Social media addiction and academic engagement: the role of sleep quality and fatigue among university students in Somalia

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Purpose: A growing concern over social media addiction (SMA) and its impact on academic performance has highlighted a need to understand the underlying mechanisms. While a negative correlation is established, the pathways of influence remain unclear. This study examines the mediating roles of sleep quality and fatigue in the relationship between SMA and academic performance among university students in Somalia.

Methods: A cross-sectional survey was administered to 566 undergraduate students. The BSMAS, UWES, PSQI, and FAS scales were used to measure SMA, academic performance, sleep quality, and fatigue, respectively. Data were analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM) to test a model of direct and indirect effects.

Results: The findings revealed a significant direct negative relationship between SMA and academic performance. Sleep quality emerged as a significant mediator; SMA was linked to poorer sleep, which in turn predicted lower academic performance. In contrast, while SMA was associated with higher fatigue, fatigue was not a significant mediator in the relationship between SMA and academic performance.

Conclusions: SMA appears to harm academic performance through two distinct routes: a direct pathway linked to motivational deficits and self-regulation failure, and an indirect pathway via energy depletion from poor sleep. Fatigue is a consequence but not a causal mechanism for academic decline in our model. Educational institutions should implement interventions targeting both sleep quality and digital self-regulation to mitigate the academic consequences of excessive social media use. Future studies employing longitudinal designs could further clarify the causal dynamics of these relationships.

1 Introduction

The Internet has become vital to millions of people, whether in communication, education, or entertainment. In early 2025, over 5.56 billion individuals, or around 67.9% of the worldwide population, were actively using the Internet, which shows its prevalence and influence (Digital Around the World, 2025). Social media is almost present everywhere (Pekpazar et al., 2021), Millions of individuals use it worldwide. The adoption of online platforms is increasing with the growth of the global population using the Internet, which shows that digital platforms and the Internet are conjoined. Social networking sites have recently been used for business, dating, politics, education, and communication (Dixon, 2024). Social media platforms have surprisingly increased along with internet accessibility, simplifying how people communicate, do business, and engage in societal activities. These platforms have shaped public discourse and education environments (Yusoff et al., 2017). As the internet expands, social networking sites' influence is expected to grow, further redefining how people engage with the world around them. These tools increase communal interactions and people's capital (Cortés-Ramos et al., 2021).

Despite its numerous benefits (Ali Homaid, 2022) to society, and extreme dependency on society, excessive social media usage has been found to cause health issues (Woo et al., 2021) among young individuals with frequent online presence, which leads to internet addiction (Turhan Gürbüz et al., 2021). Sometimes, social site addiction is defined as an uncontrollable desire or excitement about it (Huang et al., 2023a). Excessive social media usage may impact social interactions, educational or professional obligations, and personal Wellbeing (Dai et al., 2024). SMA may potentially cause unhealthy symptoms (Ali Homaid, 2022; Dong et al., 2024) depending on its location, its psychotherapy becomes problematic when it coincides with other Clinical and pathological illnesses, i.e., when it has both Brain-degenerative and systemic aspects. Mental dependency on social media is linked to behavioral addiction symptoms (Malik et al., 2020). These uncontrollable negative effects are mainly due to individual's unnecessary use of digital platforms. It is regarded as one of the elements of online addiction (Fournier et al., 2023; Huang et al., 2023b; Walsh et al., 2013).

Digital platforms contain the following functions: self-identity, communication, media sharing, online visibility, fostering relations, trust and reputation control, and social grouping. They all enable users to identify a certain digital platform factor and, based on groundbreaking characteristics, bring additional psychological incentives to Internet users (Nguyen et al., 2025). Digital platform offers multilevel and multidimensional approaches to any organization or social community. They can be described as social networking platforms or mobile ecosystems that can be accessed and used without restrictions (Alkhalaf et al., 2018; Mahdiuon et al., 2020). Social networks are essential to learning environments as a main method for communication and community support (Cadima et al., 2025). Some SNSs, like Edmodo, are explicitly directed at learning (Manca and Ranieri, 2017).

As highlighted above, digital networks have various advantages when applied to learning since they offer easy access to information and break down barriers in communication and telecommunication (Madaiah et al., 2016), enhance learning through applying group work (Al-Dhanhani et al., 2015), assist learners in improving self-study, boost students' engagement and motivation with their fellow students and teachers, and foster learning that is active and social (Hamid et al., 2015).Several studies conducted in Somalia examined how digital addiction disturbs educational activities, which may burden the focus from learning outcomes (Gezginci et al., 2025). The direct association between SMA and student performance has become the focus of existing research, but it abandons other variables essential to understanding this relationship.

In that regard, this research investigates the mediation role of both Sleep quality and fatigue on the relationship between social media addiction and academic performance. The findings will shed light on the increasing prevalence of social media addiction, a phenomenon believed to hinder students' academic progress and help educational institutions and policymakers take preventive measures against it.

2 Literature review and hypothesis development

2.1 Social media addiction and academic performance

Educational engagement is the students' energy, commitment, interest, and passion for academics. Academic vigor relates to students' passion, persistence, and commitment to perform their best in class, especially when encountering challenges. Commitment implies responsibility, motivation, passion, and readiness for learning, which are characterized by overcoming academic barriers (Zhuang et al., 2023).

Several studies indicate that students who use the internet more frequently while studying often achieve lower grades. Studies suggest that using these platforms during studying negatively affects academic performance compared to those who refrain from using them. Additionally, different distraction tasks during academic activities reduce focus and cause a decline in educational outcomes (Alageel et al., 2021), with increased multitasking worsening performance. Further findings reveal that extroverted students who frequently use digital communication platforms tend to have lower academic achievement, influenced by their self-regulating ability (Young, 2004).

Other factors determining academic performance include student educational background, teaching philosophy, and relationships with colleagues and instructors; students with high self-esteem are more self-possessed in their competence to study and thus more motivated to accomplish their academic achievements, gaining better results than those with low self-esteem. Self-respect, educational involvement, and academic achievement are all related (Landa-Blanco et al., 2024).

