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TECHNOSTRESS IN ACADEMIA AMONG OLDER SCHOLARS: THE STATE OF THE ART BASED ON A SCOPING REVIEW

This paper uses a scoping review to examine technostress among older academics, focusing on the technological tools causing distress, associated health and educational challenges, and coping strategies. Following the PRISMA Protocol, five databases (Web of Science, Scopus, PubMed, ProQuest, IEEE) were searched, resulting in 27 papers for template analysis and thematic coding. An inductive approach enabled iterative theme refinement. Four technology categories – communication, administrative, research, and mobile – were linked to technostress. Challenges include strained relationships, digital threats, role ambiguity, time pressure, and health issues. Despite these, older academics employ effective coping strategies, such as leveraging technology for teaching, fostering supportive environments, flexible schedules, and advanced communication tools. The findings highlight the importance of balancing technological demands with individual well-being and provide actionable recommendations for institutions to support older academics in managing technostress effectively.

Keywords: technostress, older academics, digitalization, academia.

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1. INTRODUCTION

The "digital university" is the fourth stage of higher education institution (HEI) transformation, founded on disruptive innovations and communication technologies that radically transform the practice of higher education (Sulkowski, 2023). The percentage of users of Information and Communication Technologies (ICTs) among all academic workers significantly increased during the COVID-19 pandemic (Alvarez-Risco et al., 2021; Sun et al., 2020; World Economic Forum, 2022). Universities were suddenly forced into remote teaching and learning (Kulikowski et al., 2021), using multiple technologies. While these tools offer many benefits (Boyer-Davis, 2020), they can also lead to numerous disadvantages for users, including technostress.

Technostress is a multidimensional phenomenon defined as computer anxiety, technophobia (Khasawneh, 2018), digital anxiety (Jamaludin et al., 2023), ICT anxiety (Hsieh et al., 2020), digital stress (Rahul et al., 2017), misfit between a person and the technological environment (Wang, Li, 2019) and maladaptive disorder that originates from and is aggravated by an inability to adapt to or cope with new technologies in a healthy way (Brod, 1984). First reported as a disease, technostress was later described as the adverse effects that technology has on the mind and body of a user (Weil, Rosen, 1997). Further research delivered more nuanced and specific dimensions of technostress, like techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty (Tarafdar et al., 2007).

Studies in technostress have focused on various employees, such as knowledge workers (Cadieux et al., 2021), health professionals (Golz et al., 2021),information technology(IT) specialists (Satpathy et al., 2021). Some studies focused on senior workers as internet users (Fattori et al., 2024; Nimrod, 2017). However, the impact of digital technologies on the quality of working life among older workers is currently under-researched (Górny et al., 2017; Nadeljko et al., 2023). This issue is particularly significant due to the rising proportion of older workers in the global workforce (EUROFUND, 2023). Given the dynamic changes consisting of learning and teaching via ICT boosted by COVID-19, technostress should be of interest for HEIs also. As digital technologies become more prevalent in higher education, some academics may face challenges which are influenced also by organizational and individual factors rather than age alone. However, limited research has investigated the technology-induced stress experienced by older academics (Rasticova et al., 2022).

The purpose of this paper is threefold. First, it aims to have an in-depth analysis of the literature using the rigorous method of scoping review to synthesize the current state of evidence regarding technostress among older academics. Secondly, it offers a comprehensive and in-depth content analysis regarding three research questions: *RQ1. What kind of technological tools are associated with distress among older academics? RQ2: What types of health and educational challenges do older academics experience because of using various technologies? RQ3: How do older academics cope with the difficulties caused by technology?* Thirdly, it provides recommendations for coping with technostress extracted from the eligible papers in this scoping review.

Our study offers valuable opportunities to refine existing theories of aging (i.e., cognitive aging theory) and coping with stress (i.e., transactional theory of stress). The findings can contribute to the development of Person-Environment Fit theory by identifying mismatches between older academics' technological skills and the increasing

demands of digital tools in academia. By integrating insights from this scoping review into theoretical models, researchers can better understand age-specific responses to technostress and develop targeted interventions to support older professionals in academia.

