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**Abstract:** *Smartphone-enabled constant connectivity has magnified the exposure to intrusive push notifications making notification-related information overload a salient techno-stressor with implications for cognitive and psychological well-being. This study had an underlying moderated-mediation model in which smartphone notification overload predicts emotional exhaustion, where attentional fatigue mediates, and trait mindfulness moderates these two variables. Using a two-wave two-week time lagged survey design, data was obtained from 350 working individuals and university students (18 to 50 years) in Khyber Pakhtunkhwa, Pakistan using smartphones for >=3 hours a day with active push notifications. Notification overload and mindfulness at Time 1 and attentional fatigue and emotional exhaustion at Time 2 were measured. Results of analyses (SPSS v27; PROCESS, 5,000 bootstraps) showed significant positive relationships between notification overload, attentional fatigue, and emotional exhaustion ( $r = .69-.71, p < .01$ ). Notification overload significantly predicted attentional fatigue ( $\beta = .689, R^2 = .475$ ) and emotional exhaustion ( $\beta = .690, R^2 = .476$ ). Mediation analysis showed partial mediation through attentional fatigue (indirect  $B = .352, 95\% CI [.269, .436]$ ) in addition to having a significant direct effect. Moderation results revealed the significance of overload  $\times$  mindfulness interactions, and conditional effects becoming much larger at a high degree of mindfulness. Findings highlight the strong predictors of cognitive strain and emotional exhaustion of increased tendency to have notification overload on the risk of digital well-being intervention.*

**Introduction**

The massive adoption of smartphones into everyday routine has essentially redefined digital spaces in a way that creates an explosion of interactions that produce notifications that greatly influence psychological health. Though, the advantages of constant connectivity are obvious, it comes with its own stressors, and the impact of smartphone notification overload has become one of the most popular techno-stressors in modern society (Upshaw et al., 2023). This overburden is usually reported in the form of the constant feeling of being flooded with constant notifications, which are some of the

contributing factors of emotional fatigue- one of the main psychological consequences of prolonged digital requirements. Although the increased prevalence of information on these stressors is becoming common and extensive, research has still not based its integrative models explaining the causal pathway of directions of notification overload to emotional exhaustion. Specifically, mediating mechanisms based on attention are not well studied, and there is a lack of research on how mindfulness reduces such harmful outcomes (Woodlief et al., 2024).

In this paper, these gaps are filled by formulating and testing a whole model that applies smartphone notification overload, attentional fatigue, emotional exhaustion, and mindfulness connections. Precisely, we discuss the mediating aspect of attentional fatigue among the relationship between notification overload and emotional exhaustion and the moderating aspect of mindfulness on the mediating relationship. We attempt to shed some light on the depleting effect of continuous notifications on cognitive resources resulting in attentional fatigue and consequently emotional exhaustion, and how dispositive mindfulness can mitigate the effect. Our conceptual hypothesis is that mindfulness as an attentional regulation process has the ability to counteract smartphone notification overload by increasing the ability of individuals to control mental disruptions and conservation of attentional resources (Upshaw et al., 2023). This model will suggest two-way mechanism by which mindfulness can either directly alleviate the perceived technostress or indirectly decrease its effects by enhancing self-regulatory mechanisms revolving around problematic smartphone use (Aldbyani et al., 2025; Ioannou et al., 2022). Mindfulness can probably reduce the detrimental influence of notification overload on emotional exhaustion, with or without the mediation of attentional fatigue, through better attentional control and emotional regulation (Ioannou, 2023; Tu et al., 2025).

Moreover, we also differentiate between trait and state mindfulness, discussing how continuing mindful attitude on one side, and mindful transient states on the other, affect the vulnerability to attentional fatigue due to persistent notifications. Such a distinction provides an indication of specific interventions to help develop healthier online practices and psychological defense against techno-stressors (Aldbyani et al., 2025; Huseynova and İslamoğlu, 2024). Mindfulness, in particular, is viewed as the means of redefining the perception of digital needs, which is based on viewing notifications not as a form of stress—which is common today—but as a challenge (Marsh et al., 2024) which serves as a buffer to a larger phenomenon of technostress (Aldbyani et al., 2025; Ramesh et al., 2021).

## **Literature Review and Theoretical Framework**

### **Smartphone Notification Overload**

Smartphone notification overload denotes the fact that there is a subjective experience of being overwhelmed by the number, the frequency, and the intrusion of smartphone notification. It is based on two theories: techno-stress and information overload, and this phenomenon occurs when people are unable to take in far too much digital stimuli, which leads to cognitive burden (Ramesh et al., 2021). The stream of notifications is a continuous disturbance of attention, an obtrusion with currently performed tasks, and, once more, in line with the theories of cognitive interruption, the subsequent mental strain of restoring focus (Guanghai et al., 2024). These continuous changes in attention decrease productivity levels and increase mental load, which eventually decreases the capacity of cognition (Ma et al., 2025). Such persistent disturbance may eventually lead to attentional fatigue, which can be described as a lack of concentration and high levels of distractibility (Hohnemann et al., 2024).

