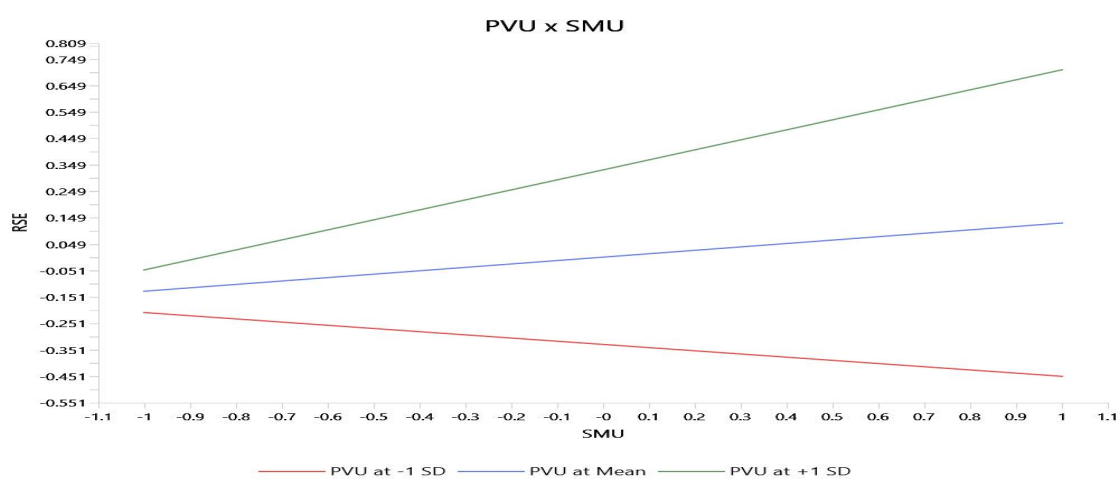
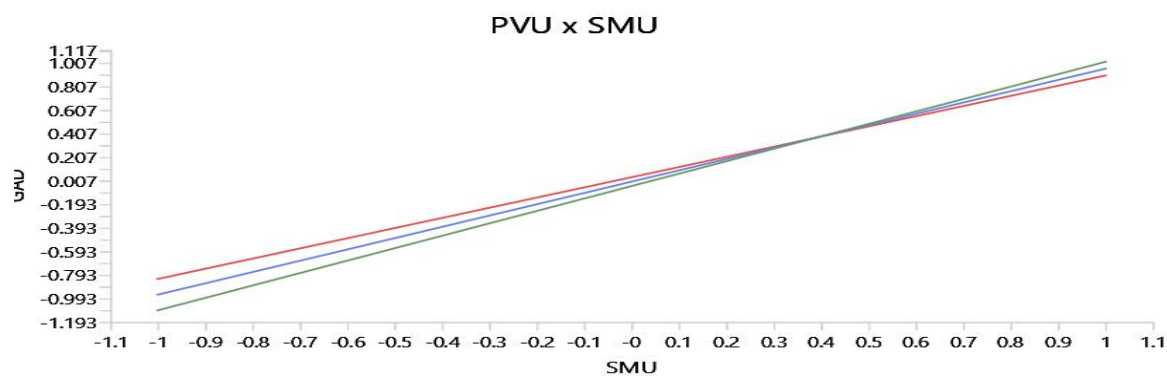
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Moderation Graph



