

Technostress and Academic Burnout in Digital Learning Environments: The Protective Role of Psychological Resilience – A Systematic Review

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This systematic review examines the relationships among technostress, psychological resilience, and academic burnout in digital learning environments. Following a systematic search in Scopus, Web of Science, PubMed, ERIC, and Google Scholar, 25 peer-reviewed original research articles published within the last five years were selected. The findings reveal that technostress is positively associated with academic burnout, anxiety, and depression. Psychological resilience serves as a significant protective factor that buffers the negative effects of technostress on burnout. Coping strategies, motivation, and digital competence mediate these relationships. Problematic digital behaviours, including internet addiction, contribute to burnout cycles. Individual characteristics, teaching quality, and pandemic-related stressors influence these relationships. However, no study simultaneously examined all three constructs in an integrated model, and research on secondary students remains limited. The review concludes that successful digital learning requires resilience-building interventions, quality instructional design, and institutional support to protect student well-being.

Keywords: Technostress, psychological resilience, academic burnout, digital learning environments, systematic review

Introduction

The rapid digital transformation of education has fundamentally reshaped the landscape of teaching and learning in the 21st century. The proliferation of digital technologies, online learning platforms,

and information communication tools has created unprecedented opportunities for flexible and accessible education. However, this digital shift has also introduced new psychological challenges for learners, particularly in the form of technostress. Technostress, defined as stress experienced by

individuals due to the use of information and communication technologies, has emerged as a significant concern in contemporary educational research (Galvin et al., 2022). As digital learning environments become increasingly pervasive, understanding the psychological impact of technology on students' well-being and academic outcomes has become a critical priority for educators, policymakers, and researchers alike.

The COVID-19 pandemic accelerated the adoption of digital learning environments at an unprecedented scale, forcing educational institutions worldwide to transition rapidly to online and remote learning modalities (Aguilera-Hermida, 2020; Ali, 2020). While this transition enabled continuity of education during global lockdowns, it also exposed students to intensified digital demands, including prolonged screen time, information overload, communication overload, and technological complexities (Smith et al., 2021). Studies have consistently documented significant increases in stress, anxiety, and depression among university students during the pandemic (Barbosa-Camacho et al., 2022; Cao et al., 2020; Husky et al., 2020). The sudden and forced nature of this transition left many students ill-prepared to cope with the psychological demands of fully digital learning environments, resulting in widespread reports of digital overload and technostress (Camacho & Barrios, 2022).

Academic burnout has emerged as a particularly concerning outcome associated with prolonged exposure to digital learning environments. Academic burnout is characterised by emotional exhaustion, cynicism or depersonalisation toward academic work, and reduced personal efficacy (Fiorilli et al., 2022). In the context of digital learning, students face unique stressors, including constant connectivity expectations, technical difficulties, lack of social interaction, and blurred boundaries between academic and personal life. Research has demonstrated that academic burnout is positively associated with problematic internet use and internet addiction among university students (Jafari et al., 2022; Zhu et al., 2022). Furthermore, studies have found that academic stress significantly contributes to academic burnout, with resilience emerging as a crucial

protective factor that moderates this relationship (Hao et al., 2022; Jiang et al., 2021).

The relationship between technostress and academic burnout has been examined across various educational contexts. Galvin et al. (2022) found that technostress was significantly associated with anxious and depressive symptomatology among university students, with coping strategies playing a mediating role in this relationship. Similarly, Panisoara et al. (2020) demonstrated that technostress and burnout significantly mediated the relationship between motivation and continuance intention in online instruction among teachers. These findings suggest that technostress not only directly affects psychological well-being but also indirectly influences academic outcomes through its impact on motivation and engagement. The cumulative evidence indicates that technostress represents a significant risk factor for the development of academic burnout in digital learning environments (Gonzalez et al., 2022; Juntunen et al., 2022).

Psychological resilience has been identified as a key protective factor that buffers the negative effects of stress on mental health and academic outcomes. Resilience refers to the ability to adapt positively to adversity, trauma, or significant sources of stress (Hao et al., 2022). In educational contexts, resilient students are better equipped to cope with academic pressures, recover from setbacks, and maintain psychological well-being in challenging circumstances. Research has shown that resilience moderates the relationship between academic stress and academic burnout, with higher levels of resilience associated with lower burnout even under conditions of high stress (Okechukwu et al., 2022). Furthermore, digital competence and internet self-efficacy, which are closely related to resilience, have been found to preserve university students' psychological well-being during the pandemic by enhancing their ability to navigate digital learning environments effectively (Wang et al., 2021; Peng et al., 2021).

Despite the growing body of research on technostress, psychological resilience, and academic burnout, most studies have examined these variables in isolation or in pairwise

relationships. There remains a limited understanding of how these three constructs interact simultaneously within digital learning environments. While some studies have explored the mediating role of coping strategies between technostress and psychological outcomes (Galvin et al., 2022), others have focused on the moderating role of resilience between stress and burnout (Hao et al., 2022). However, comprehensive models that integrate all three constructs are still scarce. This fragmentation in the literature limits our ability to develop holistic theoretical frameworks and evidence-based interventions to support students' psychological well-being in digital learning contexts.

Furthermore, previous studies have largely been conducted in specific geographical contexts, with a predominance of research from China, Europe, and the United States (Galvin et al., 2022; Hao et al., 2022; Smith et al., 2021). There is limited representation of diverse cultural and educational systems, which may influence how technostress manifests and how resilience operates as a protective factor. Additionally, the majority of existing studies employ cross-sectional designs (Fiorilli et al., 2022; Zhu et al., 2022), which limit the ability to draw causal conclusions about the direction of relationships among technostress, resilience, and burnout. Longitudinal studies that track changes in these variables over time remain relatively rare (Camacho & Barrios, 2022; Li et al., 2020).

The measurement of technostress, resilience, and academic burnout also varies considerably across studies, complicating comparisons and meta-analytic syntheses. Some studies focus on specific dimensions of technostress, such as information overload or communication overload (Smith et al., 2021), while others employ composite measures (Galvin et al., 2022). Similarly, resilience has been operationalised in diverse ways, including as a trait, a process, or an outcome (Hao et al., 2022; Okechukwu et al., 2022). This heterogeneity in measurement approaches highlights the need for systematic reviews that can synthesise findings across different operational definitions and identify common patterns in the literature.

Another critical gap in the literature is the relative neglect of specific populations and educational levels. While higher education students have been the primary focus of most studies (Galvin et al., 2022; Jafari et al., 2022; Zhu et al., 2022), there is limited research on technostress and academic burnout among secondary school students, who may be particularly vulnerable to the negative effects of digital learning due to developmental factors. Ortega-Ruipérez et al. (2021) found that excessive internet exposure was associated with psychological maladjustment among adolescents, suggesting that younger populations may require targeted attention. Similarly, the perspectives of teachers and faculty members, who experience technostress both personally and professionally while supporting their students, have received comparatively less attention (Panisoara et al., 2020; Ritter et al., 2022).

The relationship between problematic digital behaviours and academic burnout has also emerged as an important area of inquiry. Studies have found that internet addiction and problematic smartphone use are positively associated with academic burnout among university students (Jafari et al., 2022; Zhu et al., 2022). Truzoli et al. (2020) demonstrated that problematic internet use was negatively associated with study motivation in higher education students. Furthermore, Sert and Başkale (2022) found that increased time spent on social media and coronavirus anxiety predicted increased social media addiction. These findings suggest that maladaptive digital behaviours may both contribute to and result from academic burnout, creating a cyclical relationship that warrants further investigation.

The role of digital competence and self-efficacy as protective factors has been explored in several studies. Wang et al. (2021) found that digital competence positively affected university students' psychological well-being through the fulfilment of basic psychological needs, including autonomy, competence, and relatedness. Peng et al. (2021) demonstrated that positive perceptions of the smart classroom environment were associated with higher internet self-efficacy, which can be conceptualised as a form of digital resilience. These findings underscore the importance of building

students' digital capabilities not only for academic success but also for psychological well-being in digital learning environments.

Despite the promising findings from individual studies, the absence of a comprehensive systematic review that synthesises empirical evidence on the relationships among technostress, psychological resilience, and academic burnout represents a significant gap in the literature. Such a review is essential for consolidating existing knowledge, identifying consistent patterns across studies, highlighting methodological limitations, and guiding future research directions. Without a systematic synthesis, the field remains fragmented, and evidence-based recommendations for educational practice and policy remain difficult to formulate.

Therefore, this study aims to systematically review and synthesise empirical research on the relationships among technostress, psychological resilience, and academic burnout in digital learning environments. By analysing original research studies published within the last five years (2020-2026), this research seeks to provide a comprehensive overview of current trends, theoretical frameworks, measurement approaches, and empirical findings related to these three constructs. Specifically, this review addresses the following research questions: (1) What is the current state of research on technostress, psychological resilience, and academic burnout in digital learning environments? (2) How are these three constructs related to one another based on empirical evidence? (3) What research methods, samples, and digital learning contexts have been investigated? (4) What are the key findings regarding the moderating and mediating roles of resilience in the technostress-burnout relationship? (5) What are the research gaps and future directions for advancing knowledge in this field?

The significance of this study lies in its potential to inform educational practice, institutional policy, and future research. By synthesising available evidence, this review will provide educators and administrators with evidence-based insights into the psychological challenges students face in digital learning environments. It will also highlight

effective strategies for building resilience and mitigating technostress, thereby supporting student well-being and academic success. For researchers, this review will identify gaps in the current literature and propose directions for future empirical investigations. Ultimately, this study contributes to the broader discourse on the psychological dimensions of digital transformation in education, emphasising the need for holistic approaches that address both technological and human factors in learning environments.

2. Technostress, Psychological Resilience, and Academic Burnout in Digital Learning Environments

Technostress has emerged as a significant psychological phenomenon in the context of digital learning environments. Technostress is broadly defined as the stress experienced by individuals as a result of their interaction with information and communication technologies (Galvin et al., 2022). In educational settings, technostress manifests through various dimensions, including information overload, communication overload, technological complexity, invasion of privacy, and constant connectivity expectations (Smith et al., 2021). As digital learning environments become increasingly prevalent, understanding the sources and consequences of technostress has become essential for supporting student well-being and academic success.

