

# Deciphering the underlying repercussions of cognitive overload on university students' fatigue, frustration and academic productivity: Implementation of stimulus–organism–response model

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## ABSTRACT

Extant studies suggest that cognitive overload, as a nascent phenomenon, has become increasingly pervasive among university students, precipitating a multitude of detrimental consequences. Nevertheless, the adverse impacts of cognitive overload, particularly on Chinese higher education students, remain markedly underexplored in the extant literature. To improve academic understanding, this research combines quantitative data with the stimulus–organism–response (SOR) framework, constructing a robust theoretical model that elucidates the antecedents and sequelae of cognitive overload in relation to academic productivity in educational contexts. Research has suggested that several types of cognitive overload, including information, social, and system function overload, might contribute to university students' mobile SNS fatigue and frustration, which may detrimentally impact their academic productivity. This theoretical framework is empirically validated through rigorous statistical analyses derived from a sample of 660 Chinese university students who frequently utilized mobile social media. The findings underscore that these three cognitive overload forms significantly predict mobile SNS fatigue and frustration, subsequently impairing university students' academic productivity. Moreover, the relationships between three cognitive overload types and academic productivity are mediated by mobile SNS fatigue and frustration. Consequently, this study advances the theoretical and empirical discourse on cognitive overload by applying the SOR model, elucidating the underlying mechanisms by which cognitive overload impacts university students' academic productivity. These insights deepen the scholarly understanding of the adverse consequences associated with mobile social media usage from a cognitive overload perspective, furnishing empirically grounded recommendations for multiple stakeholders to implement targeted interventions aimed at ameliorating these detrimental effects.

## 1. Introduction

In recent years, social networking services (SNSs), web-based applications that serve as an online community for interpersonal relationships, communication, and information dissemination among individuals, have burgeoned into a global sociotechnical phenomenon (Gao & Zhao, 2024; Pradhan, 2022). Empirical data from the China Internet Network Information Center (CNNIC) reveals that the digital connectivity landscape of China's populace has surpassed 1.108 billion by the conclusion of 2024, achieving a penetration rate of 78.6 %, with the scale of social network users accounts for 99.3 % of the entire online population (Wang et al., 2025). Mobile social platforms now dominate

users' digital engagement, constituting approximately 35 % of total online activity, with WeChat and Weibo emerging as the predominant applications. Its utilization extends significantly within educational settings, where instructors ordinarily allocate assignments and facilitate discussions through WeChat. The burgeoning of mobile social media applications has empowered university students to seamlessly access course materials, institutional announcements, and pedagogical resources with unprecedented temporal and spatial flexibility (Masood et al., 2022). Moreover, the embedded ecosystem of micro-applications within these platforms has engendered a novel paradigm of blended learning, effectively bridging virtual and traditional classroom environments while optimizing educational outcomes. Furthermore, the

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integration of mobile social media with digital payment systems, exemplified by WeChat Pay, has rendered it virtually impossible for students to significantly curtail their utilization of these pervasive digital platforms. Consequently, Chinese students have developed a profound reliance on mobile social media, precipitating a range of adverse psychosocial and academic consequences (Chai et al., 2019; Zhang et al., 2023).

Researchers have conducted extensive investigations to explore and delineate the detrimental repercussions stemming from the pervasive adoption of mobile social media in professional contexts (Shang et al., 2022; Teng et al., 2021). Empirical research by Upadhyaya et al. has demonstrated that sustained engagement with mobile social media induces technostress, which subsequently manifests as significant impairment in work-related performance metrics (Upadhyaya & Vrinda, 2020). Additionally, Yu et al. advanced the argument that the utilization of mobile social media for occupational purposes serves as an inducement for interdomain conflicts within organizational settings, ultimately precipitating cognitive depletion among workforce populations (Yu et al., 2018). However, prior investigations into mobile social media have predominantly centered on the commercial domain, while largely neglecting to examine the negative externalities affecting student populations. This oversight is particularly noteworthy given that demographic analyses reveal youth constituencies constitute a substantial proportion of active mobile social media users (Foroughi et al., 2021; Whelan et al., 2020). Exhibiting the highest levels of engagement on these platforms, university students demonstrate a heightened propensity for experiencing the detrimental ramifications of mobile social media usage compared with other groups (Luqman et al., 2020). Within the educational field, the systematic investigation of mobile social media's detrimental effects and their consequent repercussions represents both a critical knowledge gap and an urgent research imperative.

This research delves into the deleterious aspects of mobile social media-induced cognitive overload, thereby formulating the central research inquiry: How does cognitive overload impact the academic productivity of university students? Based on the person-environment fit theory, overload is conceptualized as emerging from the disequilibrium between environmental stimuli and individuals' cognitive processing capacities (Efe Stanley, 2021; Masood et al., 2022). The ubiquitous availability of mobile social platforms has substantially exacerbated users' technological immersion, compelling them to persistently engage with an extensive array of information and social requests. Such sustained cognitive exertion may precipitate overload phenomena, potentially manifesting as both physical and psychological fatigue (Cao & Sun, 2018; Sheng et al., 2023). An individual may experience an overwhelming state through mobile social media even with intermittent usage, underscoring that excessive engagement is not a prerequisite for experiencing overload. While problematic mobile social media use, which is typified by persistent, obsessive, and addictive behavioral patterns, has the potential to generate a plethora of deleterious consequences, overload represents a ubiquitous negative outcome of mobile social media engagement (Pradhan, 2022; Sheng et al., 2023).

Building upon self-determination theory, the experience of frustration in mobile SNS usage can be understood as a threat to basic psychological needs for autonomy, competence, and relatedness (Deci & Ryan, 2000). When university students perceive cognitive overload from information, social, or system function demands, their sense of competence is undermined as they struggle to manage these digital demands effectively. This frustration of basic psychological needs may lead to motivational deficits that ultimately impair academic productivity (Al Fraidan, 2025a). The concept of digital fatigue further aligns with theories of attentional regulation and self-regulatory failure. As posited by attentional control theory, the constant demands of mobile SNS may deplete finite attentional resources, leading to difficulties in maintaining focus on academic tasks (Eysenck et al., 2007). This is particularly relevant in educational contexts where students must frequently switch between academic and social-digital domains (Al Fraidan, 2025b). The

resulting self-regulatory failure creates a cycle where frustration exacerbates fatigue, and fatigue further diminishes self-regulation capacity, a dynamic that the findings empirically support.

