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EXPLORING DIGITAL STRESS AMONG UNIVERSITY STUDENTS IN TECHNOLOGY-INTEGRATED LEARNING ENVIRONMENTS: A QUALITATIVE STUDY

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ABSTRACT

Digital technologies have become integral to higher education, yet the psychological strain they create for students is still poorly understood from the students' own perspective, particularly in developing countries. This qualitative study explored university students lived experiences of digital stress (used interchangeably with technology stress and technostress to denote stress arising from digital devices and technology-based academic systems), including its sources, psychological impacts, and coping strategies. A phenomenological qualitative design was employed. Fifteen students (7 male, 8 females; aged 19–28 years) enrolled in BS, MS/MPhil, and PhD programmes at public and private universities in Islamabad and Rawalpindi, Pakistan, were selected through purposive sampling and interviewed using semi-structured, in-depth interviews. The data were analysed using the thematic analysis approach of Braun and Clarke (2006). Five themes were identified: (1) Academic Digital Overload, (2) Technological Anxiety and Uncertainty, (3) Emotional and Cognitive Exhaustion, (4) Constant Connectivity Pressure, and (5) Coping Strategies for Digital Stress. Students described managing multiple platforms and a continuous digital workload, fear of technical failure during examinations and submissions, mental fatigue, reduced concentration and irritability, and an expectation of being permanently available. Despite these stressors, students used time management, digital breaks, and peer support to cope. Interpreted through Technostress Theory and the Transactional Model of Stress and Coping, the findings show that digital stress is a multidimensional phenomenon shaped by academic demands, technological environments, and coping resources. Universities should develop student-centred digital learning systems that reduce technology-induced stress and promote psychological well-being.

I. INTRODUCTION

The rapid advancement of digital technologies has transformed higher education worldwide. Universities increasingly rely on Learning Management Systems (LMS), virtual classrooms, mobile applications, cloud-based assignment systems, artificial intelligence tools, and social media channels to deliver teaching and manage academic communication (Bond et al., 2021). These systems have improved accessibility, flexibility, and information sharing, but they have also introduced psychological and emotional challenges for students (Dhawan, 2020). Students are now expected to use digital devices and platforms to attend lectures, submit assignments, take examinations, and stay in contact with teachers and peers. Excessive reliance on technology in academic life

has been linked with feelings of overload, exhaustion, frustration, and anxiety (Tarafdar et al., 2015), and continuous notifications, multiple academic platforms, unstable internet connections, technical failures, and pressure to remain constantly available have become ordinary features of university study. The transition to online and hybrid learning during the COVID-19 pandemic made these demands more visible (Bao, 2020). Although many institutions have returned to physical classrooms, digital systems have remained embedded in academic routines, so students continue to face sustained technological engagement. Studies conducted during the pandemic documented psychological distress among students who relied on prolonged online learning, including fear of academic loss (Hasan & Bao, 2020), and noted that digital learning brought digital fatigue, reduced interaction, and increased dependence on technology (Dhawan, 2020; Wiederhold, 2020).

Several overlapping terms are used for stress arising from technology, including “digital stress,” “technology stress,” and “technostress.” The term technostress was introduced by Brod (1984), who described it as a modern disease of adaptation caused by the inability to cope with new computer technologies. The concept initially concerned workplace adaptation, and it was later specified as a set of technostress creators, namely techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty (Tarafdar et al., 2007), with technological characteristics identified as antecedents of these stressors (Ayyagari et al., 2011). More recent work has distinguished the strain-producing (distress) and the stimulating (eustress) aspects of technology use (Tarafdar et al., 2019). In this paper, digital stress, technology stress, and technostress are used interchangeably to denote the psychological strain, emotional burden, and cognitive overload that result from interacting with digital devices and technology-based systems during academic learning. It should be noted that some authors use “digital stress” more narrowly for stress arising from digital communication and social media use (Hall et al., 2021; Steele et al., 2020); the present study uses the broader, academic-technology sense and does not use that measurement framework.