In educational practice, technostress has been identified as a critical challenge affecting students across various levels of education. Studies have shown that technostress is significantly associated with anxious and depressive symptomatology among university students, with coping strategies playing a mediating role in this relationship (Galvin et al., 2022). The COVID-19 pandemic, which forced an unprecedented transition to emergency remote teaching, intensified the experience of technostress among learners worldwide (Camacho & Barrios, 2022). Students reported increased digital workload, technical difficulties, lack of social interaction, and blurred boundaries between academic and personal life, all of which contributed to elevated levels of technostress

(Gonzalez et al., 2022). Similarly, research has demonstrated that digital overload, including information, communication, and social overload, is associated with higher psychological distress among college students (Smith et al., 2021).

In the context of online instruction, technostress has been found to affect not only students but also teachers and faculty members. Panisoara et al. (2020) demonstrated that technostress and burnout significantly mediated the relationship between motivation and continuance intention in online instruction among teachers. The study revealed that higher levels of technostress were associated with lower motivation to continue using online teaching methods. Furthermore, Ritter et al. (2022) found that digital teaching during the pandemic increased workload and potential burnout among lecturers, with teaching quality varying significantly across disciplines. These findings suggest that technostress represents a shared challenge for both educators and learners in digital learning environments.

The relationship between technostress and academic burnout has been extensively documented in recent literature. Academic burnout, characterised by emotional exhaustion, cynicism toward academic work, and reduced personal efficacy, has emerged as a particularly concerning outcome associated with prolonged exposure to digital learning environments (Fiorilli et al., 2022). Studies have shown that academic burnout is positively associated with problematic internet use and internet addiction among university students (Jafari et al., 2022; Zhu et al., 2022). In addition, internet abusive use has been found to significantly predict academic burnout, with academic burnout mediating the relationship between internet abuse and academic performance (Jafari et al., 2022). These findings underscore the interconnected nature of digital behaviours, technostress, and academic burnout.

Problematic internet use and smartphone addiction have been identified as both contributors to and consequences of academic burnout. Research indicates that increased time spent on social media, combined with coronavirus anxiety, significantly predicts higher social media addiction among

students (Sert & Başkale, 2022). Similarly, Zhu et al. (2022) found a high prevalence of internet addiction (23.7%) among undergraduate students during widespread online learning, with internet addiction positively associated with academic burnout. Truzoli et al. (2020) demonstrated that problematic internet use was negatively associated with study motivation in higher education students, suggesting that maladaptive digital behaviours may undermine academic engagement and increase burnout risk.

Psychological resilience has been identified as a crucial protective factor that buffers the negative effects of stress on mental health and academic outcomes. Resilience refers to the ability to adapt positively to adversity, trauma, or significant sources of stress (Hao et al., 2022). In educational contexts, resilient students are better equipped to cope with academic pressures, recover from setbacks, and maintain psychological well-being in challenging circumstances. Studies have shown that resilience moderates the relationship between academic stress and academic burnout, with higher levels of resilience associated with lower burnout even under conditions of high stress (Hao et al., 2022; Okechukwu et al., 2022). This moderating effect suggests that resilience serves as a psychological resource that enables students to navigate digital learning demands more effectively.

The role of resilience in the technostress-burnout relationship has been examined through various theoretical frameworks. Hao et al. (2022) found that resilience moderated the relationship between stress and academic burnout, with different types of smartphone use having different moderating effects. The study revealed that students with higher resilience were less likely to experience academic burnout even when facing high levels of academic stress. Similarly, Okechukwu et al. (2022) demonstrated that coping style and resilience moderated the relationship between academic stress and suicidal ideation, highlighting the protective function of resilience in maintaining mental health. These findings indicate that resilience is not merely a static trait but can be understood as a dynamic process that interacts with environmental demands and individual coping resources.

Digital competence and internet self-efficacy, which are closely related to psychological resilience, have also been found to preserve university students' psychological well-being during the pandemic. Wang et al. (2021) demonstrated that digital competence positively affected students' psychological well-being through the fulfilment of basic psychological needs, including autonomy, competence, and relatedness, as framed by self-determination theory. The study revealed that students who perceived themselves as digitally competent experienced lower levels of stress and higher levels of well-being in digital learning environments. Furthermore, Peng et al. (2021) found that positive perceptions of the smart classroom environment were associated with higher internet self-efficacy, which can be conceptualised as a form of digital resilience. These findings underscore the importance of building students' digital capabilities as a strategy for mitigating technostress and promoting psychological well-being.

The relationship between academic stress and burnout has been examined across diverse educational contexts and populations. Jiang et al. (2021) found that academic stress was associated with depression among Chinese adolescents in junior high schools, with school burnout and self-esteem serving as moderated mediators in this relationship. The study revealed that students who experienced high levels of academic stress were more likely to develop school burnout, which in turn increased the risk of depression. Similarly, Fiorilli et al. (2022) found that student burnout was higher among female students and working students, suggesting that demographic and contextual factors influence the experience of burnout. These findings highlight the importance of considering individual differences when examining the antecedents and consequences of academic burnout.

The COVID-19 pandemic created a unique natural experiment that dramatically accelerated the adoption of digital learning environments and provided researchers with opportunities to examine technostress, resilience, and burnout under conditions of widespread crisis. Studies conducted during the pandemic consistently

documented significant increases in stress, anxiety, and depression among university students (Barbosa-Camacho et al., 2022; Cao et al., 2020; Husky et al., 2020). Li et al. (2020) conducted a longitudinal study examining the psychological impacts of COVID-19 on college students in China and found significant increases in anxiety, depression, and stress over time. These findings suggest that the pandemic not only increased exposure to digital learning demands but also reduced students' psychological resources for coping with those demands.

The integration of technology within learning environments plays a dual role in shaping students' psychological experiences. On one hand, technology enables flexible access to educational resources and facilitates communication between students and teachers. On the other hand, excessive or poorly designed technology use can contribute to technostress and burnout. Research has shown that the quality of digital teaching significantly influences students' stress levels, with higher quality instruction associated with lower stress (Gonzalez et al., 2022). Juntunen et al. (2022) found that negative remote teaching experiences were associated with lower psychological well-being and higher exhaustion among university students, with motivation acting as a mediator in these relationships. These findings suggest that the design and implementation of digital learning environments play critical roles in shaping students' psychological outcomes.

Beyond the immediate effects on well-being, technostress and academic burnout have been linked to broader psychological outcomes, including anxiety disorders and depressive symptoms. Galvin et al. (2022) found that technostress was significantly associated with both anxious and depressive symptomatology, with coping strategies mediating these relationships. The study revealed that students who experienced higher levels of technostress were more likely to report symptoms of anxiety and depression, highlighting the mental health implications of digital learning demands. Similarly, Tomaszek and Muchacka-Cymerman (2022) found that student burnout was significantly associated with PTSD symptoms and existential anxiety, with academic

fears strengthening these relationships. These findings underscore the serious psychological consequences of unmitigated technostress and burnout in educational contexts.

The measurement of technostress, resilience, and academic burnout varies considerably across studies, reflecting the multidimensional nature of these constructs. Some studies focus on specific dimensions of technostress, such as information overload, communication overload, or technological complexity (Smith et al., 2021), while others employ composite measures that capture multiple dimensions simultaneously (Galvin et al., 2022). Similarly, resilience has been operationalised in diverse ways, including as a trait, a process, or an outcome (Hao et al., 2022; Okechukwu et al., 2022). Academic burnout is commonly measured using established instruments such as the Maslach Burnout Inventory-Student Survey (MBI-SS) or adapted versions thereof (Fiorilli et al., 2022; Zhu et al., 2022). This heterogeneity in measurement approaches highlights the need for careful consideration when comparing findings across studies.

Despite the growing body of research examining technostress, resilience, and burnout individually or in pairwise combinations, there remains limited understanding of how all three constructs interact simultaneously within digital learning environments. While some studies have explored the mediating role of coping strategies between technostress and psychological outcomes (Galvin et al., 2022), others have focused on the moderating role of resilience between stress and burnout (Hao et al., 2022). However, comprehensive models that integrate technostress as a predictor, resilience as a moderator or mediator, and academic burnout as an outcome remain scarce. This fragmentation in the literature limits the development of holistic theoretical frameworks and evidence-based interventions.

The demographic and contextual factors that influence the relationships among technostress, resilience, and burnout have also received limited attention. Research has shown that gender, work status, and academic level may influence the experience of burnout (Fiorilli et al., 2022). Allen

et al. (2021) found that sleep duration and quality moderated the relationship between stress and burnout among graduate students, suggesting that health behaviours play an important role in shaping these relationships. Furthermore, Ortega-Ruipérez et al. (2021) found that excessive internet exposure was associated with psychological maladjustment among adolescents, with evidence of an inverted-U relationship between internet use and adjustment. These findings indicate that the effects of digital engagement on psychological outcomes may not be linear and may vary depending on individual and contextual characteristics.

In addition, the majority of existing studies employ cross-sectional designs (Fiorilli et al., 2022; Zhu et al., 2022), which limit the ability to draw causal conclusions about the direction of relationships among technostress, resilience, and burnout. Longitudinal studies that track changes in these variables over time remain relatively rare (Camacho & Barrios, 2022; Li et al., 2020). Furthermore, most research has been conducted in specific geographical contexts, with a predominance of studies from China, Europe, and the United States (Galvin et al., 2022; Hao et al., 2022; Smith et al., 2021). There is limited representation of diverse cultural and educational systems, which may influence how technostress manifests and how resilience operates as a protective factor.

The role of digital competence and self-efficacy as protective factors has been explored in several studies. Wang et al. (2021) found that digital competence positively affected university students' psychological well-being through the fulfilment of basic psychological needs. This finding suggests that building students' digital skills may be an effective strategy for reducing technostress and promoting resilience. Similarly, Peng et al. (2021) demonstrated that positive perceptions of the smart classroom environment were associated with higher internet self-efficacy, which can be conceptualised as a form of digital resilience. These findings underscore the importance of designing digital learning environments that not only deliver content effectively but also support students' psychological needs and digital competence development.

Furthermore, although numerous studies have examined the impact of technostress on various psychological outcomes, many of these studies focus on higher education students without considering other educational levels. There is still limited research focusing specifically on secondary school students, who may be particularly vulnerable to the negative effects of digital learning due to developmental factors. In addition, previous studies often examine isolated variables without

providing a comprehensive synthesis of findings across different contexts. Therefore, a systematic understanding of how technostress, psychological resilience, and academic burnout are related to one another in digital learning environments remains necessary. This study aims to address this gap by synthesising recent empirical research and providing a comprehensive overview of the relationships among these three critical constructs.