Applying the stimulus-organism-response framework, this study advances a theoretical proposition wherein three distinct forms of cognitive overload (namely, information, social, and system function overload) serving as stimuli, which lead to detrimental impacts on the psychological states (namely, mobile SNS fatigue and frustration) and behavioral outcome (academic productivity) of university students. The present research contributes to the extant literature in three principal dimensions. First, by interrogating the multifaceted nature of cognitive overload, this investigation expands the research scope concerning the adverse impacts of digital technologies on the pedagogical field. Second, this research elucidates the fundamental mechanism by which stimuli affect university students' academic productivity, thereby extending the theoretical applicability of the stimulus-organism-response model. Lastly, leveraging empirically derived insights, this research furnishes actionable implications for scholars and practitioners, enabling the formulation of evidence-based interventions to mitigate the deleterious ramifications of mobile social media concerning psychological health and academic productivity.

## 2. Theoretical framework and research hypotheses

### 2.1. Connecting cognitive overload with mobile SNS fatigue

Overload constitutes a subjective cognitive appraisal wherein an individual perceives the voluminous influx of informational stimuli to exceed their cognitive and behavioral capacity for efficacious processing (Cao & Sun, 2018). In accordance with human-environment matching theory, overload emerges as a consequence of a misalignment between environmental exigencies and an individual's intrinsic processing capabilities (Bouattour Fakhfakh & Bouaziz, 2022; Efe Stanley, 2021). This phenomenon exerts a profound and pervasive impact on mobile SNS fatigue, primarily attributable to the multifarious challenges arising from the intricate interweaving between individuals' virtual and physical lives. The ubiquitous immersion in mobile social media platforms subjects users to an incessant deluge of informational and communicative demands, which encroach upon temporal resources, induce psychological strain, and disrupt quotidian functioning (Gao & Zhao, 2021; Sheng et al., 2023). As suggested by Masood et al., overload can be categorized into three distinct forms: information, social, and system function overload (Masood et al., 2022).

Information overload refers to the cognitive experience resulting from exposure to voluminous information within a restricted temporal duration, fundamentally attributable to individuals' constrained cognitive capacity for its assimilation and processing (Xiao et al., 2019). Subjectively, it manifests as a psychological state of being inundated with an overflow of information. Contemporary higher education contexts witness university students engaging in knowledge acquisition, synthesis, and dissemination at unprecedented speed, as mobile social media becomes increasingly embedded within both their quotidian routines and academic pursuits. To satisfy rigorous academic demands encompassing scholarly assignments, research papers, and presentations, students routinely resort to mobile social media to acquire relevant informational resources (Cao & Sun, 2018; Upadhyaya & Vrinda, 2020). Traversing extensive media content typically entails considerable temporal investment and cognitive exertion to identify and extract valuable insights and pertinent information. Information overload typically materializes when students encounter informational volumes that surpass their cognitive processing thresholds, potentially precipitating adverse affective states (Efe Stanley, 2021; Sheng et al., 2023). This cognitive strain may precipitate significant psychological issue, giving rise to cognitive fatigue and mental exhaustion among individuals.

Saegert (1978) initially formulated the concept of social overload as

a theoretical construct to explain the phenomenon of heightened population density within physical, real-world settings. He revealed that individuals experience social overload when the demands of maintaining interpersonal relationships exceed their intrinsic capacity for sustained interpersonal engagement. From the perspective of social media, social overload manifests as users' subjective perception of being overwhelmed by the obligation to provide excessive social support within their online networks (Chai et al., 2019; Fu et al., 2020). Currently, university students are equipped with the capacity to engage in multifaceted digital interactions, transcending temporal and spatial impediments by the proliferation of mobile-centric social media infrastructures. The persistent engagement with multifarious social interactions precipitates interaction fatigue among students, as they grapple with the cognitive and affective burdens of managing competing relational demands. According to Masood et al., social overload is a reflection of people's feelings of giving others overpowering social support, culminating in psychological depletion from overextended social connectivity (Masood et al., 2022; Teng et al., 2021). Consequently, students might experience an excessive sense of responsibility, culminating in systemic depletion as they endeavor to sustain excessive interpersonal support obligations.

System function overload constitutes a cognitive burden precipitated by technologically-mediated stimulation, operationalized as a state wherein mobile social media platforms incorporate functional complexities that exceed users' cognitive thresholds for effective operation and assimilation (Masood et al., 2022; Upadhyaya & Vrinda, 2020). Scholars unearthed that escalating technological complexity within information systems engenders a decrement in the present efficacy of software, ultimately precipitating a decline in overall productivity. According to Tan et al., the functional augmentation theoretically enhances service sustainability for mobile social media providers, the accelerated system iterations and escalating system complexity may contribute to system function overload (Tan et al., 2023; Xiao et al., 2019). The optimization along with distinctiveness of mobile social media products can be achieved through the integration of novel technological functionalities; nevertheless, the indiscriminate accumulation of functionalities risks precipitating user fatigue and systemic usability degradation (Sheng et al., 2023). Fu et al. (2020) proposed that while technological innovation ostensibly enhances functional capacity, it simultaneously amplifies interface complexity and cognitive demands. This dissonance frequently results in user discontinuation behaviors and technology fatigue when they assess the requisite cognitive expenditure for mastering novel functionalities to be disproportionate to the anticipated benefits (Cao & Sun, 2018; Tan et al., 2023).