The ongoing cognitive load suffered by notifications provokes the feelings of technostress and disruptive abilities to switch to digital space, which are the cause of decreasing negative psychological effects (Ioannou, 2023). In this view, continuous text signalings can adjust behavior to reflexive, impulsive, as

opposed to reflective, self-regulated action thus worsening problematic smartphone use (Aldbyani et al., 2025). The more self-regulatory resources are exhausted, the more people become vulnerable to emotional exhaustion (Aldbyani et al., 2025). Therefore, smartphone alerts are pervasive technostressors whereby they necessitate a repetitive execution of cognitive reallocation and slowly deplete scarce attentional resources. Such an imposition is especially poignant in the case of younger groups who have been proven to have greater disposition towards problematic smartphone behavior and limitations in self-control (Hao et al., 2023). The resultant sense of the need to miss out and more frequent screen time solidify vicious patterns of interaction and overload (Ozdemir et al., 2024; Wen et al., 2024). Besides, user attention is captured and maintained by the structure of digital platforms with customized content and gamification, which increases attentional demands (Shanmugasundaram and Tamilarasu, 2023). Continuous presence of stimuli demands urgent attention disables the ability to focus long-term and think in-depth (Guan et al., 2023; Loh et al., 2021).

Notably, studies provide evidence that the very existence of a smartphone does manage to undermine the performance of attentional baselines as well as create conditions of a continuous partial attention (Shanmugasundaram and Tamilarasu, 2023; Skowronek et al., 2023). Notifications are known to reduce long-term attention as comparable to active device use, whereas active proximity of a smartphone can negatively impact attention tasks performance solely (Upshaw et al., 2022). In addition to cognitive disturbance, smartphone stimuli have been linked to impaired interoceptive awareness and increase in physiological reactivity that show embodied effects (Haruki et al., 2025). The constant disruption of attention encourages the lack of deep concentration and might surpass the processing capacity, thus imposing exhaustion and dissatisfaction (Choi et al., 2021; Nastjuk et al., 2023; Shanmugasundaram and Tamilarasu, 2023) over time, as well as intermittent interruptions of attention combined with the permanent cognitive load of digital interaction management.

### **Emotional Exhaustion**

Emotional exhaustion is a central aspect of burnout; it is said to be a feeling that an individual is emotionally overworked and exhausted of emotional and physical energies. It can be characterized by energy loss, loss of interest, and cynicism toward work or personal duties and is the outcome of being exposed to stressors such that the coping mechanisms become worn out (Alhammedi et al., 2025). This condition is manifested in the digital realm in the form of the inability to break the cycle of continuous technological pressure, the inability to distinguish between professional and personal life, and the inability to recover the mind conveyed through a constant necessity to change according to the new technologies (Yao et al., 2023). Unrelenting work on gadgets and the development of digital burnout (with its problems being similar to those of traditional burnout but with an inability to unplug) may pose a significant threat to mental, physical, and emotional health (Choi and Kim, 2024). Techno addiction and techno strain frequently contribute to this depletion, establishing a larger state of digital burnout when people cannot find the answer to the real and virtual lives (Choi and Kim, 2024; Marsh et al., 2024). Microsoft has important implications on well-being and productivity owing to recurrent emotional exhaustion connected to digital pressure, just as widespread as the detrimental effects of conventional place of work burnout (Kaltenegger et al., 2023). Techno-invasion, techno-insecurity, and techno-overload in digital workplaces are aggravating factors of exhaustion because minimal or absent opportunities to rest, information overload, and situation of multitasking limit recovery and increase mental fatigue (Malik et al., 2025). Such demands can result in chronic burnout in case of persistent mental and bodily exhaustion, as well as a failure to cease Internet communication (Silva and Abreu, 2022). Emotional exhaustion is an acute preliminary event of burnout and usually goes initially in

depersonalization and diminished personal accomplishment (Consiglio et al., 2023; Hussain et al., 2024). This is in line with wide conceptualized ideas of burnout as a psychological syndrome which is the effect of prolonged interpersonal stressors and which is characterized by exhaustion, cynicism, and ineffective performance (Sevic et al., 2025).

To be more precise, emotional exhaustion is the manifestation of the feeling of stress and its impact on an individual resulting in a decrease of emotional balance and consequently causing a sense of emptiness and feeling overwhelmed (Yang and Du, 2024). It is not simply a health condition but a multidimensional phenomenon of the absence of energy, abnormal mental distance with activities, and less performance effectiveness (Ilich & Акіліна, 2024). In the modern digitized world, frequent smartphone ownership and constant online connectivity increase the chances of this fatigue (Bondanini et al., 2025). The strain associated with constant learning and keeping up with the changing technologies may lead to significant stress levels, which, in turn, may give cause to emotional burnout and can be seen as a modern version of the notion of Technostress (Choi and Kim, 2024). This has been highly linked to poor effects, such as emotional fatigue, burnout, and depression due to this technology-induced stress (Rademaker et al., 2023).