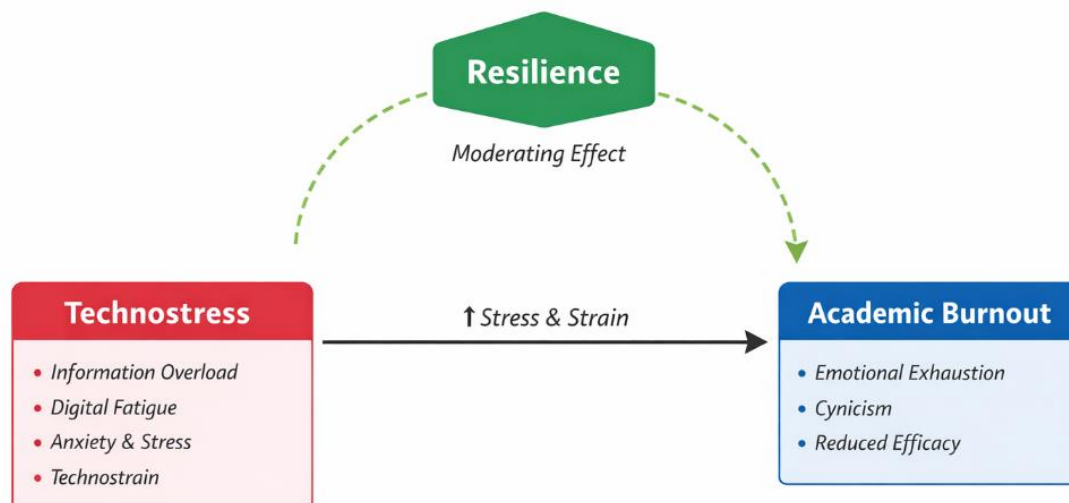


Figure 1. Conceptual Framework of the Relationship between Technostress, Resilience, and Academic Burnout

3. Methodology

3.1 Research Design

This study adopted a Systematic Literature Review (SLR) design to investigate the relationships among technostress, psychological resilience, and academic burnout in digital learning environments. The SLR design was selected to ensure a structured and methodical approach in reviewing existing research evidence. The design of this study emphasises a systematic procedure in identifying, selecting, and analysing relevant literature. It involves defining clear research focus, establishing inclusion criteria, and applying a consistent process for selecting studies. This approach allows the review to be conducted in a transparent and replicable manner. In addition, the design is oriented toward empirical evidence by focusing only on peer-reviewed research articles. The scope of the review is limited to studies published within the last five years to capture recent developments

in the field. The use of clearly defined criteria ensures that the selected studies are relevant to the research objective and comparable across different contexts.

3.2 Search Strategy and Data Sources

The literature search process began by identifying relevant keywords based on the main variables of the study, namely technostress, psychological resilience, academic burnout, and digital learning environments. These keywords were then combined into the following search string: (“technostress” OR “digital stress” OR “technology stress” OR “digital overload”) AND (“psychological resilience” OR “resilience” OR “coping” OR “self-efficacy”) AND (“academic burnout” OR “school burnout” OR “student burnout” OR “learning burnout”) AND (“digital learning” OR “online learning” OR “e-learning” OR “remote learning” OR “technology-enhanced learning”) The search was conducted using five

reputable international databases: Scopus, Web of Science (WoS), PubMed, Education Resources Information Center (ERIC), and Google Scholar. These databases were selected due to their extensive coverage of high-quality academic publications in the fields of education, psychology, and health sciences. The initial search resulted in a total of 170 identified records.

3.3 Inclusion and Exclusion Criteria

To ensure the relevance and quality of the selected studies, specific inclusion and exclusion criteria were applied. The inclusion criteria were as follows: (1) articles published in peer-reviewed journals, (2) articles written in English, (3) articles published within the last five years (2020-2026) to ensure the recency of the data, and (4) studies focusing on technostress, psychological resilience, and/or academic burnout within digital learning environments. The exclusion criteria included: (1) duplicate articles, (2) studies that were not relevant to the research topic (e.g., fake news detection, fraud detection, heavy metal pollution, inclusive education without digital components), (3) non-empirical studies (systematic reviews, meta-analyses, literature reviews, conceptual papers), and (4) publications such as books, book chapters, editorials, reports, and conference proceedings that did not meet academic journal standards.

3.4 Study Selection Process (PRISMA)

The study selection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. In the initial stage, 170 records identified from the databases were screened to remove duplicates and irrelevant studies. A total of 35 duplicate records were removed, 12 records were marked as ineligible by automation tools (non-English, non-peer-reviewed), and 8 records were removed for other reasons (books, book chapters, editorials). Next, title and abstract screening was conducted to assess the relevance of each study. Articles that did not focus on technostress, psychological resilience, academic burnout, or digital learning environments were excluded, resulting in 85 records excluded at this stage. In the subsequent stage, full-text articles were reviewed in detail to ensure alignment with the objectives of the study. Out of 30 reports

sought for retrieval, 5 reports were not retrieved due to access issues or unavailable full text. The remaining 25 reports were assessed for eligibility, and all 25 met the inclusion criteria with no further exclusions. To enhance the comprehensiveness of the review, a snowballing technique was applied by examining the reference lists of selected articles to identify additional relevant studies. Through this rigorous process, a total of 25 articles met all inclusion criteria and were included in the final analysis.

3.5 Data Extraction

Data from the selected articles were systematically extracted to ensure consistency and organisation. The extracted information included authors, year of publication, research methods, sample and context, learning model or digital environment, main variables, and key findings. This process facilitated a structured comparison across studies and supported the subsequent analysis.

3.6 Data Analysis and Coding Scheme

The analysis of the selected studies was conducted using an open coding approach. Each article was carefully read and re-read to identify key themes and patterns. Based on this process, a coding scheme was developed to categorise the studies into several aspects, including type of study, context and target group, learning model or digital environment, main variables, and key findings. Each study was assigned specific codes according to these categories to ensure systematic classification and consistency in analysis. This coding scheme enabled the researcher to identify patterns, similarities, and differences across the selected studies. The coding categories included: Type of Study (A1-A7), Context and Target Group (B1-B8), Learning/Digital Environment (C1-C8), Main Variables (D1-D14), and Key Findings (E1-E10).

3.7 Reliability and Validity

To ensure the reliability and validity of the findings, the analysis was conducted using clearly defined coding categories and systematic procedures. This approach minimised subjectivity in the interpretation of data. Furthermore, both deductive and inductive approaches were

employed. The deductive approach was used to classify studies based on predefined categories, while the inductive approach allowed for the identification of emerging themes and patterns across the literature. All selected articles were reviewed and coded by the researcher following the established coding scheme to maintain consistency.

3.8 Data Synthesis

The final stage of the study involved synthesising the findings from the selected articles. This process aimed to identify common trends, differences, and relationships among the studies regarding technostress, psychological resilience, and academic burnout in digital learning environments. Through this synthesis, the study provides a comprehensive overview of recent research findings and highlights the effectiveness of resilience in moderating the relationship between technostress and academic burnout, particularly in

the context of digital and online learning environments.

4. Findings

The findings of this systematic literature review are based on the analysis of 25 selected studies related to technostress, psychological resilience, and academic burnout across different digital learning contexts. The results reveal several dominant themes regarding how these three constructs are related to one another in digital learning environments. In addition, several moderating and mediating factors that influence these relationships were identified. Overall, the findings indicate that technostress consistently demonstrates a positive association with academic burnout, while psychological resilience serves as a protective factor that buffers this relationship across various educational levels, including higher education, secondary education, and teacher populations.



Figure 2. Key Themes and Factors Influencing Technostress, Resilience, and Academic Burnout in Digital Learning Environments

The relationships among technostress, psychological resilience, and academic burnout have been conceptualised differently across the reviewed studies. In some studies, the focus was placed on direct associations between technostress and psychological outcomes, particularly anxiety, depression, and burnout (Galvin et al., 2022; Smith et al., 2021). In these studies, technostress was

viewed as a primary predictor of psychological distress. In other studies, resilience was examined as a moderating variable that weakens the negative effects of stress on burnout (Hao et al., 2022; Okechukwu et al., 2022). In addition, several studies emphasised the mediating role of coping strategies and motivation in explaining how technostress leads to adverse psychological

outcomes (Galvin et al., 2022; Panisoara et al., 2020). Other studies highlighted the importance of digital competence and self-efficacy as protective factors that enhance resilience and reduce technostress (Wang et al., 2021; Peng et al., 2021). Furthermore, problematic digital behaviours, such as internet addiction and problematic smartphone use, were identified as both contributors to and consequences of academic burnout (Zhu et al., 2022; Jafari et al., 2022; Truzoli et al., 2020).

Interestingly, while many studies provided clear empirical evidence for pairwise relationships among these constructs, no study simultaneously examined all three constructs (technostress, resilience, and academic burnout) in a single integrated model. However, most studies implicitly linked these constructs through theoretical frameworks such as the transactional model of stress and coping, self-determination theory, and the job demands-resources model. Four main themes addressing how technostress, resilience, and academic burnout are related emerged from the analysis. These include: (1) direct effects of technostress on burnout and psychological distress, (2) the moderating role of resilience in the stress-burnout relationship, (3) mediating mechanisms (coping, motivation, digital competence), and (4) problematic digital behaviours as both causes and consequences (see Figure 2). Furthermore, several contributing factors influencing these relationships were identified. These factors include individual characteristics (gender, work status, sleep quality), digital environment factors (teaching quality, digital overload), and contextual factors (pandemic conditions, campus confinement). These factors act as both enabling and constraining elements in the relationships among technostress, resilience, and academic burnout.

4.1 How Are Technostress, Psychological Resilience, and Academic Burnout Related?

4.1.1 Direct Effects of Technostress on Burnout and Psychological Distress

Most of the reviewed studies consistently indicate that technostress is significantly associated with academic burnout and various forms of psychological distress, including anxiety,

depression, and stress. Within digital learning environments, students who experience higher levels of technostress report greater emotional exhaustion, cynicism toward academic work, and reduced personal efficacy. This direct effect has been documented across diverse educational contexts and populations.

In particular, technostress has been shown to predict anxious and depressive symptomatology among university students. Galvin et al. (2022) found that technostress was significantly associated with both anxiety and depression symptoms, with coping strategies moderating these relationships. Students who experienced higher levels of technology-related stress were more likely to report clinical levels of anxiety and depression, indicating that technostress has serious implications for mental health. Similarly, Smith et al. (2021) demonstrated that digital overload, encompassing information overload, communication overload, and social overload, was associated with higher psychological distress among college students in the United States.