Social media is a major component of modern digital engagement, and they are one of the leading factors of academic distraction. The main cause is the unmanageable time students spend staying online more frequently, especially engaging in non-educational activities on social media. Numerous studies

have confirmed that this phenomenon negatively affects students' academic performance (Salari et al., 2025).

Poor academic activities remain one of the most significant effects of SMA addiction among students (Upadhayay and Guragain, 2017). According to the literature, students frequently engage in non-academic activities in social networks: such usage distracts from academic contexts (Bekalu et al., 2019) and may exert a harmful effect on student learning by decreasing concentration levels. Previous research has shown that social networking sites hinder students' academic performance (Kim et al., 2017).

However, they also have social costs. They may lead to poor health, including mental health, poor academic performance, and decreased quality of time spent learning. Furthermore, they may adversely affect students' concentration and attention to learning. This can also result in negative consequences for students who need to control their time for online networking activity (Baumeister et al., 2007).

H1. Social media addiction has a negative impact on academic performance

2.2 The mediating role of sleep quality

According to the national sleep foundation, healthy adults require 7–9 h of sleep per night, an amount associated with optimal cognitive function, emotional regulation, memory consolidation, and overall brain health (Hirshkowitz et al., 2015). While the precise duration needed for proper brain function may vary with age, insufficient sleep leads to cognitive impairment (Al-Garni et al., 2024). Central to this cognitive enhancement is the process of memory consolidation, where sleep reinforces neural circuits to ensure future information access (Çiftci et al., 2025), a concept explained by models like the synaptic homeostasis hypothesis (De Bruin et al., 2017).

Consequently, disruptions such as sleep deprivation or fragmentation are linked to a wide range of adverse health outcomes, including impaired daytime functioning, mood disturbances, and increased risks for cardiovascular metabolic diseases (Jiang et al., 2011; Banks et al., 2007). These risks apply to both insufficient and excessive sleep durations (Shankar et al., 2011) and may be particularly detrimental for adolescents due to heightened neural adaptability during this critical developmental period.

In an academic context, poor sleep quality directly contributes to daytime fatigue and reduced memory capacity (Zhuang et al., 2023). A primary driver of this issue is excessive social media use, which is strongly associated with poor sleep (Feng et al., 2022; Hashemi et al., 2024). This pathway, where social media addiction leads to sleep disturbances and psychological imbalance, ultimately undermines academic performance and educational resilience among university students (Amin et al., 2024; Latifian et al., 2024; Evers et al., 2020).

H2. Sleep quality mediates the relationship between SMA and academic engagement.

2.3 The mediating role of fatigue

Fatigue is a complex psychophysiological state characterized by a deterioration in attention, working capacity, and motivation, which has both physical and mental manifestations. This condition is particularly common among university students and is consistently linked to lower academic performance (De Vries et al., 2003; Young, 2004). It is important to recognize that fatigue is a multifaceted phenomenon, existing on a continuum. At one end is acute or temporary exhaustion, a normal physiological response that is typically alleviated by rest (Shen et al., 2006). At the other end is a more persistent, chronic form that builds gradually, is not relieved by relaxation, and can escalate into burnout, a state of emotional exhaustion and withdrawal (Tiesinga et al., 1999; Tamura et al., 2022).

Within this context, a significant modern contributor to student fatigue is Social Media Addiction (SMA). Research shows that students who are excessively engaged in social networking experience a higher neurological burden, reporting more frequent and intense fatigue than their non-addicted peers (Fekih-Romdhane et al., 2021). The constant stimulation from appealing online social activities leads to chronic mental tiredness, which in turn results in distraction and impaired cognitive performance.

This overstimulation of the brain can have negative consequences similar to physical overexertion, making even simple academic tasks seem insurmountable (Amano et al., 2023). Considering this evidence, our study proposes the hypothesis that the heightened levels of fatigue induced by SMA serve as a key mediator that reduces engagement in educational activities (Abu-Snieneh et al., 2020).

H3. Fatigue mediates the relationship between SMA and academic engagement.

2.4 The mediation process through sleep quality and fatigue

Sleep disorders like insomnia are prevalent conditions characterized not only by nighttime disruption but also by significant daytime impairments, such as chronic fatigue, which substantially reduces functional capacity (Nagane et al., 2016; Fortier-Brochu et al., 2010). Subjective chronic fatigue is characterized as a medically unexplained multisymptomatic complex associated with persistent burnout, physical pain, and cognitive impairment (Russell et al., 2016).

Chronic Fatigue is defined by intense, lasting exhaustion within 6 months, substantially affecting daily activities. Complications with sleep disturbances are prevalent, affecting up to 95% of patients experiencing restorative sleep (Fekih-Romdhane et al., 2021). According to research by Alapin et al. (2000) fatigue was revealed to be inversely linked to sleep length, time awake at night, and sleep efficiency in both excellent and poor sleepers.

This link between poor sleep and daytime exhaustion is particularly relevant for university students, a population uniquely vulnerable due to high academic workloads and nocturnal habits that negatively impact their quality of life (Haand and Shuwang,

2020). The issue is compounded by high rates of digital addiction, as excessive use of online platforms is known to diminish sleep effectiveness and mental Wellbeing, consequently harming academic outcomes (Sarbazvatan et al., 2017).

The Developmental-Contextual Model of Digital Demands and Resources (DC-DDR) offers a framework to understand this dynamic through its "energy-draining" process. This model posits that when digital activities consume excessive time and psychological energy, they displace restorative routines like sleep, creating an imbalance that leads to exhaustion and reduced academic performance (Maksniemi et al., 2022). Therefore, grounded in this theoretical framework, our study hypothesizes that Social Media Addiction negatively influences academic performance through the mediating pathways of decreased sleep effectiveness and increased fatigue.