The socio-technical systems theory suggests cognitive overload stems from a mismatch between technological capabilities and social demands (Bryl et al., 2009). The technology-induced cognitive load frameworks further explains how technical features trigger distinct cognitive demands, while social factors amplify these effects through interactive dynamics (Essel et al., 2021). Building on both theories, this study clarifies the conceptual distinctions among three types of cognitive load. Information overload emerges when the volume and complexity of informational stimuli exceed an individual's cognitive processing capacity. From a socio-technical perspective, this reflects a mismatch between the system's information output and users' assimilation capabilities (Xiao et al., 2019). In cognitive load terms, this represents intrinsic load, which refers to the inherent difficulty of processing information content itself (Nastjuk et al., 2023). Social overload stems from excessive demands for maintaining online social relationships. Socio-technical systems theory frames this as a conflict between technological affordances for connectivity and users' limited social attention resources (Naga & Ebarido, 2025). Within cognitive load theory, this constitutes extraneous load, which refers to the cognitive resources diverted to manage non-essential social interactions rather than primary tasks (Qi & Yang, 2024). System function overload arises from interface complexity and feature proliferation. The socio-technical view

highlights how system designs may introduce unnecessary operational demands (Cao et al., 2023). In cognitive load terms, this represents germane load, which refers to the mental effort required to navigate and master system functionalities (Tarafdar et al., 2014). While these overload types may co-occur, each stem from distinct socio-technical dynamics and imposes unique cognitive burdens. Therefore, the hypotheses proposed are as follows:

- H1.** Information overload has positive effects on mobile SNS fatigue.
- H2.** Social overload has positive effects on mobile SNS fatigue.
- H3.** System function overload has positive effects on mobile SNS fatigue.

## 2.2. Connecting cognitive overload with frustration

Frustration is recognized as a detrimental affective state engendered by impediments that hinder individuals from fulfilling intrinsic needs or achieving anticipated objectives (Dai et al., 2020; Swiatek et al., 2023). From an information technology perspective, frustration manifests as users' perceived incapacity to effectively manage digital environments, view information technology as a menace and feel unable to control information technology-induced events. A body of scholarly work has investigated the antecedents and consequences of frustration stemming from engagement with mobile social media platforms (de Guinea et al., 2014; Mahmud et al., 2020). Dai et al. reported that frustration significantly influences internet users' privacy perceptions, which in turn substantially modulate their disposition toward disclosing personal information (Dai et al., 2020). Mahmud et al. demonstrated that frustration markedly influences information system users' enthusiasm, thereby adversely affecting their behavioral intentions regarding information system adoption (Mahmud et al., 2020).

In accordance with previous studies, information overload exerts a deleterious influence on cognitive faculties, thereby impairing an individual's capacity to accurately perceive, critically evaluate, and efficiently execute tasks or decisions (Efe Stanley, 2021; Xiao et al., 2019). When information overload is conceptually linked to frustration, it potentially becomes an obstacle to meeting certain requirements, such as making scientific decisions or accessing only pertinent information. Presently, the volume of information generated and disseminated via mobile social media platforms is increasing at an exponential rate, while human cognitive processing capacities remain intrinsically bounded (Sheng et al., 2023). Concurrently, the escalating commercialization of mobile social media ecosystems has engendered an unprecedented saturation of corporate promotional content. Mobile social media users are compelled to navigate vast quantities of extraneous information daily, with the difficulties in identifying and utilizing relevant content, compounded by temporal inefficiencies, which engenders significant user frustration (Efe Stanley, 2021).

Mobile social media platforms function as digital ecosystems in which phenomena of social overload commonly arise during user engagement. As users' virtual networks proliferate, demanding increasingly substantial temporal and cognitive investments to sustain these digital connections, adverse psychological states such as anxiety and frustration become increasingly prevalent (Rozgonjuk et al., 2020; Teng et al., 2021). Concomitant with the marked escalation in mobile social media usage, these platforms have transitioned from intimate, acquaintance-oriented networks into broader digital societies that incorporating more contacts into users' personal online social circles. This evolution has transformed mobile social interactions from initially strong associations to prevailing weak connections. The expansion of superficial connections, coupled with passive consumption of content on platforms like Facebook or Instagram without meaningful engagement, may exacerbate perceptions of social isolation (Maier et al., 2017). Therefore, when users encounter palpable social overload alongside persistently unmet relational needs, such experiences are likely to

culminate in a pervasive sense of frustration.

For mobile social media users, the introduction of novel functionalities is frequently employed by service providers as a strategic means to enhance system performance and competitive differentiation, necessitating continuous user adaptation to system adjustments and updates. System function overload, arising from the proliferation of features embedded within mobile social media platforms, imposes an increased burden on users to acquire proficiency in navigating these features, which in turn diminishes the perceived utility of the platform and engenders user frustration (Upadhyaya & Vrinda, 2020; Xiao et al., 2019). The “function fatigue theory” offers a theoretical explanation for the paradoxical shift in user attitudes toward multi-functional commodities before and after adoption, indicating that while users initially exhibit preference for feature-rich products, they ultimately develop aversion and dissatisfaction toward the very functionalities they originally deemed desirable (Masood et al., 2022; Upadhyaya & Vrinda, 2020). Accordingly, this research proposes these hypotheses:

- H4. Information overload has positive impacts on frustration.
- H5. Social overload has positive effects on frustration.
- H6. System function overload has positive impacts on frustration.

### 2.3. Connecting mobile SNS fatigue and frustration with academic productivity

Within the domain of information systems, productivity is conceptualized as the extent to which a digital application augments user output or enhances operational efficacy per unit of time (Alshamaila et al., 2023; Upadhyaya & Vrinda, 2020). Abramo et al. explained productivity as the amelioration of work efficiency and output within designated occupational periods, attributable to the integration of digital technologies (Abramo & D'Angelo, 2014). Foroughi et al. researched academic productivity by employing students' grade point averages (GPAs), revealing a significant inverse relationship between depressive symptoms and productivity levels (Foroughi et al., 2021).

Technologies designed to cater to hedonistic desires, exemplified by mobile social media platforms, exhibit pronounced cognitive absorption characteristics that substantially amplify user immersion and psychological dependency (Fu et al., 2020). As the cognitive and social burdens associated with mobile social media grow increasingly pervasive, an expanding segment of users confronts the tangible reality of being overwhelmed by incessant informational influx and escalating societal expectations. Students frequently allocate considerable cognitive and temporal resources to these platforms, consequently resulting in an accumulating sense of weariness. Research in occupational psychology indicates that work fatigue detrimentally compromises task performance, professional self-concept, and job satisfaction (Shang et al., 2022). Within educational contexts, Amholt et al. further elucidated that fatigue substantially diminishes academic productivity by acting as a cognitive barrier to sustained concentration and scholarly engagement (Amholt et al., 2020; Gao & Zhao, 2024; Shi et al., 2020).