Furthermore, studies have shown that technostress directly contributes to academic burnout in both student and teacher populations. Panisoara et al. (2020) found that technostress and burnout significantly mediated the relationship between motivation and continuance intention in online instruction among teachers, suggesting that technostress not only affects students but also educators who deliver digital learning. Ritter et al. (2022) reported that digital teaching during the pandemic increased workload and potential burnout among lecturers, with teaching quality varying significantly across disciplines. These findings indicate that technostress is a shared challenge across educational stakeholders.

The COVID-19 pandemic context provided a natural experiment that intensified the experience of technostress. Camacho and Barrios (2022) found that technostress significantly increased during lockdown periods, negatively affecting work-life balance and psychological well-being among teleworking employees. Similarly, Gonzalez et al. (2022) reported that students faced increased digital workload, technical difficulties, and stress

during emergency digital teaching, with digital teaching quality significantly influencing stress levels. Li et al. (2020) conducted a longitudinal study and found significant increases in anxiety, depression, and stress among college students during the COVID-19 outbreak, highlighting the prolonged psychological impact of pandemic-induced digital learning.

Academic burnout has been identified as a particularly concerning outcome of prolonged technostress exposure. Zhu et al. (2022) found a high prevalence of internet addiction (23.7%) among undergraduate students during widespread online learning, with internet addiction positively associated with academic burnout. Similarly, Jafari et al. (2022) demonstrated that internet abusive use was significantly associated with academic burnout, and academic burnout mediated the relationship between internet abuse and academic performance among nursing students. These findings suggest that technostress and problematic digital behaviours create a vicious cycle that exacerbates burnout.

Tomaszek and Muchacka-Cymerman (2022) found that student burnout was significantly associated with PTSD symptoms and existential anxiety, with academic fears strengthening these relationships. This indicates that the consequences of academic burnout extend beyond educational outcomes to broader psychological functioning. Gundogan (2022) also reported that COVID-19 student stress was positively associated with school burnout and depression, and negatively associated with subjective well-being, further confirming the detrimental effects of digital learning-related stress.

4.1.2 The Moderating Role of Psychological Resilience

A prominent theme identified across the reviewed studies is the moderating role of psychological resilience in the relationship between stress and burnout. Resilience, defined as the ability to adapt positively to adversity and significant sources of stress, has been shown to weaken or buffer the negative effects of academic stress on burnout. This moderating effect has been consistently demonstrated across different populations and digital learning contexts. Hao et al. (2022) provided

strong evidence for the moderating role of resilience in the relationship between academic stress and academic burnout. The study found that resilience significantly moderated this relationship, with students who possessed higher levels of resilience experiencing lower levels of burnout even when facing high levels of academic stress. Furthermore, the study revealed that different types of smartphone use had different moderating effects, suggesting that the way students engage with digital technology influences how resilience operates as a protective factor.

Similarly, Okechukwu et al. (2022) demonstrated that coping style and resilience moderated the relationship between academic stress and suicidal ideation among university students. This finding highlights the critical protective function of resilience in maintaining mental health under conditions of high academic pressure. Students with higher resilience were better able to cope with academic stressors and were less likely to experience severe psychological outcomes. The protective effect of resilience is also evident in the context of digital competence and self-efficacy. Wang et al. (2021) found that digital competence positively affected university students' psychological well-being through the fulfilment of basic psychological needs, including autonomy, competence, and relatedness, as framed by self-determination theory. This finding suggests that digital competence can be conceptualised as a form of resilience that enables students to navigate digital learning environments more effectively. Students who perceived themselves as digitally competent experienced lower levels of stress and higher levels of well-being.

Peng et al. (2021) further supported this finding by demonstrating that positive perceptions of the smart classroom environment were associated with higher internet self-efficacy, which can be understood as a dimension of digital resilience. Students who felt more confident in their ability to use digital technology effectively were better equipped to cope with the demands of digital learning environments, thereby reducing the negative impact of technostress on their psychological well-being. Allen et al. (2021) found that sleep duration and quality moderated the

relationship between stress and burnout among graduate students, suggesting that health behaviours interact with resilience to influence burnout outcomes. Students who maintained adequate sleep duration and quality were better able to cope with academic stress and were less likely to develop burnout. This finding highlights that resilience is not solely a psychological trait but is also influenced by behavioural factors that can be targeted through interventions.

Fiorilli et al. (2022) reported that burnout was higher among female students and working students, indicating that demographic and contextual factors influence the experience of burnout and potentially interact with resilience. These findings suggest that the protective effect of resilience may vary depending on individual characteristics and life circumstances, highlighting the need for tailored interventions that address diverse student needs.

4.1.3 Mediating Mechanisms: Coping, Motivation, and Digital Competence

Another important theme identified in the reviewed studies is the role of mediating mechanisms that explain how technostress leads to burnout and other negative psychological outcomes. Coping strategies, motivation, and digital competence have been identified as key mediators in these relationships, providing insights into the psychological processes underlying the effects of technostress. Galvin et al. (2022) found that coping strategies mediated the relationship between technostress and both anxious and depressive symptomatology. Students who employed effective coping strategies were better able to manage technostress and experienced fewer negative psychological outcomes. This finding suggests that interventions aimed at enhancing coping skills may be effective in reducing the impact of technostress on student mental health.

Panisoara et al. (2020) demonstrated that technostress and burnout significantly mediated the relationship between motivation and continuance intention in online instruction among teachers. Teachers who experienced higher levels of technostress reported lower motivation to continue using online teaching methods, and this

effect was partially explained by increased burnout. This finding has important implications for teacher professional development and support in digital learning environments. Juntunen et al. (2022) found that motivation acted as a mediator in the relationship between remote teaching experiences and psychological well-being among university students. Negative remote teaching experiences were associated with lower psychological well-being and higher exhaustion, and these effects were partially explained by changes in student motivation. Students who maintained high levels of motivation despite challenging remote learning conditions were better able to preserve their psychological well-being.

Wang et al. (2021) demonstrated that the fulfilment of basic psychological needs (autonomy, competence, relatedness) mediated the relationship between digital competence and psychological well-being. Students with higher digital competence were more likely to experience satisfaction of these basic needs, which in turn contributed to better psychological well-being. This finding aligns with self-determination theory and highlights the importance of designing digital learning environments that support students' fundamental psychological needs. Ma and Li (2021) conducted a quasi-experimental study and found that an innovative mobile-based learning method improved learning effectiveness and reduced technostress among digital media students. This finding suggests that the design of digital learning tools and platforms can influence the experience of technostress, with well-designed technology potentially reducing rather than exacerbating stress.

4.1.4 Problematic Digital Behaviours: Causes and Consequences

Problematic digital behaviours, including internet addiction, problematic smartphone use, and social media addiction, emerged as both contributors to and consequences of academic burnout in digital learning environments. The reviewed studies indicate a bidirectional relationship between maladaptive digital behaviours and psychological distress, creating cycles that can be difficult to break without intervention. Zhu et al. (2022) found

a high prevalence of internet addiction (23.7%) among undergraduate students during widespread online learning, with internet addiction positively associated with academic burnout. Students who exhibited problematic internet use patterns reported higher levels of emotional exhaustion, cynicism, and reduced academic efficacy. This finding suggests that internet addiction may be both a response to and a cause of academic burnout in digital learning contexts.

Jafari et al. (2022) further demonstrated that internet abusive use was significantly associated with academic burnout, and academic burnout mediated the relationship between internet abuse and academic performance. This mediation model suggests that internet abuse leads to burnout, which in turn impairs academic performance, highlighting the cascading effects of problematic digital behaviours on educational outcomes. Truzoli et al. (2020) found that problematic internet use was negatively associated with study motivation in higher education students. Students who engaged in problematic internet use patterns reported lower motivation to engage in academic tasks, which may contribute to the development of burnout over time. This finding indicates that motivation may serve as a mechanism linking problematic digital behaviours to burnout.

Sert and Başkale (2022) reported that increased time spent on social media and coronavirus anxiety significantly predicted higher social media addiction among students. This finding highlights the role of external stressors, such as pandemic-related anxiety, in exacerbating problematic digital behaviours, which in turn may increase vulnerability to burnout. Ortega-Ruipérez et al. (2021) found an inverted-U relationship between internet exposure and psychological adjustment among adolescents using PISA data from Spain and Latin America. This finding suggests that moderate levels of internet use may be beneficial, while both low and excessive use are associated with maladjustment. The inverted-U pattern indicates that the relationship between digital engagement and psychological outcomes is not linear, and that optimal levels of use exist.

Mädamürk et al. (2021) found that digital engagement varied by achievement goal orientation among Finnish adolescents, with different patterns of engagement linked to adaptive versus maladaptive goals. Students with mastery-oriented goals demonstrated healthier patterns of digital engagement, while those with performance-oriented or avoidant goals were more likely to exhibit problematic use patterns.

4.2 What Factors Influence the Relationships Among Technostress, Resilience, and Burnout?

4.2.1 Individual Characteristics: Gender, Work Status, and Sleep Quality

The effectiveness of resilience in buffering the negative effects of technostress on burnout is strongly influenced by individual characteristics, including gender, work status, and sleep quality. These factors determine how students experience technostress and whether resilience can effectively protect against burnout. Fiorilli et al. (2022) found that burnout was significantly higher among female students and working students compared to their male and non-working counterparts. Female students reported higher levels of emotional exhaustion and cynicism, while students who worked while studying experienced greater burnout due to the combined demands of work and academic responsibilities. These findings suggest that certain demographic groups may be more vulnerable to technostress and may require additional support to maintain psychological well-being in digital learning environments.

Allen et al. (2021) demonstrated that sleep duration and quality moderated the relationship between stress and burnout among graduate students. Students who obtained adequate sleep and reported good sleep quality were better able to cope with academic stress and were less likely to develop burnout. This finding highlights the importance of health behaviours in supporting resilience, as sleep serves as a recovery period that replenishes psychological resources depleted by stress. Hao et al. (2022) found that different types of smartphone use had different moderating effects on the relationship between stress and burnout. Students who used smartphones

primarily for academic purposes experienced different outcomes compared to those who used smartphones for entertainment or social media. This finding suggests that how students engage with technology, not just how much they use it, influences the protective effect of resilience.