Digital stress among university students can arise from several sources (Khaliq et al., 2026). Technology overload occurs when students must manage large amounts of academic information and many simultaneous digital tasks (Ayyagari et al., 2011). Constant connectivity creates pressure to remain available for academic communication through email, messaging applications, and virtual platforms (Suh & Lee, 2017). Technological complexity and uncertainty arise when students must adapt to unfamiliar systems, or when internet disruptions, software failures, and platform crashes occur at critical moments (Hasan & Bao, 2020). Prolonged screen exposure may add to cognitive fatigue and reduced concentration (Wiederhold, 2020). Technostress among users of information and communication technologies has been associated with negative psychological states such as technology-related anxiety and fatigue (Salanova et al., 2013), and digital stress has been associated with poorer psychological well-being in a meta-analysis (Khetawat & Steele, 2023). Two frameworks guide this study. Technostress Theory proposes that stress arises when individuals cannot cope effectively with technological demands such as complexity, overload, and continuous connectivity (Brod, 1984; Tarafdar et al., 2007). The Transactional Model of Stress and Coping describes stress as a transaction in which an individual appraises demands, in primary appraisal as irrelevant, benign, or stressful, and in secondary appraisal in terms of the resources available to cope, and responds with problem-focused or emotion-focused coping (Lazarus & Folkman, 1984). The first framework helps to explain what produces stress in digital learning environments, and the second helps to explain how students perceive and respond to it, and why some students are affected more than others.

Most research on technology-related stress has used quantitative surveys and psychometric scales to measure its level and correlates (Wang et al., 2020), and much of the foundational work was conducted in organisational settings (Ayyagari et al., 2011; Tarafdar et al., 2007). University students differ from employees in autonomy, digital literacy, and coping resources (Hanafi & Noor, 2016), and studies during the pandemic largely concerned emergency remote teaching (Bond et al., 2021), so it is less clear whether digital stress persists as a routine feature of post-pandemic higher education. Qualitative evidence on how students experience, interpret, and cope with digital stress is limited, particularly in developing countries such as Pakistan, where students may also face unstable internet connectivity, power outages, limited access to devices, and inconsistent institutional support (Adnan & Anwar, 2020). The present study therefore explored the lived experiences of digital stress among university students in technology-integrated learning environments in Pakistan. It aimed to understand how students experience digital stress in academic activities such as online classes, assignments, and examinations,

which technological stressors contribute to it, how it affects their emotional, cognitive, and behavioural functioning, how they interpret technology-related academic pressure, which coping strategies they use, and how the Pakistani higher education context shapes these experiences.

II. METHOD

The study was grounded in the interpretivist paradigm, which assumes that reality is socially constructed and best understood through the meanings people attach to their experiences (Creswell & Poth, 2018). A phenomenological qualitative design was used because the aim was to explore and describe students lived experiences of digital stress, the meanings they attach to technological demands, and how they respond emotionally and cognitively to digital learning pressures. The study was conducted in selected public and private universities in the twin cities of Islamabad and Rawalpindi, Pakistan, which use technology-integrated learning systems such as LMS platforms, online examination systems, and virtual learning environments.

Participants

Participants were selected through purposive sampling, which allows the intentional selection of individuals who have direct experience of the phenomenon under study. The sample size was guided by data saturation, the point at which no new themes emerge from the data, and 15 students (P1–P15) were interviewed. Students were included if they were enrolled in a university programme, regularly used digital platforms for academic learning, had experience of online or blended learning, were willing to share personal experiences of digital stress in an interview, and could communicate their experiences clearly. Students without exposure to digital learning systems or academic use of digital platforms, and those unwilling to provide consent, were excluded. Participants came from diverse academic disciplines to ensure variation in experiences. The demographic characteristics of the participants are shown in Table 1.