2. METHODOLOGY

2.1. Search strategy

The scoping review was conducted using PRISMA Protocol (Tricco et al., 2018) and the methodologies described by Arksey and O'Malley (2005) and Peters et al. (2022). The protocol was registered on Open Science Framework (Pivorienė et al., 2024). Inclusion and exclusion criteria concerning the period of publication, language, studied population, topic, and type of paper are presented in Table 1.

Table 1. Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Period of publication	Published until October 2023	
Language	English	Non-English
Topic	Technostress/stress in higher education	Stress unrelated to technology
Studied population	Academics of older age (50+). The study must include at least one teacher in higher education aged over 50 years old.	Students in higher education or teachers in other educational institutions (e.g. secondary school teachers). Papers with no academic over 50 years old were excluded.
Type of paper	Peer-reviewed research papers	Conference proceedings, editorial notes, reviews, theoretical papers, grey literature

Source: developed by authors.

To identify potentially relevant papers, five bibliographic databases were searched in September-October 2023: Web of Science, Scopus, PubMed, ProQuest, and IEEE. As per inclusion citeria we adopted 50 years as the threshold because ageing and employment research commonly defines workers aged 50 and above as older workers. This approach is consistent with OECD analyses of older workers, whereas Eurostat's 55-64 category serves primarily as a statistical indicator for labour-market monitoring. The search strategies were drafted and refined through team discussion (Table 2). To ensure the search validation procedure, the search strategy for each database was tested by two team members. The final search results were exported into an Excel file.

Table 2. Search strategies

Data Source	Query used	Specific filters	Time of search
Web of Science	(”technostress” OR ”techno-stress” OR ”stress” OR ”strain” OR ”pressure” OR ”tension” OR ”anxiety” OR ”worry” OR ”distress” OR ”burden” OR ”discomfort” OR ”nervousness” OR ”unease” OR ”apprehension” OR ”agitation” OR ”anguish”) AND (”digital*” OR ”platform*” OR ”apps*” OR ”tech*” OR ”social media” OR ”chat” OR ”online*” OR ”telemedicine” OR ”cyber” OR ”virtual” OR ”computerized” OR ”computerised” OR ”electronic” OR ”ICT”) AND (”teach*” OR ”educator*” OR ”instructor*” OR ”professor*” OR ”tutor*” OR ”mentor*” OR ”academic*” OR ”lecturer*” OR ”trainer*” OR ”pedago*” OR ”master*” OR ”academ*”)	Period of publication English language Peer-reviewed	September 2023
Scopus			
PubMed			
ProQuest			
IEEE	(„stress”, digital and academ*)		October 2023

Source: developed by the authors based on the search strategies.

2.2. Selection of sources and critical appraisal

The team of six researchers discussed and developed a data selection and extraction tool in Excel. A pilot phase consisting of the screening of 50 randomized articles was done for validation. The screening consisted of two stages: 1. Titles and abstracts; 2. Full texts. The two-stage screening process was applied to ensure that all selected references met the eligibility criteria and could be used for data extraction. In both stages of screening, two independent screeners read the title, abstract, full text, and charted data into Excel. Divergent decisions were discussed firstly in pairs, and subsequently in the research team.

Based on the research questions, the team of researchers extracted these data items: Author(s), year, country; Purpose, location of the study, nationality of respondents, educational setting, target population, age group, description of the age group, gender, sample size, percentage of older workers; Research method(s), data collecting method(s), instrument used for investigating technostress, data analysis method(s), results of older age; Definition of technostress, technological tools, description of technology, faced challenges, description of challenges, taken actions, theoretical background for data analysis, recommendations, suggestions for further research, additional remarks. The process of selection is presented in Figure 1.