4.2.2 Digital Environment Factors: Teaching Quality and Digital Overload

The quality of the digital learning environment plays a crucial role in shaping the relationships among technostress, resilience, and burnout. Teaching quality, digital overload, and the design of digital learning platforms significantly influence students' psychological experiences. Gonzalez et al. (2022) found that digital teaching quality significantly influenced students' stress levels during emergency remote teaching. Students who experienced higher quality digital instruction reported lower levels of stress, even when facing similar technological demands. This finding suggests that well-designed digital learning environments can mitigate the negative effects of technostress, while poorly designed environments can exacerbate stress and burnout.

Smith et al. (2021) demonstrated that digital overload, encompassing information overload, communication overload, and social overload, was associated with higher psychological distress among college students. Students who experienced high levels of digital overload reported greater anxiety, depression, and stress, indicating that the cumulative burden of digital demands contributes to poor mental health outcomes. Juntunen et al. (2022) found that negative remote teaching experiences were associated with lower psychological well-being and higher exhaustion among university students. Students who encountered technical difficulties, poor communication, or lack of support during remote learning were more likely to experience burnout, suggesting that the quality of the remote learning experience is a critical determinant of student well-being.

Ritter et al. (2022) reported that digital teaching increased workload and potential burnout among lecturers in Germany, with teaching quality varying significantly across disciplines. This finding

indicates that the impact of digital teaching on burnout is not uniform and may depend on disciplinary norms, institutional support, and individual teaching practices.

4.2.3 Contextual Factors: Pandemic Conditions and Campus Confinement

The broader contextual conditions in which digital learning occurs significantly influence the relationships among technostress, resilience, and burnout. The COVID-19 pandemic and associated confinement measures created unique stressors that exacerbated technostress and burnout while challenging students' resilience resources. Yan et al. (2022) found that students in campus confinement during the COVID-19 pandemic reported significant stress and mental health issues. Social support was identified as a key factor affecting mental health outcomes, with students who received adequate support from family, friends, and institutions experiencing better psychological well-being. This finding highlights the importance of social support as a resource that enhances resilience in times of crisis.

Li et al. (2020) conducted a longitudinal study and found significant increases in anxiety, depression, and stress among college students during the COVID-19 outbreak. The study revealed that the psychological impact of the pandemic persisted over time, with students continuing to experience elevated levels of distress even after the initial outbreak period. This finding underscores the prolonged nature of pandemic-related stress and the need for sustained support for students in digital learning environments. Hicks et al. (2021) reported that the pandemic increased digital use and negatively affected motivation, concentration, and well-being among undergraduate students in Canada. Students reported difficulties maintaining focus, reduced academic motivation, and decreased psychological well-being as a result of the prolonged shift to digital learning. This finding suggests that the duration of digital learning exposure may be an important factor in the development of burnout.

Bdair (2021) conducted a qualitative study examining nursing students' and faculty members' perspectives on online learning during the

COVID-19 pandemic in the UAE. Thematic analysis revealed several main issues, including poor internet connectivity, lack of interaction, increased workload, and technostress. This qualitative evidence provides rich insights into the lived experiences of students and teachers in digital learning environments, complementing the quantitative findings from other studies.

4.2.4 Teacher and Faculty Perspectives

An important finding of this review is the recognition that technostress and burnout affect not only students but also teachers and faculty members who deliver digital learning. The perspectives of educators provide valuable insights into the systemic nature of these challenges. Panisoara et al. (2020) found that technostress and burnout significantly mediated the relationship between motivation and continuance intention in online instruction among teachers in Romania. Teachers who experienced higher levels of technostress were less motivated to continue using online teaching methods, and this effect was explained by increased burnout. This finding has important implications for teacher retention and professional development in digital learning contexts.

Ritter et al. (2022) reported that digital teaching during the pandemic increased workload and potential burnout among lecturers in Germany, with teaching quality varying significantly across disciplines. Lecturers in different subject areas reported different experiences, suggesting that disciplinary contexts shape the impact of digital teaching on well-being. Bdair (2021) found that both nursing students and faculty members in the UAE reported significant challenges with online learning, including poor internet connectivity, lack of interaction, increased workload, and technostress. Faculty members expressed concerns about their ability to effectively support students in digital environments, highlighting the need for institutional support and professional development.

5. Discussions and conclusions

The findings of this systematic literature review indicate that technostress consistently demonstrates a positive and significant association

with academic burnout and various forms of psychological distress, including anxiety, depression, and stress, in digital learning environments. This result is strongly supported by prior empirical evidence demonstrating that technostress impairs students' psychological well-being through sustained exposure to digital demands, information overload, communication overload, and technological complexities (Galvin et al., 2022; Smith et al., 2021; Camacho & Barrios, 2022). From a transactional model of stress and coping perspective (Lazarus & Folkman, 1984), this can be explained by the fact that digital learning environments place continuous cognitive and emotional demands on learners, who must constantly adapt to new technologies, manage excessive information, and maintain connectivity. As a result, students experience heightened physiological arousal, emotional exhaustion, and reduced coping resources, thereby facilitating the development of academic burnout and psychological distress.

More specifically, the direct effect of technostress on academic burnout can be attributed to the unique characteristics of digital learning environments, which blur the boundaries between academic and personal life, require constant multitasking, and reduce opportunities for meaningful social interaction. Studies have shown that students experiencing high levels of technostress report greater emotional exhaustion, cynicism toward academic work, and reduced personal efficacy (Zhu et al., 2022; Jafari et al., 2022). Furthermore, the COVID-19 pandemic intensified these effects, as students were forced into emergency remote teaching without adequate preparation or institutional support (Li et al., 2020; Gonzalez et al., 2022). Such processes inherently demand continuous cognitive monitoring, rapid problem-solving, and emotional regulation, which are core resources that become depleted under chronic technostress exposure. Therefore, technostress does not merely influence learning outcomes but also fundamentally alters how students experience and engage with education in digitally mediated contexts.

A key protective factor identified in this review is psychological resilience, which serves as a buffer

against the negative effects of technostress and academic stress on burnout. The findings demonstrate that resilience consistently moderates the relationship between stress and burnout, with students who possess higher levels of resilience experiencing lower levels of burnout even under conditions of high academic pressure (Hao et al., 2022; Okechukwu et al., 2022). From a self-determination theory perspective (Ryan & Deci, 2000), this can be explained by the fact that resilient students are better able to satisfy their basic psychological needs for autonomy, competence, and relatedness even in challenging digital learning environments. Wang et al. (2021) demonstrated that digital competence, which is closely related to resilience, positively affected psychological well-being through the fulfilment of these basic needs. This shift in cognitive responsibility from external demands to internal resources is critical because it creates opportunities for students to engage in self-regulated learning, where they plan, monitor, and evaluate their own coping strategies effectively.

Furthermore, the mediating mechanisms identified in this review, including coping strategies, motivation, and digital competence, play pivotal roles in explaining how technostress leads to burnout. Galvin et al. (2022) found that coping strategies mediated the relationship between technostress and both anxious and depressive symptomatology, suggesting that students who employ effective coping mechanisms are better able to manage technology-related stress. Similarly, Panisoara et al. (2020) demonstrated that technostress and burnout mediated the relationship between motivation and continuance intention in online instruction among teachers, highlighting the importance of maintaining motivation in digital learning contexts. Juntunen et al. (2022) also found that motivation acted as a mediator between remote teaching experiences and psychological well-being. This indicates that the social cognitive foundation of self-regulated learning is instrumental in fostering both cognitive and emotional competencies simultaneously in digital environments.

The incorporation of digital competence and internet self-efficacy within the resilience framework has been shown to further amplify the

protective effects against technostress. Peng et al. (2021) found that positive perceptions of the smart classroom environment were associated with higher internet self-efficacy, which can be conceptualised as a dimension of digital resilience. Students who felt more confident in their ability to use digital technology effectively were better equipped to cope with the demands of digital learning environments. This is because such competencies provide structured scaffolding while still maintaining learner autonomy, allowing students to navigate digital platforms efficiently and reduce the cognitive load associated with technology use. Studies have demonstrated that students with higher digital competence report lower levels of technostress and better psychological well-being compared to those with lower digital competence (Wang et al., 2021; Ma & Li, 2021).

Problematic digital behaviours, including internet addiction, problematic smartphone use, and social media addiction, emerged as both contributors to and consequences of academic burnout in digital learning environments. Zhu et al. (2022) found a high prevalence of internet addiction (23.7%) among undergraduate students during widespread online learning, with internet addiction positively associated with academic burnout. Similarly, Jafari et al. (2022) demonstrated that internet abusive use was significantly associated with academic burnout, and academic burnout mediated the relationship between internet abuse and academic performance. These findings suggest a bidirectional relationship where technostress leads to maladaptive digital behaviours as coping mechanisms, which in turn exacerbate burnout and further impair academic functioning. Truzoli et al. (2020) also found that problematic internet use was negatively associated with study motivation, creating a vicious cycle of disengagement and burnout. Sert and Başkale (2022) reported that increased time spent on social media and coronavirus anxiety significantly predicted higher social media addiction, highlighting the role of external stressors in perpetuating problematic digital behaviours.

In the context of individual characteristics, this review reveals that demographic and personal factors significantly influence the relationships

among technostress, resilience, and burnout. Fiorilli et al. (2022) found that burnout was significantly higher among female students and working students compared to their male and non-working counterparts. Female students reported higher levels of emotional exhaustion and cynicism, while students who worked while studying experienced greater burnout due to the combined demands of work and academic responsibilities. This finding is particularly important because it challenges the assumption that all students experience technostress and burnout uniformly. Instead, it suggests that certain demographic groups may be more vulnerable and may require targeted interventions. Allen et al. (2021) demonstrated that sleep duration and quality moderated the relationship between stress and burnout among graduate students, indicating that health behaviours interact with resilience to influence burnout outcomes. Furthermore, Hao et al. (2022) found that different types of smartphone use had different moderating effects on the stress-burnout relationship, suggesting that the quality of digital engagement, not just the quantity, matters for psychological outcomes.

The quality of the digital learning environment emerged as another critical determinant of student psychological outcomes. Gonzalez et al. (2022) found that digital teaching quality significantly influenced students' stress levels during emergency remote teaching, with higher quality instruction associated with lower stress. Smith et al. (2021) demonstrated that digital overload, encompassing information overload, communication overload, and social overload, was associated with higher psychological distress among college students. Juntunen et al. (2022) found that negative remote teaching experiences were associated with lower psychological well-being and higher exhaustion, with motivation acting as a mediator. These findings underscore the responsibility of educational institutions to design digital learning environments that minimise technostress and support student well-being through thoughtful instructional design, clear communication, and adequate technical support.