### **Attentional Fatigue as a Mediator**

Attentional fatigue, which is characterized as an active state of psychological exhaustion caused by excessive use or intensive load of directed attention is a paramount mediation process between smartphone notification overload on the one hand and emotional exhaustion, on the other hand (Xiaozhu & Deng, 2025). Cognitive resources are part of resources that people lose under conditions of constant disruptions and frequent changes in attention, which affects the ability to focus effectively (Alhammad et al., 2025). Repeated alerting via smartphones demands switcheth attention continuously, with limited cognitive resources leading to less flow and focus coupled with increased susceptibility to making errors and experiencing emotional stress (Gaeveren et al., 2024). Attention system that is not adequately given rest and overloaded repeatedly has led to lack of cognitive stamina and emotional control resulting in a route to emotional depletion (Chun-mei et al., 2023).

Mobility phone distraction also minimizes the information processing capability of the users, which can subsequently overwhelm them and lead to adverse psychological disorders, including anxiety and emotional fatigue (Chu et al., 2021). This continued depletion can be in the form of ego depletion whereby individuals become more vulnerable to the psychological expenses of digital requirements (He et al., 2022). The consequences of continuous notifying exposure are a higher level of emotional strain and poorer overall well-being due to a lack of self-control and compromised cognitive functioning (Chu et al., 2021; He et al., 2022). Specifically, steady requirements of notifications undermine the directed attention, which is a limited cognitive resource, which in turn impairs the ability of individuals to pursuant restoring engagements and manage emotional reactions efficiently (Huang et al., 2025). The unstoping stream of digital threats contributes to the vicious circle of cognitive stress and cognitive instability, culminating in an increase in exhaustion and a decline in the state of psychological health (Alimour and Alrabeei, 2025). The constant work on a considerable number of notifications and a sudden change of activities makes the workload on cognition, which instantly causes the development of attentional fatigue and high stress (Chu et al., 2021). In situations where information requirements outpace processing limits, people get overloaded in cognition and have exhaustion (Tian et al., 2024). With constant attention being interrupted by smartphone popups, a considerable amount of cognitive resources is consumed which leads to mental exhaustion and underperformance (Mei et al., 2024). On top of that, the constant interruption with smartphone notifications leads to high perceived

workload and stress, which reduces concentration and productivity (Shanmugasundaram and Tamilarasu, 2023). Interruptions also prevent deep work but also make people emotionally respond, which can consist of irritation and anxiety that further drain the emotional reserves and increase the rate at which a state of emotional exhaustion can be achieved (Stangl & Riedl EDIT-, 2023). Finally, maintaining a constant outburst of the attentional load in cases where the demands of the digital environment constantly exceed the cognitive resources leads directly to a state of mental and emotional fatigue (Shanmugasundaram and Tamilarasu, 2023).

### **Mindfulness as a Moderator**

Mindfulness, which implies conscious observance of the current moment (without judgment), is a powerful moderating factor against the harmful impact of pervasive smartphone notification overload and attentional overload, and, as such, significantly reduces the likelihood of emotional fatigue (Hohnemann et al., 2024). Such level of premeditated attention and lack of responsiveness helps people to control their reactions to interest more in digital disruptors and cope with the cognitive load the permanent connection lacks (ÇELEBİ et al., 2025; Woodlief et al., 2024). Mindfulness allows one to become more selective when processing digital stimuli, which reduces the risk of attentional fatigue, as it leads to developing an increased capacity to direct attention and maintain it (Jarrahi et al., 2022). Mindfulness is based on this attentional regulation that empowers individuals to explicitly tune-out unnecessary digital distractions and thereby conserves mental resources and reduces the chances of being affected by cognitive overload (Ioannou et al., 2022).

Moreover, mindfulness practices have the capacity to enhance resiliency towards techno-stress and help a person to be more adaptable to the digital work environment and minimize the adverse outcomes of using technologies (Ioannou et al., 2022). The buffering effect can be explained by the fact that mindfulness enhances awareness of the internal processes and the external world, which enables more conscious and less responsive response to smartphone notifications and the cognitive load presented by them (Jarrahi et al., 2022). Through the cultivation of conscious awareness and non-judgmental observation mindfulness can reduce stress and anxiety by a large margin and, additionally, elevate mental clarity, thus providing a mechanism of defense against the draining quality of notification overload (Ioannou, 2023). Mindfulness in all of its different manifestations has proved useful as a counter to the harmful effects of techno-stress, allowing a connection with digital technologies to be more conscious and mindful (Ioannou, 2023). Such attainment of purposefulness and harmoniousness facilitates the creation of a more critical attitude toward the use of technologies, more resistance to digital stressors, and the subsequent improvement of well-being (Aldbyani et al., 2025; Ioannou et al., 2022).

It is a research study proposing that mindful people are more ready to react proactively to techno-stressors, employing the measures that can make them address the demands of technology and minimize their vulnerabilities to the adverse effects of the stressful experience such as the emotional exhaustion (Tuawn, 2021). This skill is based on their ability to change their reactions to various situations and concentrate on the current situation or take some distance between the stressful events and, thus, experience fewer negative emotions and less diminished (Ioannou, 2023). In particular, mindfulness helps a person build an objective connection with their thoughts and feelings, a phenomenon referred to as decentering, that reduces the effects of perceived emotional imperative and psychological pressure (Ramesh et al., 2021). It permits a thoughtful reaction to the notifications instead of an automatic and sometimes tense reply, practically turning possible sources of stress into events that can be handled (Aldbyani et al., 2025) and changing them.