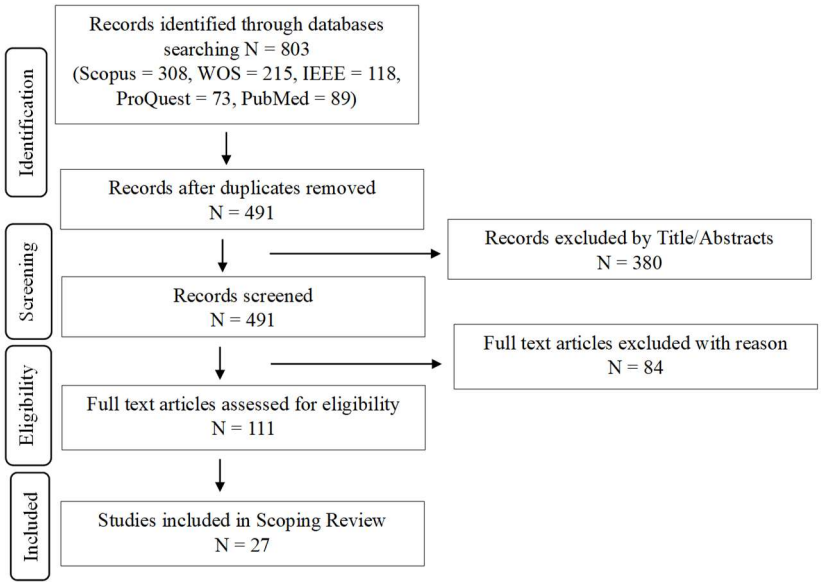


Figure 1. PRISMA protocol

Source: developd by the authors based on the search flow.

3. FINDINGS

The analytical approach used template analysis (King, 2012), and thematic coding (Braun, Clarke, 2022). Adopting an inductive approach, the analysis allowed iterative refinement of themes as researchers engaged with the data, enabling new insights to emerge. This method allowed for a structured organization of data while maintaining flexibility in coding template development, ensuring that themes were aligned with the research questions (Appendix 1). Besides themes, we also synthesized information regarding study characteristics, such as authors, country, type of population, age group, number of participants, type of method, data collection method, type of technostress, and type of technological tool.

3.1. Characteristics of studies

All studies include older academics and authors used age categories, age ranges, and mean age to describe them. There are 4 studies employed in China, 3 in Spain, 2 in Romania, 2 in India, 2 in Pakistan, 2 in Palestine, 2 in Jordan, and 2 in Malaysia. There is one study also in each of these countries: Portugal, Taiwan, Iraq, Egypt, Libya, Sultanate of Oman, Israel, Belgium, United Arab Emirates, USA, Brazil, Sri Lanka, Estonia, and Ukraine. The smallest number of participants is 14 people (García-González et al., 2020), and the highest number is 1813 (Truța et al., 2023). Seventeen studies use quantitative design, three use qualitative design, and two use mixed-method design. Of all, 26 studies included the impact of digital tools on the stress of academics and in one study this was not stated.

3.2. Research questions

3.2.1. What kind of technological tools are associated with distress among older academics?

The reviewed studies reveal a significant trend toward increased integration of ICTs in HEIs, driven by modernization agendas and recent events such as the COVID-19 pandemic(Cazan et al., 2024; Wang, Li, 2019). The rapid evolution of technology pressures older educators to continuously adapt (Cazan et al., 2024; Abilleira et al., 2021; Shaukat et al., 2022) which is reflected in their adoption of various ICT technologies for diverse academic purposes.

In the reviewed papers, four types of technologies related to work in HEI were studied: communication technologies, administrative and teaching technologies, research technologies, mobile technologies (Appendix 1).

Communication technologies (email, social media, collaboration tools) are vital for academic communication but can cause technostress (Truță et al., 2023). Perpetual connectivity leads to techno-invasion, blurring professional and personal boundaries (Dahabiyeh et al., 2022; Marrinhas et al., 2023). Information overload from emails, messages, and notifications pressures academics to maintain an active online presence (Chou,Chou, 2021; Wang, Li, 2019).Social media in academia may increase technostress, especially for older academics (Khlaif et al., 2023a). Expectations for prompt replies and ongoing involvement heighten stress and reduce well-being, as educators juggle time and focus with students' continuous access(Cameron et al., 2016).