Considering that frustration and mobile SNS fatigue are psychological ramifications attributed to information overload, the potential interrelationship among these constructs warrants investigation. Unfortunately, a thorough literature review of extant academic literature has revealed a lacuna in empirical studies specifically addressing this phenomenon. Notwithstanding this gap, several studies have investigated the contributory roles of other adverse affective states in the development of mobile SNS fatigue. For instance, emerging evidence indicates that fear of missing out among mobile social media users significantly precipitates fatigue (Rozgonjuk et al., 2020). Foroughi et al. demonstrated through empirical analysis a significant association linking despondency and tension to mobile SNS fatigue (Foroughi et al., 2021; Pradhan, 2022). Zheng et al. reported that frustration can elicit a range of detrimental affective responses, including guilt, anxiety, and

rage (Zheng & Lee, 2016). Mahmud et al. reported that frustration from internet use worsens computer users' moods (Mahmud et al., 2020). Moreover, drawing from ego depletion theory, the experience of frustration may deplete individuals' limited self-regulatory resources, making them more vulnerable to fatigue (Baumeister, 2010). When university students encounter frustrating experiences on mobile SNS (e.g., difficulty navigating interfaces or managing social demands), the cognitive and emotional effort required to regulate these negative states can exhaust their mental resources, subsequently leading to fatigue (Xiao et al., 2019). This perspective aligns with emotion regulation models which suggest that persistent negative emotional states like frustration require ongoing regulatory efforts that can be mentally taxing (Grillon et al., 2015). The continuous need to manage frustration from cognitive overload may therefore precipitate a state of mobile SNS fatigue as users' regulatory capacities become depleted.

Frustration typically originates from a confluence of unrealistic self-imposed expectations, physiological constraints, deficits in cognitive capacity or skills, and impediments to personal objectives, which collectively constitute significant barriers to goal fulfillment (Mahmud et al., 2020). In psychological discipline, frustration represents a prevalent affective response to contradictory emotional states and arises from perceived obstructions to the attainment of individual aspirations. The attainment of academic productivity necessitates a holistic approach encompassing various dimensions of well-being, including physical, interpersonal, affective, mental, and psychological aspects (Amholt et al., 2020; Foroughi et al., 2021). In contrast to students experiencing physical or psychological impairments, those who exhibit sound physical and mental health are anticipated to demonstrate markedly superior academic performance. Individuals grappling with psychological challenges such as frustration, anxiety, or tension are predisposed to encounter substantial impediments that adversely affect their academic productivity (Alshamaila et al., 2023; Shi et al., 2020). Therefore, our hypotheses are as follows:

- H7. Mobile SNS fatigue negatively affects academic productivity.
- H8. Frustration positively affects mobile SNS fatigue.
- H9. Frustration negatively affects academic productivity.

## 3. Research methodology

### 3.1. Research model

Derived from environmental psychology, the stimulus–organism–response model postulates that specific environmental elements function as external stimuli, influencing individuals' cognitive and affective states and subsequently eliciting particular behavioral responses (Cao & Sun, 2018; Tuncer, 2021). Within the domain of information systems research, the SOR framework has been extensively utilized to elucidate complex online user behaviors such as beneficiary intention and social commerce intention (Teng et al., 2021). This model offers a robust theoretical structure for examining how overload-related stimuli affect users' internal psychological processes and ultimately shape their behavioral outcomes. Accordingly, the current study employs the SOR model as its foundational theoretical framework.

By amalgamating content created by users and features designed for social interaction, mobile social media platforms fulfill multifarious objectives, including the establishment and maintenance of interpersonal relationships, information aggregation, facilitation of communication, and recreational interaction (Winstone et al., 2021). However, mobile social media functions including flash notifications, automated prompts, multitasking features, and personal exposure mechanisms may inundate university students with excessive information, persistent communicative demands, and incessant social solicitations (Shi et al., 2020). When the demands imposed on students surpass their cognitive processing capacities, they might be agitated and perceived loss of

situational control, generating distinct forms of cognitive overload. These demanding conditions adversely affect students' psychological well-being and concurrently diminish their academic productivity. This study employs information overload, social overload, and system function overload as stimuli to examine the adverse effects of mobile social media, utilizing mobile SNS fatigue and frustration as organisms and employing academic productivity as a response. Thus, the SOR model provides a robust analytical framework for elucidating the interrelationships among external stimuli (cognitive overload), internal affective and cognitive states (mobile SNS fatigue and frustration), and behavioral outcomes (academic productivity), thereby illuminating the mechanisms through which technological stressors influence university students' mental states and scholarly performance (Fig. 1).

3.2. Sample and procedure

The research scrutinizes the ramifications of cognitive overload within the educational setting, with a specific focus on university students exhibiting high mobile social media engagement. In accordance with the report issued by the CNNIC, individuals under the age of 30 constitute the predominant user demographic of mobile social media platforms, a significant proportion of whom are students (Wang et al., 2025). Consequently, the student body is a representative subset of the mobile social media user demographic (Samad et al., 2019; Zhang et al., 2023). Given the study's primary objective of elucidating the overload on student users, distinctions or categorizations among various social media applications were intentionally omitted or not considered. Therefore, the term "mobile social media" is employed as an integrative construct encompassing a plurality of widely adopted platforms within the Chinese context, such as WeChat and Weibo, rather than referring to any single application or website.

The data collection process was conducted online via the Sojump website. All participants were explicitly assured of the strict confidentiality of their responses and the non-disclosure of any identifiable information to third parties. The study protocol received formal approval from the institutional ethics review board at the authors' university. Only participants who claimed to use mobile social media were eligible for this research. Following a rigorous screening and data validation process, 660 respondents were deemed viable subjects for inquiry. Table 1 provides a comprehensive demographic profile of the sample. A substantial majority of participants demonstrated sustained mobile social media utilization patterns, with a considerable proportion utilizing these platforms for a duration exceeding 4 h daily over a temporal continuum surpassing 7 years; consequently, the sample can be characterized as comprising proficient and highly experienced mobile social media users. This result revealed that these participants were likely to engage in excessive use, thereby corroborating the appropriateness and

Table 1

Demographics of the research samples and general mobile social media usage (N = 660).