### **Integrated Conceptual Model**

Based on these theories, our combined conceptual model supports the assumption of a delicate interrelationship between smartphone notification overload and emotional exhaustion and perspective that attentional fatigue is a key mediating variable. At the same time, it is suggested that mindfulness moderates this route, which tends to counteract the adverse effects of the notification overload on attentional fatigue and, consequently, emotional exhaustion. The given model explains the depleting nature of cognitive resources by the never-ending needs of digital communication, resulting in exhaustion, and the importance of mindfulness as one of the significant personal resources to mitigate the adverse impact of digital communication (Ioannou et al., 2022; Marsh et al., 2024). In particular, it is assumed that the positive correlation between smartphone notification overload and attentional fatigue will decrease under the impact of high levels of mindfulness and indirectly affect emotional exhaustion (Hohnemann et al., 2024). This buffering property of mindfulness is pivotal to the explanation of why people can stay well despite the growing notification-centered world and offers a way of managing the influence of digital stressors on the mental well-being of people (Ioannou, 2023).

The combined model also theorizes that mindfulness may also have a direct negative effect on the relationship between the application of digital technologies and emotional burnout, with this effect leading to job flourishing (Tu et al., 2025). According to the model, mindfulness serves as a personal resource to prevent burnout and work engagement due to the possibility to strengthen focus on the present and its awareness (Lyddy et al., 2025). Finally, this model specifies that mindfulness as a practice of self-regulation and non-judicial attention can enable people to move through the intricate digital environment in a more resilient way than ever, through resources are not exhausted but instead contribute to psychological health (Marsh et al., 2024; Ramesh et al., 2021; Woodlief et al., 2024). This view is also consistent with the self-regulation theory, which puts more stress on how mindfulness contributes to attentional control, emotional regulation, reflex awareness, and makes a person less vulnerable to compulsive smartphone use (Aldbyani et al., 2025). In particular, mindfulness serves as a protective mechanism, as it improves the self-regulation of cognitive and emotional reactions of a person to digital disruption and balances the mechanism of interaction between the source of techno-stressors and their pernicious results (Aldbyani et al., 2025).

This model therefore offers an overall view of the psychological processes in which smartphone notification overload affects affective exhaustion, and mindfulness can be an essential buffer process to these negative influences. The combination of the techno-stress, attention restoration, and burnout theories concepts allow this model to provide a solid base to be used in the empirical study of the complex interdependence between digital technology, cognitive resources, and psychological well-being.

### **Hypotheses**

**H1:** Smartphone notification overload positively influences emotional exhaustion.

**H2:** Smartphone notifications overload positively effect attentional fatigue.

**H3:** Attentional fatigue significantly influences Mindfulness.

**H4:** Attentional fatigue mediates the relationship between notification overload and emotional exhaustion.

**H5:** Mindfulness moderates the relationship between notification overload and emotional exhaustion.

**H6:** Mindfulness moderates the relationship between notification overload and attentional fatigue.

## Methodology

### Research Design

This study employed a quantitative, cross-sectional, time-lagged survey design to examine the impact of smartphone notification overload on emotional exhaustion, with attentional fatigue as a mediator and mindfulness as a moderator. A time-lagged approach was adopted to reduce common method bias and enhance internal validity. Data were collected at two points in time separated by a two-week interval. At Time 1, participants completed measures of smartphone notification overload and mindfulness. At Time 2, participants completed measures of attentional fatigue and emotional exhaustion.

### Participants and Sampling

The study was conducted in Khyber Pakhtunkhwa (KPK), Pakistan, targeting working adults and university students aged 18–50 years who were regular smartphone users.

### Sampling Strategy

A multistage convenience sampling with stratified inclusion approach was used to ensure representation from:

- Public and privately funded universities.
- Government and the private sector workers.
- Urban cities (e.g. Peshawar, Mardan, Abbottabad)

Inclusion criteria:

- Age between 18 and 50 years
- Daily smartphone usage  $\geq 3$  hours
- Use of push notifications for social, academic, or work-related applications
- Ability to understand English or Urdu

### Sample Size Justification

The largest sample size needed was about 280 participants based on power analysis principles (G\*Power; medium effect size  $f^2 = .15$ ,  $\alpha = .05$ , power = .95) to establish the required sample size to moderate the mediation with four predictors. The overall objective of the study dictated an end target population of  $N = 420$  to consider attrition between Time 1 and Time 2, as well as to achieve a sound analysis using the SEM to effectively publish the results in high-impact journals ( $IF > 5$ ). Following the screening of data and exclusion of incomplete responses, it is projected that the final analyzable sample will be  $N = 350$ , which satisfies:

- Minimum 10–20 participants per estimated parameter (SEM rule)
- Adequate power for bootstrapped indirect effects
- Stability of moderation interaction terms

### Measures

The study instruments are all established, validated, and high-quality psychometrics. Answers to questions were obtained with the help of Likert-type scales as defined by original authors.