Despite its demonstrated effectiveness in explaining these relationships, the successful

mitigation of technostress and burnout is highly contingent upon contextual and institutional factors. Teacher and faculty competence emerges as one of the most critical determinants. Effective digital learning requires teachers to adopt multiple roles, including facilitator, technologist, and emotional supporter. This demands not only strong pedagogical knowledge but also the ability to integrate technology effectively and manage complex digital classroom dynamics (Panisoara et al., 2020; Ritter et al., 2022). Without adequate preparation and institutional support, teachers may struggle to implement digital learning effectively, thereby limiting their ability to support students' psychological well-being. Bdair (2021) found that both nursing students and faculty members in the UAE reported significant challenges with online learning, including poor internet connectivity, lack of interaction, increased workload, and technostress, highlighting the need for systemic institutional support.

In addition, institutional factors such as school culture, leadership support, and resource availability play crucial roles in shaping the success of digital learning implementations. Research indicates that supportive leadership and collaborative professional environments significantly enhance teachers' willingness and ability to adopt digital pedagogies while managing their own technostress (Ritter et al., 2022). Conversely, rigid curricula, limited technological resources, high workloads, and lack of technical support may act as barriers to effective implementation. This suggests that addressing technostress and burnout requires systemic change rather than isolated individual interventions. Yan et al. (2022) found that students in campus confinement during the COVID-19 pandemic reported significant stress and mental health issues, with social support identified as a key factor affecting mental health outcomes. Students who received adequate support from family, friends, and institutions experienced better psychological well-being, highlighting the importance of social support as a resource that enhances resilience in times of crisis.

Another critical dimension highlighted in this study is the role of students' digital competence and self-

efficacy in building resilience against technostress. In contemporary education, digital technologies are integral to learning, and students with higher levels of digital competence are better equipped to navigate technology-rich learning environments effectively. Studies show that students with greater digital competence experience lower levels of technostress and higher levels of psychological well-being (Wang et al., 2021). Furthermore, recent perspectives argue that digital competence is no longer limited to technical skills but extends to cognitive, social, and ethical dimensions, reflecting a shift toward holistic digital literacy that encompasses information management, critical evaluation, and responsible online behaviour. Peng et al. (2021) demonstrated that positive perceptions of the smart classroom environment were associated with higher internet self-efficacy, which serves as a form of digital resilience that protects against technostress.

Importantly, this study also reveals that the relationships among technostress, resilience, and burnout should be understood as multidimensional and context-dependent, influenced by the interaction between individual characteristics, digital environment factors, and broader contextual conditions. This complexity underscores the need for a holistic and systemic approach to intervention. Future research should therefore focus on identifying optimal conditions for digital learning across different educational levels and cultural contexts, as well as developing integrated frameworks that incorporate psychological, pedagogical, technological, and organisational dimensions.

The findings of this review also reveal several significant research gaps that warrant attention in future studies. First, while the reviewed studies provide strong evidence for pairwise relationships among technostress, resilience, and burnout, no study simultaneously examined all three constructs in a single integrated model. This represents a critical gap in the literature, as integrated models are necessary to understand how resilience moderates or mediates the technostress-burnout relationship while accounting for confounding variables. Future research should develop and test comprehensive structural equation models that

include technostress as a predictor, resilience as a moderator or mediator, and academic burnout as an outcome, while controlling for individual and contextual factors.

Second, the majority of studies (72%) employed cross-sectional designs, limiting causal inferences about the direction of relationships among variables. Longitudinal studies that track changes in technostress, resilience, and burnout over time are urgently needed to establish temporal precedence and causality. Such studies would help determine whether technostress leads to burnout, whether burnout increases vulnerability to technostress, or whether bidirectional relationships exist. Third, higher education students were the primary focus of most studies (68%), with limited research on secondary school students, who may be particularly vulnerable to the negative effects of digital learning due to developmental factors such as limited self-regulation skills, higher susceptibility to peer influence, and ongoing brain development. Ortega-Ruipérez et al. (2021) found that excessive internet exposure was associated with psychological maladjustment among adolescents, suggesting that younger populations may require targeted attention and age-appropriate interventions.

Fourth, the geographical distribution of studies was predominantly from China, Europe, and the United States, with limited representation from Southeast Asia, Africa, Latin America, and the Middle East. Cultural differences in attitudes toward technology, educational practices, and mental health stigma may influence how technostress manifests and how resilience operates as a protective factor. Future research should prioritise cross-cultural and comparative studies to enhance the generalisability of findings. Fifth, teacher perspectives, while valuable, remain understudied relative to student populations. Given that teachers experience technostress both personally and professionally while supporting their students, more research is needed on teacher technostress, burnout, and resilience, as well as on effective professional development programs that enhance teacher digital competence and well-being.

Sixth, the measurement of technostress, resilience, and academic burnout varies considerably across studies, complicating comparisons and meta-analytic syntheses. Some studies focus on specific dimensions of technostress, such as information overload or communication overload (Smith et al., 2021), while others employ composite measures (Galvin et al., 2022). Similarly, resilience has been operationalised in diverse ways, including as a trait, a process, or an outcome (Hao et al., 2022; Okechukwu et al., 2022). Future research should work toward standardised measurement instruments that capture the multidimensional nature of these constructs while maintaining cross-study comparability. Seventh, there is limited research on effective interventions to reduce technostress and enhance resilience in digital learning environments. While the protective role of resilience is well-established, few studies have tested whether resilience can be improved through targeted interventions such as mindfulness training, cognitive-behavioural skills programs, or digital literacy courses. Intervention studies are urgently needed to translate correlational findings into practical strategies for supporting student well-being.

This study concludes that technostress is a significant predictor of academic burnout and psychological distress in digital learning environments, while psychological resilience serves as a critical protective factor that buffers these negative effects. The relationships among these constructs are mediated by coping strategies, motivation, and digital competence, and are moderated by individual characteristics (gender, work status, sleep quality), digital environment factors (teaching quality, digital overload), and contextual conditions (pandemic-related stressors, social support). Problematic digital behaviours, including internet addiction and problematic smartphone use, create bidirectional cycles that exacerbate burnout and impair academic performance.

Despite the demonstrated importance of these relationships across various educational contexts, including higher education, secondary education, and teacher populations, the successful mitigation of technostress and burnout depends on multiple

factors, including individual resilience resources, teacher competence, institutional support, and the quality of digital learning environments. Therefore, a systematic and well-supported implementation framework is essential to maximise student well-being and academic success in digital learning environments. This framework should include: (1) universal screening for technostress and burnout risk; (2) targeted resilience-building interventions for at-risk students; (3) professional development programs to enhance teacher digital competence and reduce teacher technostress; (4) institutional policies that promote healthy digital boundaries, including reasonable expectations for response times and designated technology-free periods; (5) design principles for digital learning platforms that minimise cognitive load and information overload; and (6) accessible mental health support services for students experiencing significant technostress or burnout.

By implementing such comprehensive, evidence-based approaches, educational institutions can harness the benefits of digital learning while protecting the psychological well-being of both students and teachers, ultimately fostering sustainable and human-centred digital education for the 21st century.

5.1 Limitations and recommendations for further research

This study has several limitations that need to be acknowledged. One of the main limitations is the relatively small number of studies that met the inclusion criteria. Although the review focused on recent and relevant research published within the last five years, the selected 25 articles may not fully represent the wide range of educational contexts in which technostress, psychological resilience, and academic burnout are experienced and examined. A broader inclusion of participants, such as primary and secondary school students, pre-service teachers, in-service teachers, and learners from diverse cultural and socioeconomic backgrounds, would likely provide a more comprehensive understanding of how these constructs relate to one another across different populations and settings.

Another limitation concerns the dominance of cross-sectional designs in the existing literature. The majority of the reviewed studies (72%) employed cross-sectional survey methods, which capture relationships between variables at a single point in time. This design makes it difficult to determine the direction of causality among technostress, resilience, and academic burnout. While the findings consistently demonstrate significant associations, it remains unclear whether technostress leads to burnout, whether burnout increases vulnerability to technostress, or whether bidirectional relationships exist. Most of the reviewed research evaluates the impact of technostress within a limited time frame, making it difficult to determine whether changes in resilience or burnout are sustained over time. Future research should consider longitudinal approaches to examine how technostress, resilience, and academic burnout influence each other across different stages of learning and over extended periods, including before, during, and after exposure to digital learning environments.

The findings also indicate that research on technostress and academic burnout in early childhood and secondary education is still limited compared to higher education contexts. Although some studies suggest that younger learners may be particularly vulnerable to the negative effects of excessive internet exposure and digital overload (Ortega-Ruipérez et al., 2021; Mädamürk et al., 2021), there is not enough empirical evidence to draw strong conclusions about how technostress manifests and how resilience operates at different developmental stages. Further studies are needed to explore how digital learning environments affect the psychological well-being of children and adolescents, including age-appropriate measurement instruments, developmental trajectories of resilience, and effective intervention strategies tailored to younger populations.

In addition, the role of teachers and institutional contexts has not been sufficiently explored. While several studies acknowledge the importance of teacher competence, digital teaching quality, and school support (Panisoara et al., 2020; Ritter et al., 2022; Gonzalez et al., 2022), there is limited discussion on how these factors interact in practice

to shape student outcomes. For example, while teacher technostress and burnout have been identified as significant concerns, few studies have examined how teacher well-being directly impacts student technostress and burnout through classroom interactions, instructional quality, and emotional support. Future research should examine how teacher readiness, professional development, leadership support, school culture, and institutional policies influence the successful mitigation of technostress and the promotion of resilience in digital learning environments. Qualitative and mixed-methods studies would be particularly valuable for capturing the nuanced, contextual factors that quantitative surveys may miss.

Another important limitation is the lack of comprehensive analysis linking technostress, resilience, and burnout to a wider range of learning outcomes. Most studies focus primarily on psychological outcomes such as anxiety, depression, and emotional exhaustion, with less attention given to academic outcomes such as learning achievement, engagement, motivation, and retention. While some studies have examined the relationship between academic burnout and academic performance (Jafari et al., 2022; Zhu et al., 2022), the evidence remains limited and inconsistent. Further research is needed to explore how technostress and resilience influence objective academic outcomes, including grades, course completion rates, and skill acquisition, in a more integrated manner. Understanding these relationships would help educational institutions justify investments in student well-being support based on academic as well as psychological returns.