> **H4.** The correlation between SMA and academic performance is mediated by sleep quality and fatigue, which are serial mediators.

2.5 Theoretical framework: developmental-contextual model of digital demands and resources (DC-DDR)

The Developmental-Contextual Model of Digital Demands and Resources (DC-DDR) offers an integrative framework to examine digital ups and downs for academic and psychological achievement. Applied in the framework of developmental psychology and digital behavior research, DC-DDR emphasizes how exposure to digital demands, such as extended screen time on digital platforms, influences cognitive, emotional, and behavioral appraisals of personal and contextual resources (Berg and Upchurch, 2007; Haand and Shuwang, 2020). The DC-DDR model has been previously employed to identify the impact of digital engagement in various functional domains, including fatigue, sleep interference, and academic disengagement (Scholze and Hecker, 2023; Shankar et al., 2011).

The model explains that stressing academic tasks weakens academic interest and motivation by consuming cognitive resources, negatively affecting the quality of sleep, and causing chronic fatigue (Abi-Jaoude et al., 2020; Alapin et al., 2000).Two central mechanisms underpin the DC-DDR model: the Energy-Depleting and Motivational processes. The energy depletion results when technology-mediated activities demand time and effort, suggesting that time is used for enjoyable or necessary pursuits like sleep and focused academic work, resulting in mental fatigue. The motivational process underlines that if students do not have the psychological and behavioral capital to effectively self-regulate their digital engagement, lost focus and demotivation lead to lower academic outcomes for students (Walsh et al., 2013).

Previous studies have focused on the direct effects of digital platforms' presence on academic performance, ignoring the mediating role of sleep efficiency and exhaustion levels. However, recent studies indicate the need to examine these mediating paths to better understand educational disaffiliation (Schaufeli et al., 2006). Other papers have also pointed to self-regulation as another

moderating factor that mediates the adverse effects of digital demands on academic achievement (Bekalu et al., 2019).

Using the DC-DDR model's theoretical framework, this research will enhance theoretical and empirical identification of the relationship between digital demands, sleep efficiency, fatigue, and their impact on students' engagement. This approach emphasizes that to enhance the learning process in the digital context, innovative learning strategies should blend with appropriate time, adequate provisions for the regulation of the device, and sufficient break time (Kim et al., 2017). The proposed theoretical model is shown in Figure 1, which illustrates the hypothesized relationships between social media addiction, sleep quality, fatigue, and academic performance.

3 Materials and methods

3.1 Study design and target populations

To examine the predicted model using empirical data, the study population was undergraduate students from four universities (Jamhuriya, Jazeera, University of Somalia, and City University) in Mogadishu-Somalia. Quantitative design was employed to explore the influence of addiction to Social Media sites on educational accomplishment through Sleep quality and Fatigue. These systematic methods significantly contribute to understanding the underlying consequences of addiction to extreme digital platforms on educational outcomes (Zhuang et al., 2023).

As previously conducted on the consequences of excessive Social media usage on educational performance in Somalia, this research will emphasize both the implications of networking sites for academic performance and the underlying effects (Mediation): Sleep quality and Fatigue. Some of the selected undergraduate students from higher education institutions were surveyed.

For this study, a convenience sampling technique was employed to recruit students from four universities in Somalia. This method is commonly used in exploratory social science research, as it allows for efficient data collection from accessible and willing participants (Andrade, 2021; Etikan, 2016). It was chosen due to its practicality in a setting where obtaining official, comprehensive student lists for random sampling is administratively challenging and may raise privacy concerns.

Data were collected using a structured questionnaire distributed via Google Forms. The survey link was primarily shared through established WhatsApp groups managed by student representatives and department administrators at the participating universities. These groups function as major channels for academic and social communication among students.

Prior approval was obtained from university authorities to access these groups for participant recruitment. A standardized message outlining the study's purpose, voluntary participation, and anonymity was posted alongside the survey link. Data collection occurred for 3 months (Nov 2024–January 2025), during which periodic reminder messages were sent to encourage participation and improve response rates.

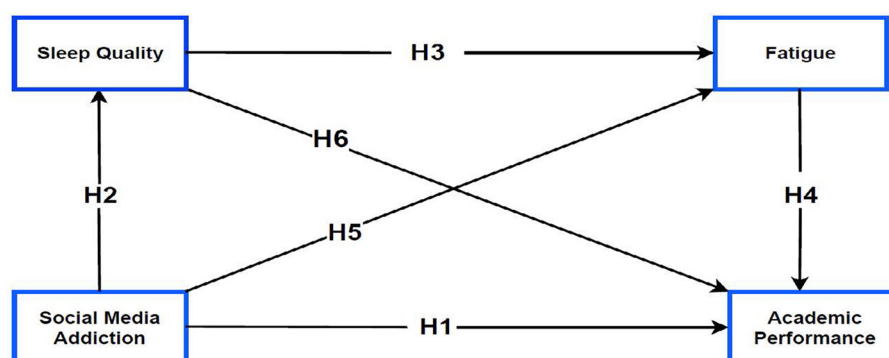This approach facilitated practical access while minimizing sampling bias.

FIGURE 1
Theoretical model.

The demographic characteristics of the final sample, including each university representative sample and their response rates, are summarized in Table 1. Therefore, we evaluated the reliability of all items employing Cronbach's alpha(α), and the overall items indicated over 0.7, which is the standard threshold (Hair and Alamer, 2022).

3.2 Measurements used

A. **Bergen Social Media Addiction (BSMAS)**, which was initially referred to as the Bergen Facebook Addiction Scale BFAS and later renamed The Bergen Social Media Addiction (Shahnawaz and Rehman, 2020), is used to measure the level of Social Addiction (Andreassen et al., 2016). The word social media here refers to Facebook, X (Formerly Twitter), Snapchat, and many others. The scale contains six items that measure the addiction level with a 5-point Responses were measured on a 5 Likert scale from 1 = Very rarely, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very Often, thus yielding a composite score from 6 to 30 in total, with a higher score indicating a greater degree of Social Media Addiction (Bányai et al., 2017). Students with a total score equal to or >19 were considered to have SMA.