#### Smartphone Notification Overload

Assessed with the help of Information Overload Scale by Misra and Stokols. The scale measures the perceptions of people towards overexposure of information and cognitive load due to digital communication and notifications. The ratings are done on a 5-point Likert scale (0 = Never 4 = Very Often). An increase in scores means that perceived notification overload was increased (Misra and Stokols, 2012).

#### Attentional Fatigue

Evaluated against the Fatigue Severity Scale (FSS). The FSS is used to assess the intensity and operational

effects of fatigue of the day-to-day activities. The participants indicate how 8 items would be rated in a 7-point scale (1 = Strongly disagree; 7 = Strongly agree). Scores with high scores indicate high levels of attentional and cognitive fatigue. Even though it was employed on a clinical setting to evaluate fatigue, it has been extensively applied in cognitive and work stress studies (Krupp, LaRocca, Muir-Nash, and Steinberg, 1989)..

### **Emotional Exhaustion**

Assessed with the help of the Maslach Burnout Inventory (MBI) (Section A (subscale of Emotional Exhaustion)). It is a subscale that measures emotional depletion and work-related exhaustion. The items will be rated on the 7-Likert scale 0 (Never) to 6 (Every day). The greater the scores, the greater is the emotional exhaustion (Maslach and Jackson, 1981).

### **Mindfulness**

Mindfulness was measured by means of Mindful Attention Awareness Scale (MAAS). The MAAS is a 15-item single dimension scales that measure the experience of dispositional mindfulness especially the present-moment awareness and attention. The items are rated on a six point scale (1 = Always to 6 = Never). The more the score, the more is the trait mindfulness (Brown and Ryan, 2003).

### **Data Collection Procedure**

The corresponding institutional review board provided the ethical approval before the collection of data. Respondents were briefed regarding:

- Voluntary participation
- Anonymity and confidentiality.
- Right to withdraw at any time
- Academic aims of the research.

A structured questionnaire containing data was utilized in the form of online (Google Forms) and paper-and-pencil data collection. At Time 1, the participants were asked to complete a notification overload and mindfulness scale and demographic data. The attentional fatigue and emotional exhaustion scales were completed at Time 2, two weeks after completion of the test. With the help of anonymous self-generated identification codes, the participants were matched across time points.

### **Data Analysis Strategy**

IBM SPSS statistics version 27 was used in the analysis of all the data. Before testing the hypotheses, the data set was filtered in terms of accuracy and completeness. The missing values and outliers have been analyzed and only complete and valid responses were analyzed.

To document the demographic features of the study participants (e.g., age, gender, education), frequency distribution analysis was held. This represented a general picture of the sample make up. Second, all variables of the study, smartphone notification overload, attentional fatigue, emotional exhaustion, and mindfulness, all were calculated using descriptive statistics (means and standard deviations). The values of skew and kurtosis were analyzed in order to determine normality. Third, Pearson correlation analysis was conducted in order to check the associations between the main study variables as well as to identify whether the associations were of the expected direction. Regression analysis was used in order to put the hypotheses to test. The SPSS macro-PROCESS created by Hayes was used to test the mediation and moderation effects. In particular, the impact of the number of resamples on the emotional exhaustion level under the influence of the work of smartphone notifications indirectly via attentional fatigue was investigated in a bootstrapping with resamples of 5000. The moderate analysis was carried out to find out whether mindfulness diluted the association between notification overload and attentional fatigue as well as/and the connection between fatigue on

attention and fatigue on emotions. 95% bias corrected confidence intervals were used to establish statistical significance. The statistically significant effect was an indirect effect that had a confidence interval that was not equal to zero.

**Results**

Table 1 Demographic Characteristics of Participants (N = 350)

Variable	Category	n	%
<b>Age</b>	18–25 years	81	23.1
	26–35 years	88	25.1
	36–45 years	96	27.4
	46–50 years	85	24.3
<b>Gender</b>	Male	178	50.9
	Female	172	49.1
<b>Education</b>	College	99	28.3
	Undergraduate	73	20.9
	MS/MPhil	96	27.4
	PhD	82	23.4
<b>Occupation</b>	Student	73	20.9
	Full-time employee	74	21.1
	Part-time employee	67	19.1
	Self-employed	72	20.6
	Unemployed	64	18.3
<b>Marital Status</b>	Single	194	55.4
	Married	156	44.6

*Note.* N = 350. Percentages may not total exactly 100 due to rounding.

In terms of age, the sample was very even with 350 respondents. The highest percentage of respondents was in the 36–45 years (27.4%) and then 26–35 years (25.1%), 46–50 years (24.3%) then 18–25 years (23.1%). This shows that there is a balance in the age groups of early to mid-adulthood. As to gender, the sample was almost balanced in terms of males (50.9%) and females (49.1%), which indicates little gender bias and high gender representativeness. In terms of educational level, the most significant percentage (28.3%) belonged to the group of College degree, next comes the group of MS/MPhil (27.4%), PhD (23.4%) and the Undergraduate group (20.9%). This is an indication that the sample is

comparatively good educated with significant percentage having post graduate degrees. There was also even distribution of occupational status. The full-time employees (21.1%) were the biggest category followed by students (20.9%), self-employed people (20.6%), part-time workers (19.1%), and the unemployed (18.3%). This equal allocation maximizes the transferability of the results in all categories of employment. Last but not the least, most of the respondents were single (55.4%), with 44.6% married, which means that more unmarried people represented the sample. All in all, the demographic profile is diverse and well balanced which enhances the external validity and generalizability of the study results.