This study also does not examine in depth how different components of digital learning environments, such as platform design, instructional quality, social interaction opportunities, and technical support, are interconnected in influencing technostress and burnout. Understanding how these elements influence each other would help in designing more effective and human-centred digital learning models. For instance, does poor platform usability directly increase technostress, or does it operate indirectly through reduced self-efficacy and

increased frustration? Do collaborative learning features buffer or exacerbate technostress? Future studies are encouraged to investigate these relationships using mediational and moderational analyses and to develop a more coherent framework for digital learning implementation that prioritises psychological well-being alongside academic outcomes.

Furthermore, there is inconsistency in the use of theoretical frameworks across the reviewed studies. While some research is grounded in clear theoretical perspectives, such as the transactional model of stress and coping, self-determination theory, or the job demands-resources model, others do not explicitly state their conceptual basis or use fragmented theoretical approaches. This may lead to differences in how technostress, resilience, and burnout are interpreted, operationalised, and applied across studies. For example, resilience has been conceptualised variously as a personality trait, a dynamic process, and an outcome, leading to different measurement approaches and analytical strategies. Future research should strengthen the use of integrated theoretical frameworks that explicitly define the relationships among technostress, resilience, and burnout, specifying the mechanisms (e.g., mediation, moderation) through which these constructs interact. The development of a unified theoretical model would support more consistent, rigorous, and comparable findings across studies.

The geographical distribution of the reviewed studies represents another significant limitation. The majority of studies were conducted in China, Europe (UK, Finland, Norway, Poland, Italy, Germany, Romania, Spain), Turkey, and the United States, with limited representation from Southeast Asia, Africa, Latin America, South Asia, and the Middle East (with the exception of Iran, UAE, and Turkey). Cultural differences in attitudes toward technology use, academic pressure, mental health stigma, social support structures, and educational systems may significantly influence how technostress manifests and how resilience operates as a protective factor. For instance, collectivist cultures may place greater emphasis on social support as a resilience resource, while individualist cultures may prioritise personal

coping strategies. Future research should prioritise cross-cultural and comparative studies across diverse geographical and cultural contexts to enhance the generalisability of findings and to identify culturally sensitive intervention strategies.

Additionally, the measurement of key constructs varies considerably across the reviewed studies, complicating comparisons and meta-analytic syntheses. Some studies focus on specific dimensions of technostress, such as information overload, communication overload, or technological complexity (Smith et al., 2021), while others employ composite measures that combine multiple dimensions (Galvin et al., 2022). Similarly, resilience has been operationalised using different scales, including the Connor-Davidson Resilience Scale, the Brief Resilience Scale, and single-item measures. Academic burnout has been measured using the Maslach Burnout Inventory-Student Survey (MBI-SS), the Oldenburg Burnout Inventory, and various adapted versions. This heterogeneity in measurement approaches limits the ability to compare effect sizes across studies and to conduct reliable meta-analyses. Future research should work toward the validation and standardisation of measurement instruments that capture the multidimensional nature of these constructs while maintaining cross-study comparability. The development of brief, reliable, and culturally adapted scales would facilitate more consistent research across diverse contexts.

Another limitation concerns the lack of intervention studies in the current literature. While the protective role of resilience is well-established through correlational and cross-sectional research, very few studies have tested whether resilience can be improved through targeted interventions, and whether such improvements actually reduce technostress and burnout. Similarly, there is limited research on the effectiveness of strategies to reduce technostress at the individual level (e.g., digital detox programs, time management training, mindfulness) or at the institutional level (e.g., platform design improvements, technical support enhancements, workload policies). Intervention studies, including randomised controlled trials and quasi-experimental designs, are urgently needed to translate correlational findings into practical,

evidence-based strategies for supporting student and teacher well-being in digital learning environments. Such studies should include pre-test, post-test, and follow-up measurements to assess both immediate and sustained effects.

The predominance of self-report measures in the reviewed studies represents an additional methodological limitation. Most studies relied exclusively on self-report questionnaires to assess technostress, resilience, burnout, anxiety, and depression. While self-report measures are efficient and practical, they are subject to various biases, including social desirability bias, recall bias, and common method variance, which may inflate observed relationships between variables. Few studies incorporated objective measures such as physiological indicators of stress (e.g., cortisol levels, heart rate variability), behavioural data (e.g., screen time logs, platform usage patterns, task completion times), or academic records. Future research should consider multi-method approaches that combine self-report with objective and physiological measures to provide more robust and valid assessments of technostress and burnout. The use of ecological momentary assessment (EMA) methods, which capture experiences in real-time and in natural contexts, could also reduce recall bias and provide richer longitudinal data.

Finally, this study does not examine in depth how different types of digital learning environments (e.g., synchronous vs. asynchronous, fully online vs. blended learning, video-based vs. text-based, individual vs. collaborative platforms) differentially influence technostress, resilience, and burnout. Given the rapid evolution of educational technologies, including the increasing use of artificial intelligence, learning analytics, virtual reality, and adaptive learning systems, understanding how specific technological features affect psychological outcomes is critically important. Future research should systematically compare different digital learning modalities and platform designs to identify features that minimise technostress and support resilience. Such research would provide actionable guidance for educational technology developers, instructional designers, and institutional decision-makers.

In summary, future research should prioritise: (1) longitudinal and experimental designs to establish causality and examine developmental trajectories; (2) diverse populations, including younger learners, teachers, and underrepresented geographical regions; (3) integrated theoretical frameworks that explicitly model mediation and moderation mechanisms; (4) standardised and validated measurement instruments; (5) intervention studies testing resilience-building and technostress-reduction strategies; (6) multi-method approaches combining self-report with objective and physiological measures; (7) comparative studies across different digital learning modalities and platform designs; and (8) qualitative and mixed-methods research to capture contextual factors and lived experiences. Addressing these gaps will significantly advance our understanding of how to create digital learning environments that are not only educationally effective but also psychologically supportive and sustainable for all learners and educators.

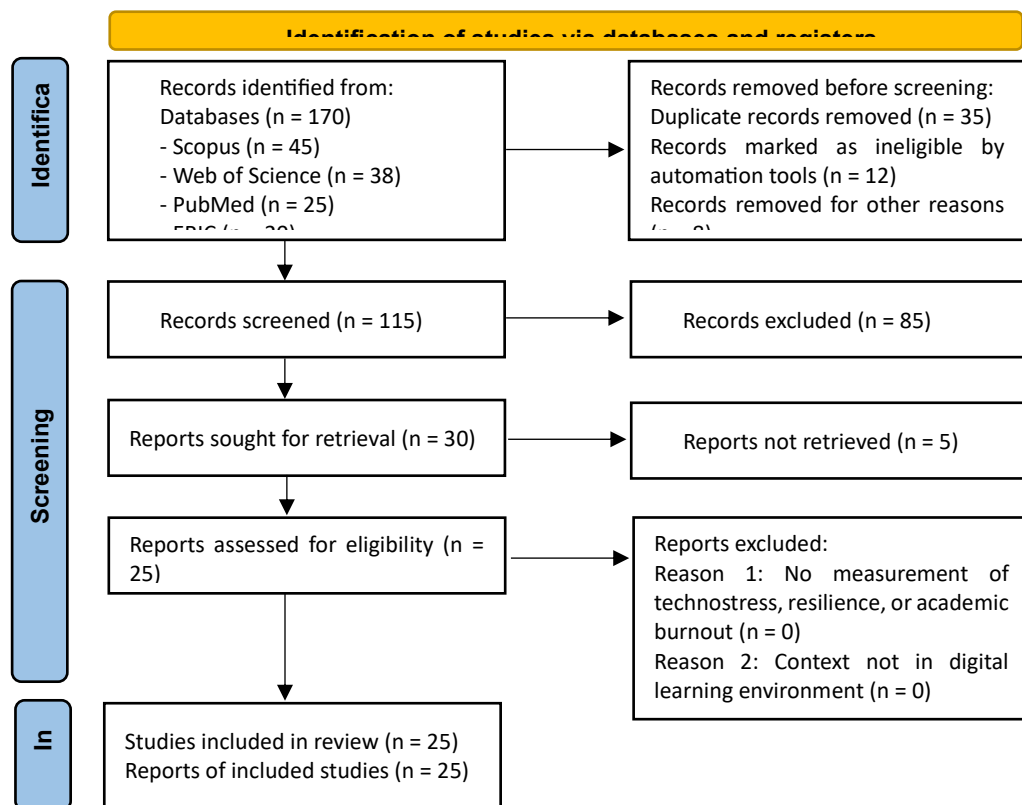
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Appendices

Appendix 1: An overview of the screening and selection



Appendix 2: Coding scheme to analyse included studies

Category	Code	Label	Definition
Type of Study	A1	Quantitative (Cross-sectional)	Refers to studies using cross-sectional survey design with statistical analysis (e.g., regression, correlation, SEM)
	A2	Quantitative (Longitudinal)	Refers to studies collecting data at multiple time points to examine changes or causal relationships
	A3	Quantitative (Quasi-experimental)	Refers to studies using quasi-experimental design without random assignment
	A4	Quantitative (Secondary analysis)	Refers to studies analyzing existing secondary data (e.g., PISA, national surveys)
	A5	Qualitative	Refers to studies using interviews, focus groups, or thematic analysis
	A6	Mixed methods	Refers to studies combining qualitative and quantitative methods
	A7	Literature / Systematic review	Refers to review-based studies (excluded from original research SLR)

Context and Target Group	B1	Early childhood / Preschool	Refers to studies conducted on children aged 4–7 years
	B2	Elementary school	Refers to studies conducted in primary school level (grades 1–6)
	B3	Secondary school	Refers to studies conducted in junior/high school (grades 7–12)
	B4	Higher education (undergraduate)	Refers to studies conducted on undergraduate university students
	B5	Higher education (graduate)	Refers to studies conducted on graduate/master/doctoral students
	B6	Teachers / Faculty / Lecturers	Refers to studies involving educators as participants
	B7	Mixed / Various groups	Refers to studies involving multiple or combined participant groups
	B8	General population / adults	Refers to non-student, non-teacher adult populations (e.g., teleworkers)
Learning / Digital Environment	C1	Fully online learning	Refers to learning conducted entirely online (synchronous/asynchronous)
	C2	Blended / Hybrid learning	Refers to combination of face-to-face and online learning
	C3	Emergency remote teaching (ERT)	Refers to forced transition to online learning during COVID-19 pandemic
	C4	Technology-enhanced learning (general)	Refers to general use of technology in learning (not fully online)
	C5	Smart classroom / Digital campus	Refers to technology-integrated physical classroom environments
	C6	Mobile learning / Smartphone-based	Refers to learning using mobile devices or smartphones
	C7	Social media-based learning	Refers to learning using social media platforms
	C8	Teleworking / Remote work	Refers to work-from-home digital environment (for teacher/employee studies)
Main Variables	D1	Technostress	Refers to stress caused by technology use (e.g., information overload, communication overload, complexity, invasion)
	D2	Digital overload	Refers to excessive digital demands (information, communication, social overload)