B. **The Utrecht Work Engagement Scale (UWES-9S)** was employed to assess the academic performance (Schaufeli et al., 2006). The scale, which consists of three main categories that measure academic vigor, dedication, and absorption, was adopted. This UWES-9S was measured at a 7-point Likert from 0 (never) to 6 (always) (Zhuang et al., 2023).

C. **Fatigue Assessment Scale (FAS)** was employed to assess fatigue (Michielsen et al., 2003). The FAS contains ten elements, and each is rated on a 5-point Likert scale from 1 (never) to 5 (always), with advanced scores revealing advanced stages of subjective fatigue. This scale has been widely used as a real self-reporting tool to determine subjective fatigue (De Vries et al., 2003; Ho et al., 2021)

D. **The Pittsburgh Sleep Quality Index (PSQI)** was assessed to examine the efficiency of sleep (Buysse et al., 1989). The scale consists of seven items, with subjective sleep quality, sleep duration, sleep duration, sleep latency, sleep disturbances, habitual sleep efficiency, sleeping medication use, and daytime dysfunction, measured by a Likert scale from 0 to 3. The overall score on the measure is the cumulative of the scores for these seven elements, ranging from 0 to 21 (Zhuang et al., 2023).

Therefore, considering contemporary awareness about SMA and its effect on academic performance, this research employs structured data collection methods to limit data bias sources and minimize measurement errors. Realizing how students engage in digital behaviors and the impacts they could stimulate, quantitative research was used to examine the moderating functions of sleep efficiency and fatigue between SMA and academic participation.

3.3 Ethical approval

To ensure the research was conducted ethically, approval was sought from the Jamhuriya University of Science Research Ethics Committee (JUREC) with a reference number of JUREC0102/CGS315/052024. Such approval guarantees compliance with international ethical standards within the framework of the Declaration of Helsinki. Furthermore, all participants agreed to use their data through their faculty deans, which ensured their willingness to participate and the confidentiality of their information.

Furthermore, the research design was implemented using SPSS 25 for coordinating demographic analysis, giving researchers a precise approach to identifying participant characteristics such as age, gender, academic qualification, and internet usage. In addition, PLS-SEM was used to determine direct, indirect, and mediating influences, thus providing a clear picture of the effects of digital platform addiction affecting educational engagement through sleep efficiency and tiredness.

Due to these ethical and methodological precautions, this study enhances the knowledge of digital addiction and academic achievement. It contributes to education policies and social student welfare measures with real-life data.

TABLE 1 Sample frequency, percentage (N = 566).

Variable	Item	Frequency	Percent (%)
Age	≥18 and ≤20	363	64.1
	≥21 and ≤23	172	30.4
	≥24 and ≤26	27	4.8
	≥27 and above	4	0.7
Total		**566**	**100**
Gender	Male	357	63.1
	Female	209	36.9
Total		**566**	**100**
Qualification	Computer and IT	457	80.7
	Business and Management	39	6.9
	Engineering	23	4.1
	Health Sciences	47	8.3
Total		566	100
Distribution by University	**University Name**	**Representative Sample**	**Response Rate (%)**
	Jamhuriya University	420	225 (54%)
	Jazeera University	170	170 (61%)
	University of Somalia	113	133 (68%)
	City University	58	58 (46%)
Total		**990**	**566 (57%)**
Internet usage	<1 h	204	36
	≥1 to ≤ 2 h	196	34.6
	≥3 to ≤ 4 h	60	10.6
	≥5 to ≤6 h	60	10.6
	More than 6 h	46	8.1
Total		**566**	**100**

4 Result

The results of the PLS-SEM analysis are presented below. The analysis begins with the validation of the measurement model, followed by the testing of the structural model and the research hypothesis (Ringle et al., 2014).

4.1 Respondent's profile

Table 1 presents the demographic distribution of the 566 undergraduate students surveyed from four universities in Mogadishu, Somalia. The majority of participants (64.1%) were between 18 and 20 years old, followed by those aged 21–23 years (30.4%). The sample was predominantly male (63.1%) over female (36.9%). Regarding academic discipline, students from the faculty of Computer and IT constituted the largest group at 80.7%.

The remaining were from health Sciences (8.3%), Business and Management (6.9%), and Engineering (4.1%). For daily internet use, 36% of students were online for <1 h, and 8.1% for more than 6 h.

4.2 Measurement model

The first step of using PLS-SEM is to assess the measurement model. It contains reliability and validity and maintains internal steadiness for convergent and discrimination (Figure 2, Table 2). All the items were above the standard threshold of 0.708, except AC4, AC5, AC8, F4, F3, F10, SP3, SP5, and SP9, which were removed due to their low loadings. Cronbach's alpha (α) and composite reliability (CR) were conducted to construct internal consistency reliability, and the CR value was higher than the standard threshold of 0.70.

The average variance extracted was also tested and exceeded the recommended standard of 0.5. The item's discriminant validity was also measured using the heterotrait–monotrait ratio (HTMT) criterion, Fornell–Larcker Criterion, and Cross loadings (Henseler et al., 2015). Tables 3–5 indicate that all items meet the required thresholds, thereby confirming the establishment of discriminant validity.

4.3 Structural model assessment

The structural model results are illustrated in Figure 3, highlighting the path coefficients, significance levels, and explained variances for each construct. After the validation of the validity and reliability measurement, the first step is to evaluate the model (Henseler et al., 2015). The next step is to evaluate the variance inflation factor (VIF) through multicollinearity. As we assessed the data, we found AC8 above the threshold and removed it. We re-assessed and was not found any multicollinearity; all values were within the standard threshold (Hair and Alamer, 2022). The next phase is to assess the accuracy of the proposed hypothesis using bootstrapping 10,000 sub-sample procedures.