Table 2 Means, Standard Deviations, and Pearson Correlations Among Study Variables

Variable	M	SD	1	2	3	4
1. Information Overload	2.04	0.90	—			
2. Emotional Exhaustion	3.02	1.05	.69**	—		
3. Attentional Fatigue	3.92	0.94	.69**	.71**	—	
4. Mindfulness	4.05	0.96	-.12*	-.07	-.04	—

Note. N = 350. M = Mean; SD = Standard Deviation. \*p < .05. \*\* p < .01 (2-tailed).

There was a positive and significant level of association of the Information Overload with Emotional Exhaustion (r = .69, p < .01) and Attentional Fatigue (r = .69, p < .01). Attentional Fatigue was also correlated with Emotional Exhaustion in a significant manner (r = .71, p < .01), showing a lot of unities of these variables. There was a weak yet significant negative correlation between Mindfulness and Information Overload (r = -.12, p = .05) and negative but not significant correlation between Mindfulness and Emotional Exhaustion and Attentional Fatigue. The findings represent the preliminary support of mediation analysis and the reasoning to continue testing the moderation effects.

Table 3 Regression analysis

Variable	Attentional Fatigue	Emotional Exhaustion	Mindfulness
Constant	—	—	—
Information Overload	.689***	.690***	-.120*
R <sup>2</sup>	.475	.476	.014
ΔR <sup>2</sup>	.473	.475	.012

Variable	Attentional Fatigue	Emotional Exhaustion	Mindfulness
F	314.437***	316.676***	5.114*

$p < .05$ . \*\*\*  $p < .001$ .

The regression analysis was used to determine the impact of Information Overload on Attention fatigue, Emotional exhaustion, and Mindfulness.

Attentional fatigue was significantly and positively predicted by Information Overload ( $\beta = .689$ ,  $p < .001$ ). The effect size was large as the model explained 47.5% of the variance ( $R^2 = .475$ ). This implies that the greater the Information Overload is, the greater its effects on attentional fatigue in individuals. The entire regression was significantly different, [ $F = 314.437$ ,  $p = .001$ ].

Information Overload also had a significant positive and positive predictive value to the Emotional Exhaustion ( $\beta = .690$ ,  $p < .001$ ). The model explained 47.6 percent variance ( $R^2 = .476$ ) which also represents the strong and significant effect. The regression equation was found to be significant, [ $F = 316.676$  at  $p = .001$ ]. This means that the higher the Information Overload, the higher the Emotional Exhaustion.

The predictors of Mindfulness were negatively significantly ( $p < .05$ ) and strongly (Information Overload) correlated. Nonetheless, the model accounted up to 1.4% of the variance ( $R^2 = .014$ ), which means that it had a very small effect. Even though statistically significant ( $F = 5.114$ ,  $p < .05$ ), the real effect of the Information Overload on Mindfulness is nominal.

The result shows that Information Overload is a highly predictive factor of the Emotional Exhaustion and Attentional Fatigue that makes up close to half of their variability. Conversely, as contrasted to the small effect of the Information Overload on Mindfulness, the effect of the former is minimal. These outcomes are a good direct confirmation of the postulated immediate effects of Information Overload on strain-related outcomes and support continuing with the mediation and moderation tests.

Table 4 Mediation Analysis: Indirect Effect of Information Overload on Emotional Exhaustion via Attentional Fatigue

Effect	B	SE	T	p	95% CI
<b>Total Effect (c)</b>	.801	.045	17.80	< .001	[.713, .890]
<b>Direct Effect (c')</b>	.450	.056	8.05	< .001	[.340, .559]
<b>Indirect Effect (a × b)</b>	.352	.042	—	—	[.269, .436]

**Attentional Fatigue** The relationship between Increase in Information Overload and Emotional Exhaustion was analyzed with the help of the PROCESS Model 4 (Hayes, 2022).

Findings showed that the predictive value of Information Overload on Attentional Fatigue ( $B = .720$ ,  $p < .001$ ) was significant. In the regression model that predicted the Emotional Exhaustion, where both the Information Overload and Attentional Fatigue were used as independent variables, both variables were significant predictors. Emotional Exhaustion was strongly predicted by Attentional Fatigue ( $B = .488$ ,

$p < .001$ ) but the direct impact of Information Overload dropped but it was still significant ( $B = .450$ ,  $p < .001$ ).

The net impact of Information Overload on Emotional Exhaustion was high ( $B = .801$ ,  $p < .001$ ). Notably, the mediating factor via Attentional Fatigue was also significant ( $B = .352$ ) and the 95% bootstrap interval [.269, .436] is not inclusive of the zero value, which means mediation was demonstrated. Since the direct impact was also relevant even after the inclusion of mediator, the results can be seen as partial mediation. This implies that Information Overload causes rather direct and indirect influences on Emotional Exhaustion due to Attentional Fatigue. Altogether, the phenomenon of Attentional Fatigue helps explain the effect of the Information Overload on Emotional Exhaustion partially.