Category	Frequency	%
Gender		
Male	311	47.1
Female	349	52.9
Age		
18–21	199	30.1
22–25	357	54.1
26–29	94	14.2
30–33	10	1.6
Years of using mobile social media		
≤1 year	8	1.5
1–3 year	25	3.8
4–6 year	245	37.1
≥7 year	382	57.6
Daily usage time of mobile social media		
≤1 h	21	3.2
1–3 h	193	29.2
4–6 h	388	58.8
≥7 h	58	8.8

relevance of the sample selection we conducted.

3.3. Measurement

The study employed five-point Likert scales to measure all constructs. To ensure the validity and reliability of the measurement instruments, the constructs employed were adopted from previously published literature, with some terminological adjustments implemented to align with the research setting. Items assessing information overload and system function overload were sourced from Xiao et al. (Xiao et al., 2019), whereas the measurements for social overload were derived according to Cao et al. (Cao & Sun, 2018). The measurement items for mobile SNS fatigue and frustration were respectively extracted from Swiatek et al. (Swiatek et al., 2023) and Dai et al. (Dai et al., 2020). Given the considerable variation in grade point average (GPA) calculation standards and methodologies across Chinese universities, utilizing GPA as a direct measure of academic productivity presents considerable challenges. Consequently, this research employs the measurement items scrutinized by Whelan et al. (Whelan et al., 2020) to assess academic productivity among university students.

Given that the research focused on Chinese university students, ensuring the accuracy of measurement instruments was critical. To mitigate potential linguistic ambiguities, a reverse translation method was implemented meticulously. During the initial translation phase, the original English instruments were meticulously translated into Chinese. Subsequently, the Chinese versions underwent a rigorous back-

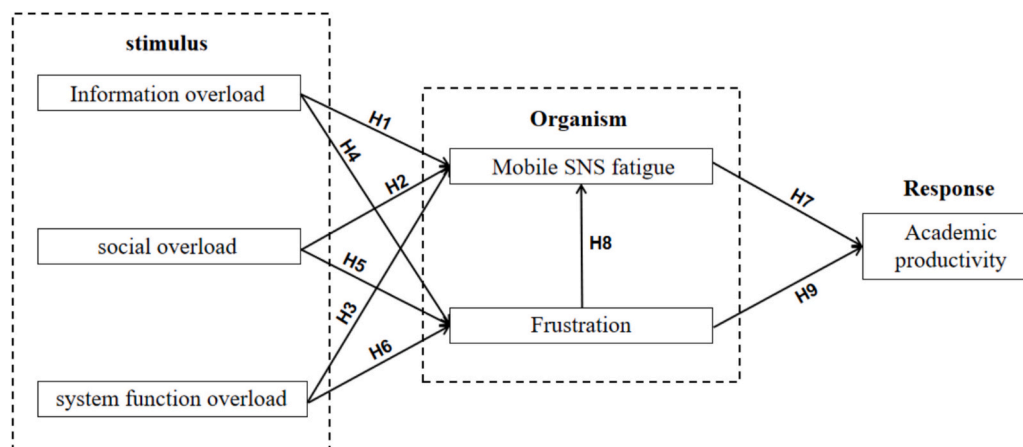


Fig. 1. The conceptual research model.

translation process conducted by independent translators who did not consult the source texts. Following a comparative analysis of the original and back-translated English versions, the researcher implemented necessary terminological refinements and phrasing adjustments. Additionally, prior to the formal data collection, a pilot study was conducted with a cohort of 100 university students who reported regular engagement with various mobile social media platforms. The outcomes demonstrated excellent scale validity and reliability.

#### 4. Data analysis strategy

Originally, responses were filtered and subsequently prepared using Excel, ensuring compliance with the required criteria. Preliminary statistical analyses were subsequently performed utilizing SPSS 26, which included an evaluation of common method variance (CMV) to mitigate potential biases. The final phase of data analysis involved the application of structural equation modeling (SEM) via AMOS 24 to examine the hypothesized relationships. The measurement model was rigorously evaluated through confirmatory factor analysis (CFA), encompassing assessments of overall model fit, construct reliability, and both convergent and discriminant validity. Subsequently, SEM was employed to analyze the latent structural relationships among variables. The SEM method is suitable for research as it facilitates the analysis of complex statistical relationships by illuminating the correlations among the major variables. Additionally, employing SEM enables investigators to assess the unified model with multiple standalone elements while simultaneously analyzing multiple independent and dependent variables rather than assessing each in isolation.

### 5. Results

#### 5.1. Assessment of the measurement model

To evaluate the accuracy of the measurement model, this study assessed the reliability, convergent validity, and discriminant validity of the constructs employed. The measurement model was first subjected to CFA, followed by SEM to test the hypothesized structural relationships. The authors adopted a two-phase procedure to examine the theoretical model and relationships within the research framework to guarantee the reliability as well as the validity of the evaluation while enhancing the interpretability of the findings rather than relying on a single analytical technique. The initial phase entailed a comprehensive assessment of the overall research model, which subsequently enabled a comprehensive examination of the relationships among all latent variables. As summarized in Table 2, a well-fitting model is indicated by goodness-of-fit indices (GFI, AGFI, NFI, IFI, TLI, and CFI) exceeding 0.90, RMSEA values below 0.08, RMR values under 0.05, and a  $\chi^2/df$  ratio less than 3 (Kareem et al., 2022). The results of the fit indices ( $\chi^2/df = 2.452$ ; RMSEA = 0.043; RMR = 0.037; GFI = 0.959; AGFI = 0.963; NFI = 0.948; IFI = 0.966; TLI = 0.937; CFI = 0.969) collectively indicate a satisfactory model fit, with all indices satisfying the model fit standards.