Table I: Demographic Characteristics of the Participants (N = 15)

Variable	Category	n
Gender	Male (P1–P7)	7
	Female (P8–P15)	8
Level of study	BS	9
	MS/MPhil	4
	PhD	2
Age range	19–28 years	–

Measures

Data were collected through semi-structured, in-depth interviews, which allow personal experiences to be explored in detail while keeping flexibility in questioning. An interview guide of open-ended questions was developed to cover students' academic use of technology, experiences of digital stress, emotional and psychological responses, technological challenges in learning, and coping strategies. Sample questions included "How do you use technology in your academic learning?", "Can you describe a situation where technology caused stress during your studies?", "What challenges do you face while using online learning platforms?", "How does constant digital connectivity affect your daily academic life?", and "How do you cope with stress caused by digital learning tools?"

Procedure

Participants were informed about the purpose of the study and gave informed consent before the interviews. Participation was voluntary, participants could withdraw at any time, and confidentiality and anonymity were assured. Interviews were audio-recorded with the participants' permission and transcribed for analysis. Data were stored securely and used only for research purposes. The transcripts were analysed using the six phases of thematic analysis proposed by Braun and Clarke (2006): familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. To establish rigour, the criteria of Lincoln and Guba (1985) were followed. Credibility was addressed through member checking

and participant validation, transferability through thick description of the context and participants, dependability through clear documentation of the research process, and confirmability through an audit trail and reflexivity.

III. RESULTS

Thematic analysis of the interviews with 15 university students produced five themes that reflect the emotional, cognitive, and behavioural experiences of digital stress in technology-integrated learning: (1) Academic Digital Overload, (2) Technological Anxiety and Uncertainty, (3) Emotional and Cognitive Exhaustion, (4) Constant Connectivity Pressure, and (5) Coping Strategies for Digital Stress. The themes, their definitions, and their subthemes are presented in Table 2, and each theme is described below with illustrative extracts from participants (identified by participant number).

Table II: Themes, Definitions, and Subthemes of Digital Stress among University Students

Theme	Definition	Subthemes
1. Academic Digital Overload	A state of cognitive and informational overload caused by excessive academic demands delivered through digital platforms.	1.1 Multiplicity of digital platforms; 1.2 Excessive academic digital workload
2. Technological Anxiety and Uncertainty	Psychological distress arising from fear of system failure, unpredictability, and lack of control over digital academic tools.	2.1 Fear of technical failure; 2.2 Unfamiliarity with digital systems
3. Emotional and Cognitive Exhaustion	Mental and emotional fatigue resulting from prolonged exposure to digital learning environments.	3.1 Mental fatigue and screen exhaustion; 3.2 Reduced concentration and attention; 3.3 Emotional irritability
4. Constant Connectivity Pressure	Psychological pressure to remain continuously available and responsive in digital academic environments.	4.1 Always-available expectation; 4.2 Notification overload
5. Coping Strategies for Digital Stress	Cognitive, emotional, and behavioural strategies used by students to manage or reduce digital stress.	5.1 Time management and planning; 5.2 Digital breaks and disconnection; 5.3 Social support and peer help

Theme I: Academic Digital Overload

This theme refers to the excessive cognitive and informational burden students experienced because of continuous academic tasks delivered through digital platforms such as the LMS, online classes, and digital submission systems. The overload reduced their capacity to process information and led to psychological strain. In the first subtheme, multiplicity of digital platforms, students described having to manage several academic applications and platforms at once, often with each instructor using a different system. One participant said, *"Every teacher uses a different application, and sometimes I don't know where to check assignments"* (P3), and another reported, *"We use LMS, WhatsApp, Zoom, and email all at the same time. It becomes confusing"* (P9). In the second subtheme, excessive academic digital workload, students described a continuous inflow of assignments, quizzes, and submissions without time to recover: *"Assignments never end; as soon as one is submitted, another appears online"* (P6) and *"We are always busy with online work, even on weekends"* (P11).