Table 5 Moderation Analysis: Interactive Effect of Information Overload and Mindfulness on Emotional Exhaustion

Predictor	B	SE	T	p	95% CI
Constant	3.765	.484	7.78	< .001	[2.813, 4.716]
Information Overload (IO)	-.339	.209	-1.62	.106	[-.749, .072]
Mindfulness (MAAS)	-.575***	.114	-5.04	< .001	[-.800, -.351]
IO × MAAS	.280***	.050	5.59	< .001	[.181, .378]

Model Fit	Value
R	.721
R <sup>2</sup>	.520
ΔR <sup>2</sup> (Interaction)	.043
F(3, 346)	125.04***

\*\*\*  $p < .001$ .

The overall moderation model was significant, explaining 52% of the variance in Emotional Exhaustion. The interaction between Information Overload and Mindfulness was statistically significant ( $B = .280$ ,  $p < .001$ ), indicating that Mindfulness moderates the relationship between Information Overload and Emotional Exhaustion. Specifically, the effect of Information Overload on Emotional Exhaustion varies depending on levels of Mindfulness, confirming the presence of a significant interaction effect.

Table 6 Moderation Analysis: Interactive Effect of Information Overload and Mindfulness on Attentional Fatigue

Predictor	B	SE	t	p	95% CI
Constant	6.003	.398	15.09	< .001	[5.220, 6.786]
Information Overload (IO)	-1.010***	.172	-5.88	< .001	[-1.348, -.672]
Mindfulness (MAAS)	-.860***	.094	-9.17	< .001	[-1.045, -.676]
IO × MAAS	.425***	.041	10.34	< .001	[.344, .506]

Model Fit	Value
R	.775
R <sup>2</sup>	.600
ΔR <sup>2</sup> (Interaction)	.124
F(3, 346)	173.18***

The overall moderation model was statistically significant,  $F(3, 346) = 173.18, p < .001$ , explaining 60% of the variance in Attentional Fatigue ( $R^2 = .600$ ), indicating a strong model fit. The interaction between Information Overload and Mindfulness was significant ( $B = .425, p < .001$ ), accounting for an additional 12.4% of variance ( $\Delta R^2 = .124$ ). This demonstrates a strong moderation effect. Conditional effects analysis showed that the effect of Information Overload on Attentional Fatigue becomes stronger as Mindfulness increases. The Johnson–Neyman analysis indicated that the relationship becomes statistically significant when Mindfulness exceeds approximately 2.69. Overall, Mindfulness significantly moderates the relationship between Information Overload and Attentional Fatigue.

### Discussion

The current research adds to the existing literature review on the psychological implications of the digital engagement in proving the strong correlation between the information overload, emotional exhaustion, mindfulness, and attentional fatigue. The external validity of the results is reinforced by the diverse range of the demographic composition of the sample since the respondents were represented by different age groups, educational levels, occupational statuses, and categories of gender. The heterogeneity of this kind boosts the confidence in the assumption that the observed effects are not limited to a particular subgroup, but rather to general society patterns in the experience and coping with digital stressors (Chiang et al., 2024; Khan et al., 2025). Such a balanced representation offers a significant contextual framework within which to interpret the central findings of the study and place them in a context of the current discourse of the signs of digital well-being.

As has been previously found out, information overload was found to be a powerful predictor of affective exhaustion as well as attentional fatigue. The participants with reports of increased exposure levels to excessive information also acknowledged experiencing a significantly greater amount of psychological strain which confirms the previous evidence that constant digital stimulation drains the

cognitive and emotional resources (Liu et al., 2023; Qin et al., 2024). The result is concurrent with the theoretical views that the human cognitive systems have a low processing capacity, and when it is overloaded by constant digital stimulation, people feel exhausted and experience stress (Yan et al., 2024). The findings, according to the studies of digital psychology, highlight the role of the omnipresent introduction of digital technologies into daily life and the formation of the environment of constant notifications, the need to multitask, and the exchange of information, which, according to the studies of digital psychology, is the cause of psychological overload (Sun, 2023; Alimour and Alrabeei, 2025).

Notably, the mediation analysis showed that information overload and emotional exhaustion have a partial relationship due to attentional fatigue. This observation implies that cognitive depletion is a process within which an over-exposure to information is converted to an expanded emotional stress. Digital stimuli have been reported to weaken attentional control systems, decrease mental stamina, and interrupt when processing a task (Aziz et al., 2024; Gaeveren et al., 2024). With the depletion of attentional resources, a person can no longer control his or her emotions effectively, and they all contribute to vulnerability to emotional exhaustion (An et al., 2025). This direction is aligned with the findings of a relationship between compulsive technology use and social media interaction with fatigue and stress as well as low well-being (Chu et al., 2021; Xie et al., 2023). The current results are thus an extension of the previous literature that empirically shows attentional fatigue as an important explanatory interval between digital overload and emotional depletion.