The direct relationships between the study variables are presented in Table 6. We evaluated the direct effects of SMA on educational performance (ACP), Poor Sleep (SQ), and Fatigue (FT). Finally, we found the direct effects of SMA on academic performance, sleep quality, and fatigue. As the result in Table 6 shows, SMA is negatively and significantly correlated with ACP ($\beta = -0.155$, $t = 3.152$, $P = 0.002$), with SMA is certainly and substantially associated with SQ ($\beta = 0.256$, $t = 6.168$, $P = 0.000$), with SMA is positively and significantly correlated with FT ($\beta = 0.324$, $t = 8.151$, $P = 0.000$).

Moreover, we learned that SQ is directly positively, and significantly associated with ACP ($\beta = 0.174$, $t = 3.756$, $P = 0.000$). Similarly, SQ is direct, positively, and significantly associated with FT ($\beta = 0.286$, $t = 7.125$, $P = 0.000$). Hence, H1, H2, H3, and H4, and H5 were supported. Thus, H6 investigated the direct relationship with FT and ACP since we found it negatively impacted but ($\beta = -0.045$, $t = 7.125$, $P = 0.000$) was not significant and meaningfully impacts

FIGURE 2
Measurement model.
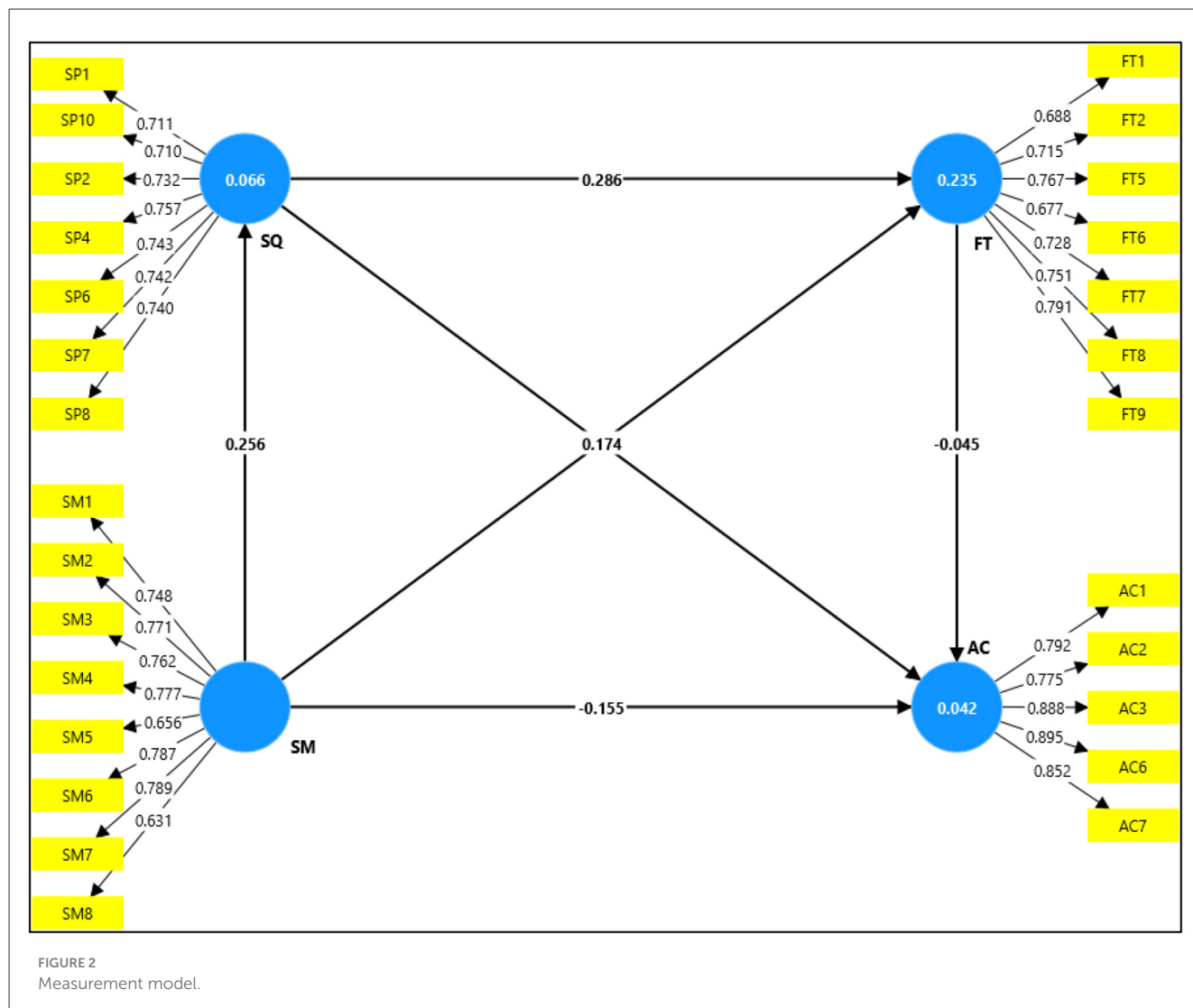
Academic performance. The mediation analysis provides indirect effects of SMA on educational performance (ACP), sleep quality (SQ), and fatigue (FT). The mediation analysis results are summarized in Table 7, showing the indirect pathways and their statistical significance.

The investigators found that SQ (Sleep Quality) Facilitates the correlation between digital platform habit (SMA) and fatigue (FT), and H7 is supported ($\beta = 0.073$, $t = 4.836$, $P = 0.000$). Similarly, SQ (Sleep Quality) Facilitates the correlation between digital platforms and educational engagement (ACP). Therefore, H9 was supported ($\beta = 0.045$, $t = 3.164$, $P = 0.002$). However, the indirect effects of H8 (SMA $\rightarrow$ FT $\rightarrow$ ACP), H10 (SMA $\rightarrow$ SQ $\rightarrow$ FT $\rightarrow$ ACP), H11 (SQ $\rightarrow$ FT $\rightarrow$ ACP) were rejected. This indicates that fatigue alone or together with SMA nor SQ does not affect ACP and was not significant, respectively ($\beta = -0.015$, $t = 0.958$, $P = 0.338$), ($\beta = -0.003$, $t = 0.902$, $P = 0.367$), ($\beta = -0.013$, $t = 0.915$, $P = 0.360$). The model's descriptive power was assessed using the coefficient of determination (R^2).