Theme II: Technological Anxiety and Uncertainty

Students described fear, worry, and emotional tension linked to unpredictable digital environments, including system errors, internet failure, and platform instability during academic tasks. Under the subtheme fear of technical failure, they worried that technology might fail at critical academic moments such as examinations or submissions: *"I remain worried that my internet might stop during an online exam"* (P7) and *"Even a small internet issue feels like a disaster during submission time"* (P2). Under the subtheme unfamiliarity with digital systems, students described stress caused by limited familiarity with academic technologies and by frequent changes of platform: *"Sometimes I don't understand how to use new software for assignments"* (P5) and *"Every semester the system changes, and it becomes difficult to adjust"* (P12).

Theme III: Emotional and Cognitive Exhaustion

This theme captures mental fatigue, reduced concentration, emotional depletion, and psychological exhaustion that students attributed to prolonged exposure to digital learning environments. Mental fatigue and screen exhaustion were described as cognitive tiredness after long online classes and extended screen time: *"After long online classes, my mind feels completely tired"* (P4) and *"Too much screen time makes me mentally exhausted"* (P10). Students also reported difficulty maintaining focus during online learning, as in *"I cannot focus properly during long online lectures"* (P1) and *"My attention keeps shifting when studying online"* (P8). Emotional irritability, including frustration and emotional instability, was also reported: *"I feel irritated after attending continuous online classes"* (P13) and *"Sometimes I get frustrated without any clear reason after using digital platforms all day"* (P6).

Theme IV: Constant Connectivity Pressure

This theme refers to the psychological burden of being continuously available and responsive to academic communication through digital platforms. The always-available expectation was described as perceived pressure to remain online and respond at all times: *"Teachers expect us to be available all the time on WhatsApp and LMS"* (P14) and *"It feels like we are never offline from studies"* (P3). Notification overload referred to stress caused by the continuous flow of academic messages and alerts: *"My phone never stops receiving academic notifications"* (P8) and *"Every minute there is a new message from class groups"* (P11).

Theme V: Coping Strategies for Digital Stress

Students described behavioural, cognitive, and emotional efforts to manage or reduce the effects of digital stress. Time management and planning meant the structured scheduling of academic tasks to reduce overload: *"I try to manage my time strictly to avoid pressure"* (P2) and *"Planning helps me reduce stress from online work"* (P9). Digital breaks and disconnection involved intentionally disengaging from devices: *"Sometimes I switch off my phone to relax my mind"* (P7) and *"Taking breaks from screen helps me feel better"* (P15). Social support and peer help involved relying on friends and classmates for academic and emotional support: *"I ask my friends when I don't understand online tasks"* (P4) and *"We help each other during difficult assignments"* (P10).

Taken together, the themes describe digital stress as a multidimensional experience characterised by academic digital overload, technological anxiety, emotional and cognitive exhaustion, constant connectivity pressure, and adaptive coping. Digital learning was seen to provide access and flexibility, but it also created considerable psychological and emotional strain.

IV. DISCUSSION

The present study explored university students lived experiences of digital stress in technology-integrated learning environments in Pakistan. Five themes were identified, and they are discussed below in relation to Technostress Theory, the Transactional Model of Stress and Coping, and earlier research. The first theme, academic digital overload, corresponds to the techno-overload dimension of Technostress Theory, in which technology obliges individuals to handle more tasks, or to work faster, than they otherwise would (Tarafdar et al., 2007; Tarafdar et al., 2015). The use of several systems at once (LMS, Zoom, WhatsApp, and email) fragmented students' attention and added to their cognitive load, which is consistent with the view that technological characteristics are antecedents of technostress (Ayyagari et al., 2011). In Pakistani higher education this overload may be intensified by inconsistent platform use across faculty members and by varying levels of digital literacy. The second theme, technological anxiety and uncertainty, reflects the techno-uncertainty and techno-complexity dimensions of Technostress Theory. From the perspective of the Transactional Model, students appraise technological situations as threatening when they perceive that they have little control over the outcome (Lazarus & Folkman, 1984). Fear of internet failure during an examination is an example of a primary appraisal of high threat combined with limited coping resources. The finding is in line with evidence of psychological distress among students during online learning that was linked to disruption and fear of losing the academic year (Hasan & Bao, 2020), and it extends that evidence by suggesting that such anxiety persists beyond emergency remote teaching and has become part of routine academic life. Because students in Pakistan may also contend with unstable connectivity and power disruptions (Adnan & Anwar, 2020), their anxiety about technical failure may be grounded in real infrastructural risk and not only in perceived threat.