In addition to this mediating process, mindfulness turned out to be an important moderating variable. The interaction effects reveal that the degree of relationship between psychological strain and information overload is varying by the levels of mindfulness. Mindfulness that can be defined as present-oriented awareness and nonjudgmental attention has always been linked to better emotion regulation and greater attentional control (Aldbyani et al., 2025; Woodlief et al., 2024). Being mindful may help careful people to better utilize their cognitive resources and turn off stimuli that they do not need in the online environment, so the level of overload situations will decrease (ÇELEBİ et al., 2025; Marsh et al., 2024). This role of buffering corresponds to the evidence based on which mindful use of technologies may reduce the emotional effect of bad online material and increase resilience (Sandra, 2025).

In general, the results demonstrate the presence of a complicated interaction where attentional fatigue is related to the overload of information, which, in turn, gives way to emotional depletion, whereas mindfulness is a safeguarding factor in psychology. This work supports the significance of incorporating the use of digital well-being tools and ways of supervising the work environment as digital to decrease the effects of technostress on people. The intellectual resources and future-friendly psychological well-being in the age of the most accessible information in history might depend on having conscious awareness of technical devices and the internet (Khan et al., 2025; Liu et al., 2025).

### **Implications**

The current findings have a number of implications, both theoretical, practical, and policy implications. To initiate with, the research contributes to literature on digital psychology by empirically confirming the use of a mediated -moderated model where attentional fatigue serves as a cognitive mediator between information overload and emotional exhaustion, and mindfulness serves as buffering resource. The study combines the theories of cognitive resources and mindfulness models together, thus adding value to the more complete picture of how digital stressors are converted into psychological strain. By showing that the effect of digital overload is not direct only, but mediated by recognizable psychological mechanisms, this integrative model generates some value to other theories of technostress and

cognitive load.

Practically, the findings demonstrate a need to organize digital well-being interventions (individual, organizational), which requires digital safety training and utilization of tools enhancing forming a supportive self-image and community connections. The firms can consider the following policies to minimize extravagant flow of information, which include restricted flow of information after-hours, optimization of the notification mechanisms and encouraging dedicated working sessions. Moreover, mindfulness-based trainings would help employees develop greater attentional control and emotional regulation abilities through integration into the employee development programs. At a personal level, developing not only mindful technology consumption (e.g., digital breaks, active use of material, multi-tasking reduction) but also mindful cognition could have a beneficial impact on preserving cognitive resources, as well as avoiding emotional depletion.

The psychological costs of digital saturation should also be implied in educational institutions and policymakers. The concept of digital literacy training should be integrated with teaching methods that focus on mind-centered practices and replenishing cognitive self-regulation as a more effective way to help people navigate high-information environments. There is a strong need to adopt proactive measures aimed at tackling exposure and coping-related behaviors as digital technologies keep finding their way in everyday life to ensure sustainable psychological well-being.

#### **Limitations and Suggestions for Future Research**

The study has limitations in addition to its contributions. First, the preclusion of causal inference is imposed on the use of cross-sectional design. As much as the proposed relationships are theoretically based, longitudinal or experimental research design studies would be required in order to determine temporal order and causality more conclusively. As a part of future research, time lagged or diary research design could be utilized to investigate the changes in information overload and psychological strain over the time. Second, self-tests used can lead to common method bias and social desirability biases. Despite the use of the procedural remedies, in future the studies it is possible to use objective behavioral indicators (e.g., digital usage logs, attention-tracking metrics) or multi-source data in order to increase the methodological rigor. Third, the sample was heterogeneous, although there was no direct study of cultural or contextual issues. The relationships may be mitigated by cultural expectations in terms of the use of technology, expectations in the workplace, and how emotions are expressed. The cross-cultural comparative studies would thereafter offer some meaningful information on the generalizability of the findings. Fourth, the research was conducted on the protective factor of mindfulness. Further moderators (including psychological resilience, emotional intelligence, self-control or organizational support) may also be investigated in further researchers. Theorizing on the possibility of reciprocal relations, i.e. that emotional exhaustion could increase maladaptive digital engagement even more, would also benefit theoretical knowledge. Lastly, line of future research could be investigated focusing on intervention-based designs to determine whether mindfulness training can be an effective intervention to directly test attentional fatigue and emotional burnout reduction in digitally intensive settings. To support the utility of mindfulness-based digital well-being programs applied, experimental validation would be more convincing.

#### **Conclusion**

To sum up, the current study adds to the existing amount of research on the topic of digital well-being as it clarifies psychological mechanisms of the correlation between information overload and emotional exhaustion. The results show that attentional fatigue is a crucial mediating variable where too much information exposure leads to the depletion of resources of emotion, whereas mindfulness is also a

moderating variable that prevents such effects. Combining the cognitive depletion theory with mindfulness approaches, the study provides a critical insight into the way people feel and manage the digital stressors in the modern world of information. With the growing integration of digital engagement in work, school as well as personal sectors, it is necessary to establish both risk and protective factors as well as mechanisms. Finally, the promotion of mindful practice of digital technologies can be an essential key to maintaining attentional resources, emotional depletion, and sustainable psychological health in the digital era.

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