	D3	Problematic internet use / Internet addiction	Refers to maladaptive or compulsive internet/smartphone use
	D4	Psychological resilience	Refers to ability to cope, adapt, or recover from adversity/stress
	D5	Coping strategies	Refers to specific behavioral or cognitive strategies to manage stress
	D6	Self-efficacy (digital/technology/internet)	Refers to confidence in using digital technology effectively
	D7	Psychological well-being	Refers to overall mental health, life satisfaction, or positive functioning
	D8	Academic burnout	Refers to emotional exhaustion, depersonalization/cynicism, and reduced efficacy toward academic work
	D9	School burnout	Refers to burnout specifically related to school demands (similar to academic burnout)
	D10	Anxiety	Refers to symptoms of generalized anxiety, test anxiety, or COVID-19 related anxiety
	D11	Depression	Refers to depressive symptoms or mood disorders
	D12	Stress (general/academic)	Refers to perceived stress from academic or general life demands
	D13	Motivation	Refers to intrinsic/extrinsic motivation or amotivation toward learning
	D14	Multiple variables (≥ 3)	Refers to studies examining three or more main variables simultaneously
Key Findings	E1	Positive relationship between technostress and burnout	Refers to findings that higher technostress is associated with higher academic/school burnout
	E2	Negative relationship between technostress and well-being	Refers to findings that higher technostress is associated with lower psychological well-being
	E3	Resilience moderates stress-burnout relationship	Refers to findings that psychological resilience weakens or buffers the positive effect of stress on burnout
	E4	Resilience moderates technostress-burnout relationship	Refers to findings that psychological resilience weakens the positive effect of technostress on burnout
	E5	Coping strategies mediate technostress-outcome relationship	Refers to findings that coping strategies explain the mechanism between technostress and psychological outcomes

	E6	Digital competence / self-efficacy protects against technostress	Refers to findings that higher digital competence or self-efficacy reduces technostress or its negative effects
	E7	Problematic internet use increases burnout	Refers to findings that internet addiction or problematic use is positively associated with academic burnout
	E8	Digital overload increases psychological distress	Refers to findings that information/communication/social overload is associated with higher distress
	E9	No significant relationship found	Refers to findings that hypothesized relationships were not statistically significant
	E10	Gender/individual differences moderate relationships	Refers to findings that gender, age, or other individual factors influence the relationships

ppendix 3: Synthesis of Literature on Technostress, Psychological Well-being, and Academic Burnout in Digital Learning

No	Author(s) (Year)	Research Method	Sample Context	& Learning Variables	Model & Main	Main Findings
1	Galvin, J., et al. (2022)	Quantitative (Cross-sectional)	322 university students, UK	Learning Model: Digital learning during COVID-19 pandemic; Variables: Technostress, coping, anxious symptomatology, depressive symptomatology	Digital	Technostress is significantly associated with anxiety and depression symptoms in students. Coping strategies moderate this relationship.
2	Wang, X., Zhang, R., Wang, Z., & Li, T. (2021)	Quantitative (Cross-sectional)	University students, China	Learning Model: Digital learning during pandemic; Variables: Digital competence, psychological well-being, self-determination theory	Digital	Digital competence positively affects students' psychological well-being through fulfillment of basic psychological needs (autonomy, competence, relatedness).
3	Hao, Z., Jin, L., Huang, J., & Wu, H. (2022)	Quantitative (Cross-sectional)	University students, China	Learning Model: Smartphone use in learning; Variables: Academic stress, academic burnout, smartphone use types, problematic smartphone use, resilience	Smartphone	Resilience moderates the relationship between stress and academic burnout. Different types of smartphone use have different moderating effects.
4	Panisoara, I. O., et al. (2020)	Quantitative (Cross-sectional)	212 teachers, Romania	Learning Model: Online instruction during pandemic; Variables: Motivation,	Online	Technostress and burnout significantly mediate the relationship between

No	Author(s) (Year)	Research Method	Sample Context	& Learning Model & Variables	Main Findings
				continuance intention, burnout, technostress	motivation and continuance intention in online learning.
5	Camacho, S., & Barrios, A. (2022)	Quantitative (Longitudinal)	Teleworking employees, Spain	Learning Model: Teleworking; Variables: Technostress, work-life balance, psychological outcomes	Technostress significantly increased during COVID-19 lockdown, negatively affecting work-life balance and psychological well-being.
6	Juntunen, H., et al. (2022)	Quantitative (Cross-sectional)	University students, Finland	Learning Model: Remote teaching and learning; Variables: Remote teaching experiences, motivation, psychological well-being, exhaustion	Negative remote teaching experiences are associated with lower psychological well-being and higher exhaustion. Motivation acts as a mediator.
7	Gonzalez, R., Sørsum, H., & Raaen, K. (2022)	Quantitative (Cross-sectional)	University students, Norway	Learning Model: Emergency digital teaching; Variables: Students' perspectives, digital teaching quality, stress	Students reported increased digital workload, technical difficulties, and stress. Digital teaching quality influences stress levels.
8	Tomaszek, K., & Muchacka-Cymerman, A. (2022)	Quantitative (Cross-sectional)	Students, Poland	Learning Model: Online learning during pandemic; Variables: Student burnout, PTSD symptoms, existential anxiety, academic fears	Student burnout is significantly associated with PTSD symptoms and existential anxiety. Academic fears strengthen this relationship.
9	Zhu, K., et al. (2022)	Quantitative (Cross-sectional)	1,302 undergraduate students, China	Learning Model: Widespread online learning; Variables: Internet addiction, academic burnout	High prevalence of internet addiction (23.7%). Internet addiction is positively associated with academic burnout.
10	Gundogan, S. (2022)	Quantitative (Cross-sectional)	University students, Turkey	Learning Model: Online learning during pandemic; Variables: COVID-19 student stress, school burnout, depression, subjective well-being	COVID-19 student stress is positively associated with school burnout and depression, and negatively associated with subjective well-being.
11	Sert, H. P., & Başkale, H. (2022)	Quantitative (Cross-sectional)	Students, Turkey	Learning Model: Social media use in learning; Variables: Time spent on social media, coronavirus anxiety, social media addiction	Increased time spent on social media and coronavirus anxiety significantly predict higher social media addiction.

No	Author(s) (Year)	Research Method	Sample Context	& Learning Variables	Model & Main	Main Findings
12	Smith, A., et al. (2021)	Quantitative (Cross-sectional)	492 students, USA	Learning Model: Digital learning environment; Variables: Digital overload, mental health app use, psychological distress	Digital overload (information, communication, social overload) is associated with higher psychological distress in students.	
13	Jafari, F., et al. (2022)	Quantitative (Cross-sectional)	380 nursing students, Iran	Learning Model: Online learning; Variables: Internet abusive use, academic burnout, academic performance	Internet abusive use is significantly associated with academic burnout. Academic burnout mediates the relationship between internet abuse and academic performance.	
14	Truzoli, R., et al. (2020)	Quantitative (Cross-sectional)	Higher education students, Italy & UK	Learning Model: Technology-enhanced learning; Variables: Problematic internet use, study motivation	Problematic internet use is negatively associated with study motivation. Students show lower motivation.	
15	Allen, H. K., et al. (2021)	Quantitative (Longitudinal)	1,954 graduate students, USA	Learning Model: Graduate education; Variables: Stress, burnout, sleep duration, sleep quality	Stress and burnout are reciprocally related. Sleep duration and quality moderate the relationship.	
16	Fiorilli, C., et al. (2022)	Quantitative (Cross-sectional)	489 university students, Italy	Learning Model: Higher education; Variables: Students' burnout, gender, worker status	Burnout is higher in female students and working students. Gender and work status influence burnout levels.	
17	Ma, H., & Li, J. (2021)	Quantitative (Quasi-experimental)	Digital media students, China	Learning Model: Mobile internet technology-based learning; Variables: Learning method, learning outcomes	Innovative mobile-based learning improves effectiveness and reduces technostress.	
18	Mädamürk, K., et al. (2021)	Quantitative (Cross-sectional)	2,515 adolescents, Finland	Learning Model: Digital engagement in school; Variables: Digital engagement, achievement goal orientation	Digital engagement varies by achievement goal orientation and is linked to adaptive goals.	
19	Ortega-Ruipérez, B., et al. (2021)	Quantitative (Secondary analysis – PISA)	26,378 students, Spain & Latin America	Learning Model: Internet exposure in school; Variables: Internet exposure, adolescent adjustment, psychological risks	Excessive internet exposure is linked to psychological maladjustment. Inverted-U relationship observed.	
20	Peng, C., Shi, Y., &	Quantitative (Cross-sectional)	Students, China	Learning Model: Smart classroom; Variables:	Positive classroom perception increases	

No	Author(s) (Year)	Research Method	Sample Context	&	Learning Variables	Model	&	Main	Main Findings
	Yang, H. (2021)				Environmental internet self-efficacy			perception,	internet self-efficacy (digital resilience).
21	Ritter, M., et al. (2022)	Quantitati ve (Cross- sectional)	Lecturers students, Germany	&	Learning teaching; Variables: Teaching experience, burnout, teaching quality	Model: Digital		Digital	Digital teaching increases workload and potential burnout. Teaching quality varies.
22	Yan, C., et al. (2022)	Quantitati ve (Cross- sectional)	Students, China		Learning confinement; Variables: Mental health, stress	Model: Campus		Campus	Students report significant stress and mental health issues. Social support affects outcomes.
23	Li, H. Y., et al. (2020)	Quantitati ve (Longitudi nal)	Students, China		Learning learning during outbreak; Variables: Anxiety, depression, stress	Model: Online		Online	Significant increases in anxiety, depression, and stress during COVID-19.
24	Bdair, I. A. (2021)	Qualitative (Thematic analysis)	20 students & 10 faculty, UAE		Learning learning; Variables: Challenges, technostress	Model: Online		Online	Main issues: poor internet, lack of interaction, workload, technostress.
25	Hicks, L. J., et al. (2021)	Quantitati ve (Longitudi nal)	Undergraduat e students, Canada		Learning learning; Variables: Learning experience, psychological impact	Model: Pandemic		Pandemic	Pandemic increased digital use and negatively affected motivation, concentration, and well-being.