The third theme, emotional and cognitive exhaustion, is consistent with research linking prolonged technology use to negative psychological states such as fatigue among technology users (Salanova et al., 2013) and with descriptions of fatigue associated with prolonged video-based communication (Wiederhold, 2020). Reduced concentration and shifting attention suggest that continuous digital engagement may reduce cognitive processing efficiency, and irritability suggests a depletion of psychological resources. Within Technostress Theory, this exhaustion can be read as an outcome of sustained techno-overload and techno-invasion, in which the boundary between academic and personal cognitive space becomes blurred (Tarafdar et al., 2015). The fourth theme, constant connectivity pressure, reflects techno-invasion, in which technology intrudes into personal life and removes recovery time (Tarafdar et al., 2015). The expectation of continuous responsiveness produced a state that can be described as "always-on learning," which disrupts the balance between study and rest and increases emotional strain. This is in line with research on constant connectivity and the pressure to remain available (Suh & Lee, 2017) and with the concern that digital overload affects psychological detachment (Wiederhold, 2020). Participants' accounts of being expected to respond on WhatsApp and the LMS suggest that, in the Pakistani academic context, informal communication between students and instructors through messaging platforms may add to this pressure.

The fifth theme, coping strategies, is strongly aligned with the Transactional Model, in which coping is a central process between a stressor and its psychological outcome (Lazarus & Folkman, 1984). Planning and time management are problem-focused strategies that helped students manage academic demands, whereas digital disconnection is an emotion-focused strategy that reduced emotional tension, and peer support emerged as an important protective factor that shows the social dimension of coping. However, reliance on avoidance, such as switching off devices, may provide only temporary relief and does not address the structural causes of digital stress, such as multiple platforms, workload, and inconsistent institutional practice. Overall, the findings suggest that digital stress in higher education is not merely a technological problem but a psychological adaptation challenge influenced by institutional practices, digital infrastructure, and students' coping capacities. Technostress Theory helped to explain what produced stress in these students' accounts, and the Transactional Model helped to explain how they appraised and responded to it. The study also shows that digital stress is not uniform, since it is shaped by the socio-technical environment in which students' study, including infrastructural limitations, inconsistent internet access, and varying institutional digital policies in Pakistan.

Implications

The findings have practical implications at several levels. Universities should streamline their digital learning systems, preferably by adopting a unified LMS and reducing the number of platforms in use, provide technical support services to reduce anxiety related to system failure and complexity, and offer training to improve students' digital literacy and confidence. Faculty members should regulate the frequency of online assignments, notifications, and digital communication, give clear guidelines for digital submissions, and avoid unnecessary academic intrusion outside learning hours. Students can be supported to develop structured time management, regular digital breaks, and peer support systems. At the policy level, higher education regulatory bodies should develop standardised digital learning policies for platform use and workload distribution, and mental health support should be integrated into digital learning systems.

V. CONCLUSION

The study shows that digital learning environments, while essential to modern higher education, generate considerable psychological pressure for students. Five themes (academic digital overload, technological anxiety and uncertainty, emotional and cognitive exhaustion, constant connectivity pressure, and coping strategies) indicate that digital stress is a multidimensional phenomenon shaped by technological demands and by students' coping capacities, and that students actively use time management, digital breaks, and peer support to manage it. The findings support the relevance of Technostress Theory and the Transactional Model of Stress and Coping in academic settings and call for student-centred digital learning systems. However, the small, purposively selected sample from universities in Islamabad and Rawalpindi, the reliance on self-reported accounts, and the single-point data collection limit the transferability of the findings and the understanding of change over time. Future research

should use longitudinal designs to examine the long-term psychological effects of digital stress, compare urban and rural institutions in Pakistan, and apply mixed-methods designs that combine students' experiences with quantitative measurement of digital stress.

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