Table 2 summarizes the factor loadings, squared multiple correlations (SMCs), Cronbach's alpha coefficients, average variance extracted (AVE) values, and composite reliability (CR) metrics, which collectively depict the structure of the model. Concerning the dependability of the measurement model, Cronbach's alpha and the CR are typically applied to evaluate inner consistency among the constituent items. All six latent variables demonstrated values exceeding the recommended threshold of 0.7 for both Cronbach's alpha and CR, indicating robust internal consistency and high reliability across the measurement model. Additionally, convergent validity was assessed through estimation of factor loadings, AVE alongside SMC. The high loadings of the elements attest to the good convergence validity of the hypothetical structure. All loadings surpassed 0.7, and each SMC value exceeded 0.5, providing further empirical confirmation of the scale's convergent validity. Table 3 presents the discriminant validity of the constructs in the study, which

**Table 2**  
Summary of the confirmatory factor analysis.

Constructs and Items	Loading	SMC	Cronbach's Alpha	AVE (>0.5)	CR (>0.7)
Information overload (IO)			0.787	0.553	0.788
IO1	0.722	0.521			
IO2	0.718	0.516			
IO3	0.779	0.607			
Social overload (SO)			0.813	0.596	0.815
SO1	0.795	0.632			
SO2	0.732	0.536			
SO3	0.787	0.619			
System function overload (SFO)			0.821	0.605	0.821
SFO1	0.746	0.557			
SFO2	0.785	0.614			
SFO3	0.801	0.642			
Mobile SNS fatigue (MSF)			0.806	0.584	0.808
MSF1	0.727	0.529			
MSF2	0.808	0.653			
MSF3	0.756	0.572			
Frustration (F)			0.854	0.663	0.855
F1	0.866	0.750			
F2	0.821	0.674			
F3	0.752	0.566			
Academic productivity (AP)			0.908	0.718	0.910
AP1	0.872	0.760			
AP2	0.835	0.697			
AP3	0.826	0.682			
AP4	0.855	0.731			

**Table 3**  
Discriminate validity: Pearson's correlation coefficient.

	SFO	SO	IO	F	MSF	AP
SFO	<b>(0.744)</b>					
SO	0.322	<b>(0.772)</b>				
IO	0.415	0.402	<b>(0.778)</b>			
F	0.428	0.417	0.253	<b>(0.764)</b>		
MSF	0.669	0.383	0.455	0.566	<b>(0.814)</b>	
AP	-0.317	-0.185	-0.176	-0.479	-0.381	<b>(0.847)</b>

Notes: SFO, system function overload; SO, social overload; IO, information overload; F, frustration; MSF, mobile SNS fatigue; AP, academic productivity. The diagonal elements (bold) represent the square root of the AVE. The off-diagonal elements represent the correlations between variables.

assesses the extent to which each construct is distinct from the others. The diagonal elements represent the square root of the Average Variance Extracted (AVE), a measure of how much variance a construct captures relative to measurement error. For robust discriminant validity, these values should exceed the correlation coefficients between the constructs, indicating that each construct shares more variance with its own measures than with other constructs, supporting discriminant validity.

#### 5.2. Common method variance (CMV) test

The CMV implies overlap variation induced by collection approaches instead of substantive structural significance. Given that this study utilized a self-reported questionnaire for data acquisition, potential biases inherent to the methodological approach may arise due to the contextual and procedural characteristics of the survey administration. Such systematic error constitutes a source of method-induced variance. The CMV could be examined by employing Harman's single factor test, a statistical technique detecting if one factor explains the predominant portion of covariance in the dataset. In this investigation, exploratory factor analysis (EFA) was conducted on all measured items using maximum variance rotation, in accordance with established methodological

recommendations (Luo et al., 2019). The results indicated that no single factor explained more than 50 % of the total variance, suggesting that common method bias does not substantially threaten the validity of the findings.

5.3. Structural path analysis

The structural model and its corresponding fit indices were evaluated using Amos 24. A  $\chi^2/df$  value of 2.762, which falls below the recommended threshold of 3, indicates that the model exhibits satisfactory fit. Further fit statistics support the model's robustness: the RMSEA = 0.061, the RMR = 0.053, the GFI = 0.939, the AGFI = 0.941, the NFI = 0.926, the IFI = 0.945, the TLI = 0.921, and the CFI = 0.932. Information, social, and system function overload were each found to exert significant positive effects on both mobile SNS fatigue and frustration, with standardized path coefficients of 0.289, 0.176, 0.523, 0.356, 0.310, and 0.502, respectively. These empirical findings substantiate that every element is a significant predictor of mobile SNS users' fatigue and frustration, thereby providing empirical support for hypotheses H1 through H6. Furthermore, mobile SNS fatigue and frustration demonstrated pronounced adverse effects on academic productivity, with coefficients of -0.339 and -0.415, respectively, confirming hypotheses H7 and H9. Additionally, frustration exhibited a significant positive influence on mobile SNS fatigue (the factor is 0.161), in support of hypothesis H8. Complete results are presented in Table 4 and illustrated in Fig. 2.

Following a comprehensive evaluation of hypotheses H1–H9, this study investigates the mediating roles of mobile SNS fatigue and frustration in the relationship between cognitive overload and academic productivity within mobile social networking contexts. Through the implementation of bootstrap analysis, the findings demonstrated that mobile SNS fatigue mediates the impact of information overload ( $\beta = 0.121, p < 0.05; 95\% \text{ CI } [0.061, 0.220]$ ), social overload ( $\beta = 0.067, p < 0.05; 95\% \text{ CI } [0.038, 0.133]$ ), and system function overload ( $\beta = 0.035, p < 0.05; 95\% \text{ CI } [0.022, 0.163]$ ) on academic productivity. Similarly, frustration mediates the effect of information overload ( $\beta = 0.139, p < 0.05; 95\% \text{ CI } [0.062, 0.205]$ ), social overload ( $\beta = 0.048, p < 0.05; 95\% \text{ CI } [0.001, 0.123]$ ), and system function overload ( $\beta = 0.055, p < 0.05; 95\% \text{ CI } [0.001, 0.116]$ ) on academic productivity. These mediation analyses highlight the critical importance of mitigating information, social, and system function overload on mobile SNS platforms, as such overload may precipitate affective reactions such as fatigue and frustration, ultimately impairing users' academic productivity. For this reason, mobile SNS designers and programmers should prioritize these considerations in their design processes to optimize user experience. By proactively addressing these factors, mobile SNSs can evolve into more sustainable digital environments that maximize benefits for users while reducing adverse psychological outcomes.

Table 4  
Statistical results of the structural model.

Hypotheses	Paths	Path coefficient	p value
H1	Information overload → Mobile SNS fatigue	0.289	0.000**
H2	Social overload → Mobile SNS fatigue	0.176	0.000**
H3	System function overload → Mobile SNS fatigue	0.523	0.000**
H4	Information overload → Frustration	0.356	0.000**
H5	Social overload → Frustration	0.310	0.000**
H6	System function overload → Frustration	0.502	0.000**
H7	Mobile SNS fatigue → Academic productivity	-0.339	0.011
H8	Frustration → Mobile SNS fatigue	0.161	0.000**
H9	Frustration → Academic productivity	-0.415	0.000**

Note: \*\*P < 0.01.