The results show that the predictors explained 4.2% of the variance in academic performance (ACP), 6.6% in fatigue (FT), and 23.5% in SQ (Table 8). These findings suggest that the model provides meaningful descriptive power for SP. Furthermore, the relevance (Q^2) of the constructs was evaluated. As shown in Table 8, the Q^2 values for ACP (0.011), FT (0.060), and SP (0.149) are all above the standard threshold of 0, confirming the relevance of the model. Notably, SQ demonstrates stronger predictive power, while ACP and FT present opportunities for enhancement by incorporating additional influencing factors.

5 Discussion

This research investigated the impact of Social Media Addiction (SMA) on the academic performance of students in Somali universities, examining sleep efficiency and exhaustion as mediating variables. Our findings confirmed a significant negative relationship between SMA and academic engagement (H1). This result aligns with a substantial body of literature demonstrating that excessive social media use corresponds with reduced commitment to studies, lower participation in educational activities, and ultimately, poorer academic outcomes.

TABLE 2 Outer loadings, validity, reliability, and collinearity (VIF).

Item	Indicator	Outer loadings	α	CR	AVE	VIF
AC	AC1		0.897	0.924	0.709	
	AC2	0.775				
	AC3	0.888				2.507
	AC6	0.895				
	AC7	0.852				
FT	FT1		0.855	0.890	0.536	
	FT2	0.715				
	FT5	0.767				1.724714
	FT6	0.677				
	FT7	0.728				
	FT8	0.751				
	FT9	0.791				
SM	SM1		0.883	0.907	0.551	
	SM2	0.771				
	SM3	0.762				
	SM4	0.777				1.724714
	SM5	0.656				
	SM6	0.787				
	SM7	0.789				
	SM8	0.631				
SP	SP1		0.860	0.891	0.538	
	SP10	0.710				
	SP2	0.732				1.757857
	SP4	0.757				
	SP6	0.743				
	SP7	0.742				
	SP8	0.740				

α, Cronbach's Alpha; CR, Composite reliability; AVE, average extracted; VIF, variance inflation factor; AC, Academic Performance; FT, Fatigue; SM, social media; SP, Sleep Quality.

TABLE 3 Discriminant validity—HTMT criterion.

Item	AC	FT	SM	SP
AC				
FT	0.092			
SM	0.143	0.447		
SP	0.146	0.408	0.275	

These findings show that individuals who excessively use SMA and encounter addictive behaviors find it inspiring to stay focused on their academic activities; these distractions caused by SMA not only interfere with learners' ability to focus but also reduce their mental perseverance, which is significant for maintaining engagement in academic performance. Similar results were found

TABLE 4 Discriminant validity—Fornell–Larcker criterion.

Construct	AC	FT	SM	SP
AC	0.842			
FT	−0.043	0.732		
SM	−0.129	0.397	0.742	
SP	0.118	0.369	0.256	0.734

by Erduran Tekin (2024), Madaiah et al. (2016), Rosen et al. (2013), Walsh et al. (2013), Young (2004), and Zhuang et al. (2023).

Therefore, the results align with other countries' evidence and strengthen SMA's influence on academic performance. In the second hypothesis (H2), the study found that SMA is negatively related to sleep quality and mediates SMA and academic engagement. These results also support previous studies conducted by (Alapin et al., 2000; Banks et al., 2007; De Bruin et al., 2017; Gillen-O'Neel et al., 2013; Jiang et al., 2011; Shankar et al., 2011; Yoo et al., 2007), which has supported that extended use of social media, particularly at night, affects sleep.

These disruptions to learning and development may impact pace, behavior, and organization, causing learners to lose focus or motivation. Thus, the third hypothesis (H3) indicates that sleep quality significantly mediates the relationship between SMA and academic performance. Improving sleep could be the solution to minimizing the effects of SMA on academic performance, which also supports previous studies conducted by De Bruin et al. (2017) and Zhuang et al. (2023).

Furthermore, in hypotheses 4 (H4) and 5 (H5), SMA remarkably correlates with fatigue. This study shows that students who are overexposed to SMA experience higher levels of mental fatigue and emotional distress due to heavy social media engagement. Additionally, sleep quality mediates the relationship between SMA and fatigue. Lack of quality sleep was associated with increased fatigue, which aligns with the findings demonstrating that disruptions in sleep result ft daytime tiredness, decreased concentration, and lowered performance at academic tasks.

These indications also support the previous studies conducted by Fortier-Brochu et al. (2010), Russell et al. (2016), and Salari et al. (2025) and implies that students who are addicted to social media will likely suffer from fatigue linked to compromised sleep, which will affect their functioning and academic activity. Most significantly, hypotheses about the serial mediation pathway (SMA → sleep quality → fatigue → academic engagement) were not supported.

This is similar to the previous study by Amano et al. (2023) and Dharmawan et al. (2024) who observed no correlation between social fatigue and academic performance. According to their research, fatigue results from digital overwhelm, but it is not necessarily reflected in lost academic functioning. Its negative effects, however, can be offset through other cognitive or behavioral interventions like improvements in study skills and self-regulation in digital learning environments. Likewise, this study's lack of a strong indirect effect indicates that fatigue alone may not fully explain academic disengagement in the presence of social media addiction.

TABLE 5 Discriminant validity—cross loadings.