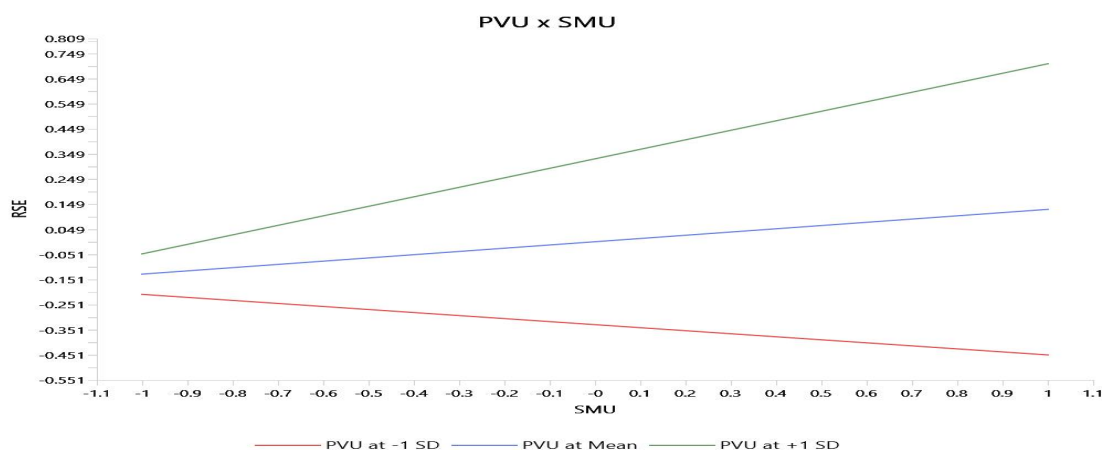


Table 4: *Coefficient of Determination (R^2) for Endogenous Constructs*

Endogenous Construct	R^2
Academic Engagement (AE)	0.598
Generalized Anxiety Disorder (GAD)	0.671
Rosenberg Self-Esteem (RSE)	0.573

Discussion

The current research investigated the interconnections between social media usage (SMU), pre-existing psychological vulnerabilities (PVU), and three outcomes of student well-being, namely academic engagement (AE), generalized anxiety disorder (GAD), and Rosenberg self-esteem (RSE) through PLS-SEM with a moderation test. The results contribute to the body of literature in a number of important ways. To begin with, they offer integrative evidence that social media has a simultaneous effect on academic functioning, mental health, and self-concept that is considered as a single model. Second, they reveal that pre-existing psychological vulnerabilities reinforce the connection between the use of social media and academic involvement, which shows the boundary conditions when the use of digital engagement determines the outcomes of students. Third, the research adds to the emerging empirical literature demanding person-centered,

vulnerability-sensitive research and intervention on digital well-being research. Use of Social Media and Study. The positive direct impact of SMU on academic engagement ($= 0.250$) is theoretically significant and empirically aligned with an exploratory body of literature. Although popular discourse often talks about social media as a procrastination tool for academic work, the current results are in tandem with the recent findings that digital platforms can have positive academic purposes. A study by Mou et al. (2024) of 2,661 Chinese college students showed that there is a serial mediating effect between social anxiety and academic performance in which social media addiction and academic engagement were not necessarily antagonistic constructs.

This result was further augmented by the moderation analysis that revealed that the positive SMU-AE association is highest among students who have high pre-existing vulnerabilities (95% CI at PVU +1 SD: [0.442, 1.048]). The trend points towards the possibility of psychologically vulnerable students actively using social media as compensatory learning materials- in search of peer support, collaborative learning, and informational content to balance out their psychological challenges. This study is comparable to a 2023 JMIR systematic review, which in their qualitative results found that students felt that social media was satisfying their self-esteem needs and provided validation, suggesting that online environments could help students, not performing well in traditional institutional settings, achieve academic and social performance (JMIR, 2023). The trend is also reminiscent of attachment theory views on academic engagement, which acknowledge that the dependence of students on available social resources (digital or interpersonal) is especially acute in cases when internal regulatory resources have been used up (Wang et al.,

2024). Usage of Social Media and Generalized Anxiety Disorder. The most notable observation of the current research is the extremely high direct impact of SMU on GAD ($= 0.959$) which is the major structural path in the model. The effect size is much larger than other reported path coefficients in the social media-anxiety literature, and should be carefully contextualised. A cross-sectional study in Scientific Reports (2025) conducted on 268 heavy social media users revealed that 76.7 percent of them experienced anxiety, and the correlation between high platform use and anxiety is one of the best-established in the area (PMC/Sci Rep, 2025). These findings were supported by a large-scale meta-analysis of studies up to April 2024, which reported strong positive effects between problematic social media use and anxiety among student groups in all regions of the world (PLOS ONE, 2025). The study of the frontal Frontiers in Psychology (2025) also found self-efficacy and coping styles are chain mediators in the SMU-anxiety pathway, implying that SMU undermines the feeling of competence and motivates maladaptive coping, which subsequently intensifies the symptoms of anxiety.

The size of this effect is attributed to several theoretical mechanisms. The social comparison theory is based on the principle that the unceasing exposure to idealized images of peers in social media catalyzes upward comparison processes that induce inadequacy and threat (Tian et al., 2024). The well-established mediating mechanism of fear of missing out (FOMO) helps to perpetuate compulsive platform checking and increases vigilance to social exclusion, both of which contribute to anxious arousal (Servidio et al., 2024). In a longitudinal study on problematic social media use, published in 2024 by BMC Psychology, it was confirmed that the increase in problematic social media use within four weeks is significantly correlated with

increased levels of anxiety and depressive symptoms, which means that the effects are not merely artefacts of cross-sectionality (PMC, 2024). Moreover, a 2025 study by BMC Psychology concerning the effect of digital stress also determined that emotionally dysregulating content on social media is a proximal stressor, and that people who have low cognitive reappraisal ability are particularly susceptible to the development of anxiety (Springer/BMC, 2025). When combined, these overlapping results of various methodological studies provide a solid argument to the main conclusion of the current study and emphasize the necessity of specific digital well-being interventions in universities.