6. Discussion

6.1. Summary of major results

The detrimental effect of mobile SNSs on psychological well-being has emerged as a salient research topic across diverse disciplines, garnering significant attention from both the media and the academic community. This study contributes to the growing literature by applying the stimulus-organism-response framework to investigate how cognitive overload impairs university students' academic productivity through the mediating effects of mobile SNS fatigue and frustration. This study gathered extensive empirical data from a substantial cohort of young mobile SNS users (N = 660), facilitating a rigorous evaluation and validation of the proposed theoretical model and its corresponding hypotheses. The results demonstrate that three distinct forms of cognitive overload exert adverse effects on university students' academic productivity, mediated significantly by both mobile SNS fatigue and frustration. With the increasing integration of mobile social media into daily existence, assuming an increasingly pivotal role in their daily existence, the findings substantially contribute to a deeper comprehension of mobile SNS-induced fatigue and frustration.

First, each dimension of mobile SNS-triggered overload (namely, information, social, and system function overload) significantly contributes to user fatigue. This conclusion aligns with prior empirical research that has consistently demonstrated a robust association between mobile SNS fatigue and perceived overload (Fu et al., 2020; Pradhan, 2022). Fundamentally, users exhibit psychological exhaustion when the cumulative demands imposed by informational, social, and systemic functional stimuli exceed their cognitive processing capacities. For instance, information overload forces users to expend excessive time and effort filtering irrelevant content to navigate and locate specific information, which commonly triggers user fatigue (Efe Stanley, 2021; Lin et al., 2020). Social overload occurs when users feel compelled to maintain excessive communication and reciprocal support on mobile SNS platforms. This constant demand for interaction depletes temporal and cognitive resources, leading to fatigue as users struggle to maintain responsiveness and manage relationships (Chai et al., 2019). With respect to system function overload, technological innovations may induce cognitive stress, psychological tension, and user adaptation costs, increasing their psychosocial risk (Masood et al., 2022; Upadhyaya & Vrinda, 2020). Our empirical investigation yields robust evidence substantiating the prevalence of mobile SNS fatigue phenomenon.

Second, users' perceptions of information, social, and system function overload within mobile SNS significantly exacerbate affective states of frustration. This conclusion complements the findings of Lin et al. (2020), who established information and social overload as triggers for frustration. The principal reasons are delineated as follows: according to cognitive load theory (Chandler & Sweller, 1991), when information processing demands exceed users' cognitive capacity, it leads to psychological strain and frustration (Bouattour Fakhfakh & Bouaziz, 2022; Efe Stanley, 2021). Social overload may precipitate frustration resulting from the inability to adeptly navigate the complexities of social relationships. As online communities continue to proliferate, users face mounting pressure to provide sustained interpersonal support, often exceeding their emotional and cognitive resources (Yu et al., 2018), with excessive or inappropriate social requests exacerbating this frustration. With respect to system function overload, technological advancements have facilitated the integration of numerous features into mobile SNSs, most of which are perceived as operationally essential. However, marketing research suggests that excessive functional augmentation may inversely affect user satisfaction. The accumulation of complex system features can elevate the cognitive and operational demands placed on users, thereby fostering frustration (Tan et al., 2023; Teng et al., 2021).

Third, consistent with theoretical expectations, mobile SNS fatigue and frustration demonstrate a significant positive correlation among university students, collectively posing a substantial detriment to

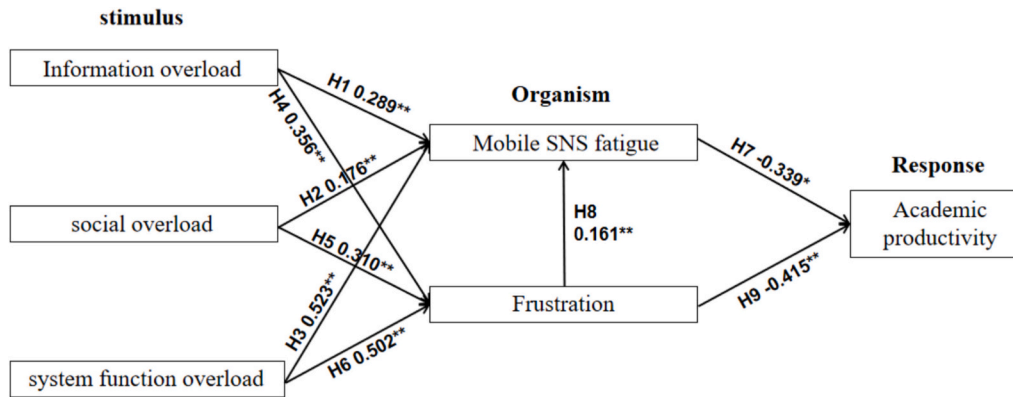


Fig. 2. Results of structural path analysis. Note: \* $p < 0.05$ , \*\* $p < 0.01$ .

academic productivity. Prior studies show these states drive behavioral responses, including discontinuous usage intentions and avoidance conduct, which can emerge from mobile SNS fatigue and frustration (Cao & Sun, 2018; Tan et al., 2023). Such findings substantiate the proposition that reduced academic output may be attributable to the fatigue and frustration experienced on mobile SNS platforms. This outcome aligns with current research identifying mobile SNS fatigue and frustration as critical determinants of productivity impairment within organizational contexts (Malik et al., 2020). Students experiencing mobile SNS fatigue and frustration are prone to manifesting adverse study behaviors, continual distractions, and heightened stress levels (Masood et al., 2022). Therefore, their competence in focusing and actively participating in scholarly endeavors is impaired. Recurrent fatigue and frustration further disrupt time management and energy allocation, degrading sustained attention and academic productivity through prolonged cognitive strain. Furthermore, as evidenced by H8, heightened frustration exacerbates fatigue, corroborating prior findings that emotional strain intensifies cognitive exhaustion (Dai et al., 2020; Farooq et al., 2023). They should therefore manage their behaviors to prevent them from having an undesirable psychological position.