Construct	AC	FT	SM	SP
AC1	**0.792**	−0.052	−0.082	0.061
AC2	**0.775**	0.032	−0.046	0.145
AC3	**0.888**	−0.085	−0.169	0.063
AC6	**0.895**	−0.068	−0.119	0.102
AC7	**0.852**	0.004	−0.104	0.126
FT1	−0.002	**0.688**	0.226	0.247
FT2	−0.112	**0.715**	0.264	0.225
FT5	−0.065	**0.767**	0.308	0.262
FT6	−0.022	**0.677**	0.280	0.271
FT7	−0.008	**0.728**	0.300	0.303
FT8	0.013	**0.751**	0.326	0.267
FT9	−0.030	**0.791**	0.317	0.308
SM1	−0.068	0.285	**0.748**	0.174
SM2	−0.072	0.302	**0.771**	0.177
SM3	−0.117	0.256	**0.762**	0.193
SM4	−0.184	0.201	**0.777**	0.149
SM5	−0.056	0.287	**0.656**	0.184
SM6	−0.084	0.338	**0.787**	0.198
SM7	−0.148	0.337	**0.789**	0.207
SM8	−0.044	0.313	**0.631**	0.221
SP1	0.147	0.291	0.153	**0.711**
SP10	0.052	0.274	0.162	**0.710**
SP2	0.014	0.333	0.284	**0.732**
SP4	0.096	0.317	0.220	**0.757**
SP6	0.110	0.243	0.181	**0.743**
SP7	0.088	0.168	0.130	**0.742**
SP8	0.119	0.188	0.115	**0.740**

The bold values indicate Discriminant validity – Cross Loadings indicate the factor loadings of each measurement item on its intended construct.

Our finding of a significant negative correlation between Social Media Addiction (SMA) and academic performance is well explained by the Developmental-Contextual Model of Digital Demands and Resources (DC-DDR). The model's two main mechanisms, energy depletion and motivational mechanism, support our results, particularly the mediating role of sleep quality.

The energy-depleting mechanism suggests that technology consumes cognitive resources. Our results provide strong support for this model as SMA predicts poorer sleep quality, which in turn lowers academic performance (supporting H9). This demonstrates how SMA disrupts restorative sleep, a critical process for cognitive function and academic readiness. Interestingly, while sleep quality mediates SMA and fatigue (supporting H7), fatigue itself did not emerge as a significant mediator in our proposed model (rejecting H8, H10, H11).

Consequently, the primary academic harm in our findings comes from the cognitive consequences of poor sleep, rather than subjective fatigue. This aligns with the findings of Killgore (2010) and Walker (2009). The motivational process of the DC-DDR framework explains the direct negative link between SMA and academic performance. This model highlights failure in self-regulation, where the immediate reward of social media competes with the delayed gratification of academic success.

As the framework suggests, when students lack the psychological and behavioral capacity to effectively self-regulate (Hofmann et al., 2008), their focus is captured by social media platforms, leading to demotivation and disengagement observed in our findings. This motivational conflict operates independently of the sleep pathway and explains why SMA has its own detrimental effect.

5.1 The study limitations

The study has several limitations that warrant consideration. Though we emphasized that the statistically significant path from SMA through sleep quality to academic performance is a key finding from our study, regardless of the overall R^2 value. However, we acknowledge that academic performance is likely influenced by additional variables that were beyond the scope of our study. The primary contribution of our study is not in explaining the total variance in academic performance, but in successfully testing a specific theoretical pathway proposed by the DC-DDR framework.

The 4.2% variance explained in our study is consistent with findings from similar research on social media and academic outcomes, which often report modest effect sizes due to the complex, multifactorial nature of academic behavior in higher education settings (Al-Barashdi et al., 2015; Samaha and Hawi, 2017), suggesting a broader investigation into other factors that contribute to academic progress. This study utilized a cross-sectional design, which constrains the capacity to derive causal inferences, rather than exploring the association of the IV to DV.

Moreover, employing self-reported metrics may add biases stemming from subjective impressions and the accuracy of reporting. A notable limitation of this study is the overrepresentation of participants from the Faculty of Computer and IT, who accounted for 80.7% of the respondents. Despite efforts to distribute the survey equally across faculties, the response rate from non-IT disciplines was relatively low, likely due to differences in screen usage and accessibility. As a result, the findings may not be fully generalizable to students from other academic backgrounds.

Future research should aim for more balanced disciplinary representation to improve generalizability. Additionally, employing longitudinal or experimental methods could help establish causal links, while incorporating objective measures alongside self-reports could reduce bias. Finally, expanding the sampling to include a wide range of academic faculties and institutions would further enhance the representation.