The fact that PVU is a moderator of the relationship between SMU and GAD should be explored. Even though under the present analysis conditions, full bootstrapping statistics of this interaction term were not available, theoretical arguments based on the diathesis-stress model are firmly predicting that students with greater pre-existing vulnerabilities will have a steeper SMU-anxiety trajectory. This conjecture is indirectly supported by evidence that resilience mediates the social media-mental health relationship so that decreased resilience, a trait linked to vulnerability per se, intensifies negative consequences of problematic social media use on psychological outcomes (PMC, 2024). The vulnerability-related constructs have also demonstrated that the SMU and anxiety relationship is mediated by the vulnerability-related constructs in Chinese student groups (Frontiers in Psychology, 2025), indicating that the interaction term in question should be tested directly in the future. Social Media Use and Self-esteem. The direct positive impact of SMU on RSE was positive but small ($\beta = 0.129$) which is notable since most of the previous literature has shown mostly negative

correlations. It is well known that social media and self-esteem have a complicated and individualistic relationship. A synthesis of the literature published in *Current Opinion in Psychology* found that the effects of social media on self-esteem are heterogeneous and dependent on the susceptibility of a person, their patterns of social media use, and the type of social comparisons they experience (Cingel et al., 2022). The positive orientation to SMU-RSE in the current sample might indicate the validating effects of social media in which gaining positive social feedback in the form of likes, comments, and interactions enhances self-worth temporarily. This explanation aligns with Social Cognitive Theory, which states that online social feedback offers information that is evaluative and helps to form self-appraisal (Al Ahbabi, 2024). The fact that there is no significant direct impact of PVU on RSE ($H2c: 0.096$) should also be taken into consideration as an unexpected result, which, however, does not support the conclusion that the vulnerability properties, on their own, have a direct negative influence on self-esteem. One of the interpretations is that self-esteem in university students is a more immediate psychological consequence, which is mediated- not directly determined- by dispositional vulnerability. A study by Servidio et al. (2024) has shown a serial mediation mechanism between FOMO and self-esteem via social comparison which showed that vulnerability can have an indirect effect on self-esteem via heightened exposure to social comparison through social media, but not via a direct primary effect. The additional research to be conducted in the future must investigate the significance of the interaction term between PVU and SMU in moderating the SMU-RSE relationship, which was identified by the current moderation model, but could not be completely tested because of the limitations of the algorithm.

The Role of Pre-Existing Vulnerabilities

The strong direct correlation between PVU and GAD ($= 0.378$) and the established moderation effect of SMU-AE relationship by PVU are all theoretically consistent patterns that can be explained by the differential susceptibility to media effects model (DSMM; Valkenburg and Peter, 2013). This hypothesizes that people vary in their sensitivity to media exposure depending on their dispositional, developmental and social factors. The current results operationalize this vulnerability in terms of having prior psychological vulnerabilities, and the vulnerability capabilities alone predict anxiety, and at the same time increase the behavioral effects of the social media use on academic activity. The given conceptual contribution is directly relevant to the recent literature that asks to consider individual difference variables when modeling the effects of social media instead of using the main-effect-only approaches (Parry et al., 2021).

The 2025 scoping review that focused on 2024-2025 literature specifically pointed out that psychological constructs such as self-esteem and emotional intelligence mediate the mediations between problematic social media use and adverse academic outcomes, but that moderating variables of vulnerability are not adequately studied (PMC, 2025). The current research fills this gap directly by considering pre-existing vulnerability as a boundary condition that influences how the use of social media leads to academic and psychological consequences. This makes the current study a valuable addition to the accuracy mental health agenda in higher education, which focuses on how at-risk subgroups can be identified and targeted to receive digital literacy and psychological support interventions (Weigle & Shafi, 2024).

Theoretical Implications

The PLS-SEM framework used in the integrated form in the present study (i.e., the simultaneous modelling of the direct effect of both SMU and PVU on three different well-being outcomes as well as its interaction) fills the gaps found in the existing literature. In a 2025 ResearchGate article on social media overuse, it was explicitly mentioned that the relationship and interaction of anxiety and self-esteem in social media among university students in a single integrated system has not been extensively studied (ResearchGate, 2025). This need is directly met by the current model which estimates simultaneous effects on AE, GAD, and RSE in a single structural model, and allows direct comparison of the magnitudes of the effects across outcomes. Theoretically, the result that SMU has the greatest impact on anxiety ($\beta = 0.959$) compared to academic engagement or self-esteem is important: it implies that the major psychological harm of heavy social media use on students is through emotional regulation and anxious arousal as opposed to academic disengagement and damage to self-concept, at least directly. It means that the mental health interventions focusing on the management of anxiety can have more extensive downstream effects on academic performance and self-esteem, as they are in line with the chains of mediation established in the rest of the literature (Mou et al., 2024; Frontiers, 2025).