The findings align with self-determination theory's proposition that frustration of basic psychological needs undermines intrinsic motivation (Deci & Ryan, 2000). The three forms of cognitive overload the study identified, namely information overload, social overload, and system function overload, can be understood as environmental factors that frustrate students' needs for competence (through overwhelming demands), autonomy (through compulsive usage patterns), and relatedness (through superficial social connections). This explains why overload-induced frustration mediates academic productivity decline, as the motivational energy required for academic tasks is diverted to coping with these digital stressors (Al Fraidan, 2025a). However, alternative explanations exist: first, individual differences in cognitive abilities, self-regulation skills, and personality traits (e.g., neuroticism) might influence how students experience and respond to cognitive overload. Second, environmental factors such as academic workload, family expectations could interact with mobile SNS use to affect academic productivity. Third, the cross-sectional nature of the study design limits the ability to make definitive causal claims, as poor productivity might increase SNS reliance as a coping mechanism. Future longitudinal research could help disentangle these causality relationships.

## 6.2. Theoretical and practical contributions

This study makes several substantive theoretical contributions to the existing body of literature. First, diverging from prior research emphasizing beneficial dimensions mobile social networking services bring to educational environments, this study's theoretical framework focuses on their negative repercussions, despite these platforms being originally

designed to enhance interpersonal connectivity (Wang, 2019). The educational implications of mobile SNS remain a contested and vigorously debated topic in contemporary academic discourse. Nevertheless, it is critical to emphasize that sustained interaction with mobile SNS can induce significant adverse psychological consequences, including emotional exhaustion, stress, and burnout (Pradhan, 2022; Sheng et al., 2023). These outcomes underscore the need to critically evaluate SNSs' dual benefits and costs; particularly how cognitive overload undermines academic productivity. Second, while the SOR model has been widely applied to consumer behavior, its utility in explaining university students' mobile SNS-induced responses remains underexplored (Foroughi et al., 2021). Education research lacks theoretically grounded empirical studies on overload mechanisms; these findings clarify the stimulus-organism-response chain, offering novel insights into cognitive overload's detrimental effects. Third, the study reveals the mediating role of mobile SNS fatigue and frustration in linking overload to academic productivity. Unlike prior research focusing solely on overload-fatigue pathways (Yu et al., 2018), this study demonstrates how frustration and fatigue jointly impair productivity, advancing theoretical understanding of their interactive effects.

These findings offer actionable insights for educational practitioners, university consultants, and service suppliers. First, for students, while mobile SNSs are ubiquitous, their cognitive overload risks demand proactive mitigation (Masood et al., 2022; Sheng et al., 2023). By identifying the repercussions stemming from cognitive overload prompted by mobile SNS utilization, students can adopt strategies like disabling non-essential notifications, filtering irrelevant content, and limiting time on low-value platforms to reduce psychological strain. Second, the conclusions of this study provide insights for mobile SNS stakeholders. The service suppliers bear the responsibility of implementing source-level information curation mechanisms and maintaining rigorous quality control over both the quantity and quality of disseminated content (Kim et al., 2021). From a human-computer interaction perspective, platform designers should prioritize user-centered principles: simplifying interfaces, reducing feature redundancy, and offering customizable notification controls to align with cognitive capacities. Adaptive interfaces that dynamically adjust to users' cognitive states could further minimize fatigue (Swiatek et al., 2023; Wang, 2019). Third, the findings highlight the urgency of addressing SNS-related cognitive overload in academic settings. For instance, administrators should integrate digital literacy training into curricula, teaching time management and information filtering skills to combat overload, helping students develop healthier interaction habits with technology. From the perspective of mental health, university counselors and mental health practitioners should implement targeted interventions to address frustration and fatigue induced by mobile social networking, such as mindfulness-based training or psychoeducational counseling on digital wellbeing management. Recognizing the interplay between cognitive

overload, exhaustion, and frustration enables mental health professionals to deliver more holistic therapeutic interventions that simultaneously address both psychological and technogenic dimensions of student life.

## 7. Limitations and future scope

The present study is subject to several methodological and theoretical limitations requiring explicit attention and resolution in subsequent research. First, the exclusive focus on Chinese university students and domestic social media platforms restricts cross-cultural generalizability, as cultural norms and platform designs significantly influence usage patterns. Future research should replicate this study across diverse educational contexts and global platforms to establish broader generalizability. Second, this study has limitations due to time and budgetary constraints, which, if the sample capacity is substantially increased, would enhance the applicability of research findings. Third, the conceptual model could be further refined through the inclusion of additional variables, future research could incorporate personality traits, self-regulatory capacities, and internet self-efficacy as weighting factors in research frameworks for exploring the intermediary impact of information, social, and system function overload. Simultaneously, exploring additional information quality dimensions (e.g., credibility, relevance) may provide a more comprehensive understanding of mobile SNS fatigue mechanisms. Fourth, reliance on self-reported measures for cognitive overload, fatigue, frustration, and academic productivity introduces response biases such as social desirability bias and recall bias. Social desirability bias may lead participants to respond in ways they perceive as socially acceptable, rather than providing truthful answers. Recall bias may affect the accuracy of participants' memories about their experiences, leading to overestimation or underestimation of the variables. Future research should incorporate behavioral data (e.g., digital study logs, time-on-task metrics) alongside self-reports to triangulate findings. Fifth, the cross-sectional design limits causal inference, as mobile SNS usage is dynamically influenced by psychological states and environmental factors. Longitudinal studies, experimental designs, and focus group discussions could better establish temporal relationships and contextual interactions between variables. Although the current study did not employ a specific mood induction technique, participants' mood states at the time of survey completion could have influenced their responses. Mood congruent effects, where individuals tend to recall and report experiences that are consistent with their current emotional state, may introduce bias into the data. Future studies could benefit from incorporating mood assessment scales to control for the potential confounding effects of mood on self-reported measures. Experimental designs that manipulate mood states could also provide valuable insights into how mood interacts with cognitive overload and its subsequent effects on mobile SNS fatigue, frustration, and academic productivity.

## CRedit authorship contribution statement

**Hua Pang:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis.  
**Xiaoyi Jin:** Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation.  
**Wanting Zhang:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation.

## Informed consent

All the subjects involved in the research provided informed consent.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

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