6 Conclusion

The study investigated the mechanisms through which social media addiction (SMA) impacts academic performance among
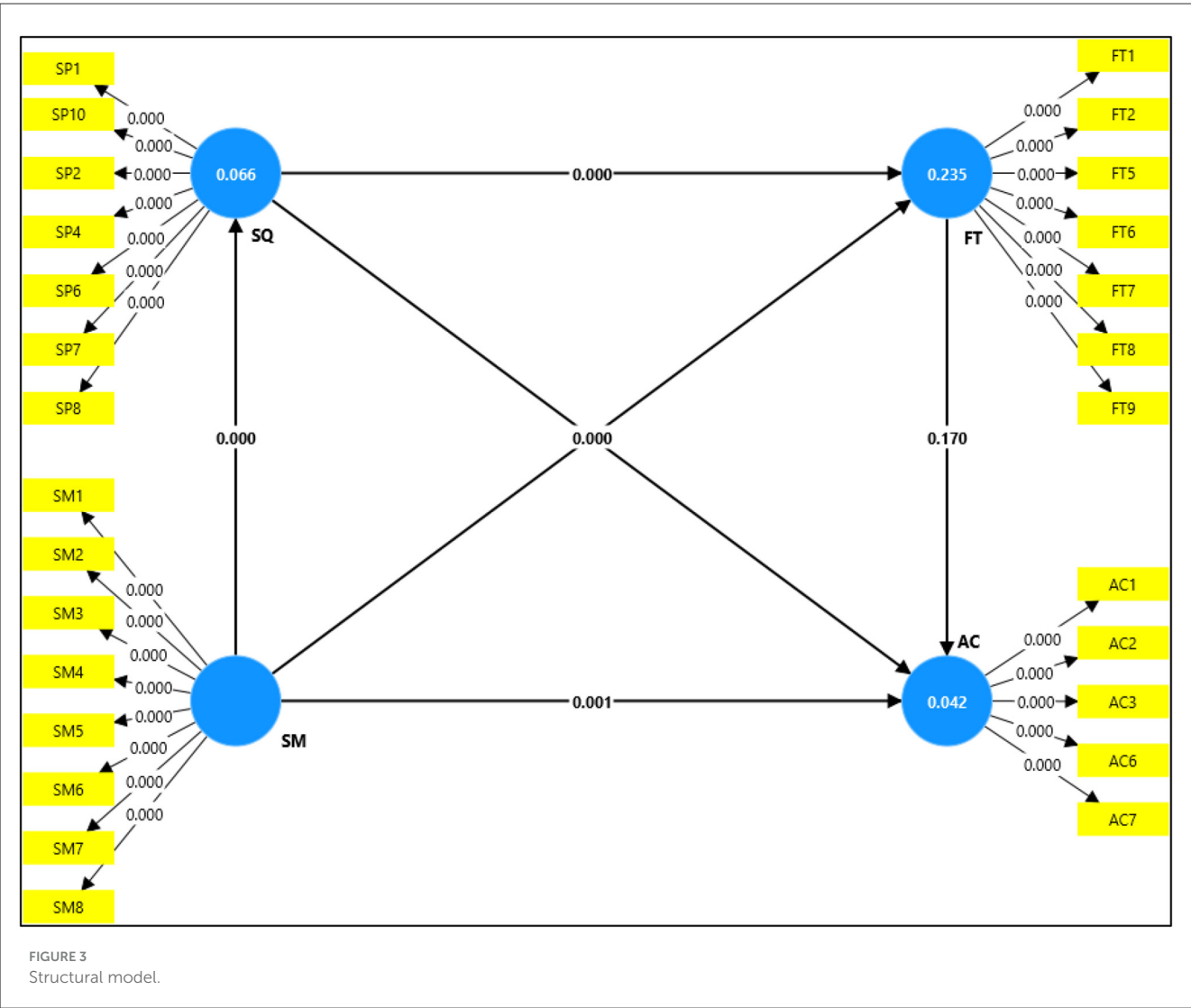
FIGURE 3
Structural model.

TABLE 6 Direct relationships.

Hypothesis	Model	β	STDEV	t	P	Result
H1:	SMA → ACP	−0.155	0.049	3.152	0.002	Accepted
H2:	SMA → SQ	0.256	0.042	6.168	0.000	Accepted
H3:	SMA → FT	0.324	0.040	8.151	0.000	Accepted
H4:	SQ → ACP	0.174	0.046	3.756	0.000	Accepted
H5:	SQ → FT	0.286	0.040	7.125	0.000	Accepted
H6:	FT → ACP	−0.045	0.047	0.967	0.334	Rejected

undergraduate students in Somalia, testing sleep quality and fatigue as mediators. Our findings suggest that SMA harms academic performance via two distinct pathways. First, there is a direct negative relationship, suggesting that SMA creates a motivational conflict that diverts attention from academic goals. Second, and more significantly, SMA has a powerful indirect effect by degrading sleep quality, which in turn diminishes academic performance. Critically, while SMA was linked to higher fatigue, fatigue was not a significant mediator in our model. This key finding suggests that cognitive impairment from poor sleep is a more direct driver of academic decline than the subjective feeling of being tired. These results support our DC-DDR model, confirming that SMA acts through both motivational and energy-depletion mechanisms.

TABLE 7   Mediation analysis.

Hypothesis	Constructs	β	SD	t	P	Result
H7:	SMA → SQ → FT	0.073	0.015	4.836	0.000	Supported
H8:	SMA → FT → ACP	−0.015	0.015	0.958	0.338	Not Supported
H9:	SMA → SQ → ACP	0.045	0.014	3.164	0.002	Supported
H10:	SMA → SQ → FT → ACP	−0.003	0.004	0.902	0.367	Not Supported
H11:	SQ → FT → ACP	−0.013	0.014	0.915	0.360	Not Supported

TABLE 8   Model's explanatory power.

Construct	R^2	R-square adjusted	Q^2
AC	0.042	0.037	0.011
FT	0.235	0.232	0.060
SQ	0.066	0.064	0.149

6.1 Recommendations and future direction

The findings of this study offer practical implications for university administrators, educators, and mental health professionals in Somalia and similar contexts. Instead of advocating for unrealistic measures like digital detoxes or technology bans, approaches that are often unsustainable for digitally native students, our results emphasize more practical, educational, and supportive interventions. Universities should develop targeted awareness campaigns that highlight the connection between late-night social media use, poor sleep, and academic underperformance. Programs focusing on sleep strategies, such as setting a digital wellbeing plan and avoiding screens before bedtime, can help encourage healthier habits.

The study also recommends integrating digital literacy and self-regulation skills into student orientation programs. These initiatives should aim to equip students with the tools to manage their technology use responsibly, without demonizing social media. Training could focus on monitoring screen time, recognizing compulsive use, and fostering focused, productive work. In addition to that, the faculty also has a role to play. They need to employ interesting and interactive teaching approaches to keep the students attentive in class and reduce their tendency to escape by browsing their social media accounts. However, universities must offer counseling and support services to students who may have developed social media dependency or are under pressure due to the large workload. Introducing such support systems would ensure that the faculty members assist students in obtaining the necessary support to manage the new digital behaviors.

Data availability statement

The raw data supporting the conclusions of this article will be made available upon reasonable request from corresponding author.

Ethics statement

The studies involving humans were approved by Ethical Committee, Jamhuriya University of Science and Technology. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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