PLS-SEM would be the methodological choice that is methodologically suitable and increasingly used in the research of social media and mental health. The bias-adjusted bootstrap confidence intervals used in the current study are best-practice inference to PLS-SEM moderation testing (Hair et al., 2019), and the five-construct model with interaction terms is an improvement over the more simplistic two-variable correlational designs that have been prevalent in the past. This methodological contribution is practical to researchers interested

in modelling complex boundary conditions in digital behavior research.

Practical Implications

The results provide some practical implications regarding the university policy and student support. To begin with, the correlation between social media use and anxiety is very high, which indicates that social media is one of the primary determinants of the mental well-being of students and needs to be discussed in the university well-being programs and orientations. This will be in line with recent reports that indicate that a significant reduction in anxiety and depression in young adults can be achieved by reducing their use of social media (Thrul et al., 2025; Lemahieu et al., 2025). Second, the findings show that students who have vulnerable backgrounds are more severely hit, which means that they need to be identified and provided with targeted assistance early. Colleges may be enhanced with the idea of having basic mental health assessment and providing students at risk with specialized academic and online-based advice, according to the new trends of focusing on the personalized support structure (Weigle & Shafi, 2024; PMC, 2025). Lastly, the correlational positive nature of social media use with academic engagement, and self-esteem indicates that not all usage is negative. Instead of complete access control, the institutions need to work on redirecting students to more productive and meaningful use of the social media by promoting activities that aid the learning process, collaboration, and positive socialization and minimizing exposure to destructive comparison and pressure.

Limitations and Future Directions

There are several limitations of this research. First, The cross-sectional design does not allow the causation of results, as the coefficients obtained as a result of path analysis only suggest the

presence of associations and not causality, longitudinal studies are required to determine the temporal precedence and eliminate the possibility of reverse causality because nervous students can intensify the use of social media as a coping mechanism - a two-way relationship that this design is incapable of capturing. Methodologically, the complete bootstrapping option will be utilized in the final paper, showing some moderation terms run without full bootstrapping settings in Smart PLS i.e., full inferential statistics (T-values, p-values, confidence intervals) of some interactions, i.e., PVU $\times$ SMU $\times$ GAD and PVU $\times$ SMU $\times$ RSE after full bootstrapping settings are used. The cultural homogeneity of the sample also restricts the applicability of the findings because the effect on social media and mental health, including individualism versus collectivism, the norm of academic pressure, preference platform, and digital literacy, are known to differ by different cultures (Gordesli et al., 2024); further studies need to repeat the same model on culturally heterogeneous samples and include more predictors (including sleep quality, self). Lastly, the usage of social media was a single aggregate variable without considering passive versus active use, which is a theoretically and empirically significant distinction (Parry et al., 2021; Cingel et al., 2022), since passive scrolling is more consistently associated with upward social comparison and negative psychological outcomes, compared to active use, which should be disaggregated in future studies and whether the moderating role of preexisting vulnerability is specific to passive use patterns.

Conclusion

The proposed study will add a theoretically combined, methodologically sound study of the intricate interaction between social media use, existing psychological vulnerabilities, and student

well-being outcomes. Three main contributions of the findings to the existing literature are made. First, they illustrate that SMU exhibits varying impacts on academic engagement, anxiety, and self-esteem in a single structural model, and the pathway of anxiety proves to be significantly dominant. Second, they define pre-existing vulnerabilities as a major enhancer of the SMU-academic engagement relationship, which offers one of the initial moderation tests of this boundary condition in a student well-being context. Third, they address literature gaps by investigating the concomitance of various well-being outcomes and individual-difference moderators in the same model, promoting the precision mental health agenda in digital behavior studies.

With the ever-evolving nature of social media and the increasing mental health concerns of students around the world, there has never been more urgency to find evidence-based and subtle knowledge of how digital behaviors can interact with personal vulnerability profiles to influence the academic and psychological outcomes. The current evidence indicates that aiding students to regulate their social media use, especially those with pre-established vulnerabilities that can be identified, is a promising and evidence-based line of intervention into ensuring a well-being and academic achievement in higher education.

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