Administrative and pedagogical technologies (LMS, VLEs) aim to enhance education but can generate technostress among older educators (Shaukat et al., 2022). Their complexity and frequent updates require ongoing learning and adaptability (Dahabiyeh et al., 2022; Wang et al., 2024). Rapid technological advances subject educators to perpetual technostress due to insufficient knowledge (Abilleira et al., 2021). Swift progression and complexity often elevate stress in older teaching professionals (Khlaif et al., 2023b). Transitioning to online instruction demands significant time investment for resource design and development(Bruggeman et al., 2022). Increased workloads from manual data entry and managing multiple sources add pressure (Siddiqui et al., 2023). The need to produce persuasive online content may lead to feelings of inadequacy and irritation, negatively affecting job satisfaction and commitment (Shaukat et al., 2022).

Research technologies (statistical software, databases, data analysis tools) are essential for advanced research but introduce unique stressors for older researchers (Abilleira et al., 2021). Their complexity and frequent updates can be overwhelming (Dahabiyeh et al., 2022; Siddiqui et al., 2023). The educator's role has shifted from knowledge transmitter to transformer, requiring integration of technology into teaching, which increases challenges in managing time and keeping up with new technologies and pedagogical methods (Shaukat et al., 2022). Researchers must continually update skills amid rapid technological changes, which can heighten anxiety and a sense of obsolescence, negatively impacting productivity and well-being (García-González et al., 2020). Mobile technologies (smartphones, tablets) offer flexibility but also contribute to technostress among older academics (Khlaif et al., 2023b). Constant accessibility leads to work-home conflict, blurring professional and personal boundaries (Wang et al., 2024). Online teaching and continuous availability pressures reduce time for personal matters, disrupting work-life balance and productivity. Users often sacrifice private time for work, feeling overwhelmed (Dahabiyeh et al., 2022). Technology's omnipresence creates expectations of constant

availability, exacerbating technostress and techno-invasion (Dahabiyeh et al., 2022; Khlaif et al.,2023b). These technologies also have psychological and physiological impacts, lowering satisfaction with learning experiences.

3.2.2. What types of health and educational challenges do older academics experience as a result of using various technologies?

Online work exposes older academics to diverse challenges in work, education, and health: student connections, colleague relationships, digital threats, role ambiguity, time pressure, support, work-family conflict, and health issues (Appendix 1). Kostikova et al. (2023) found depression, isolation, family danger, and lack of social life as key negative impacts of online education during wartime for Ukrainian academics. Online teaching offers both advantages and challenges: some academics report easier student interaction, while others note lack of informal contact, student distance, and privacy concerns (Bruggeman et al., 2022; Roy, 2020). Monitoring students in real time is harder online, complicating classroom management (Zhang et al., 2022). Poor student engagement lowers productivity, commitment, and satisfaction (Jena, 2015). Female professors may face emotional exhaustion if unable to shape student attitudes directly (García-González et al., 2020). Active student participation is crucial for effective online learning (Jamaludin et al., 2023), but expectations of 24/7 availability can be burdensome (Jena, 2015). Online teaching impacts colleague relationships: some find collaboration inspiring, others experience isolation and boundary issues Female academics may face uncertainty due to lack of direct communication with supervisors (García-González et al., 2020). Administrators' and colleagues' attitudes toward technology shape academics' technostress experiences(Khlaif et al., 2023a).Digital threats affect feedback, interaction, transparency, and flexibility (Bruggeman et al., 2022). Continuous ICT training is needed, but lack of prior training reduces control and autonomy (García-González et al., 2020). Fear of replacement by tech-savvy colleagues heightens exhaustion (Dahabiyeh et al., 2022).Rapid technological change requires constant adaptation and skill development (Jamaludin et al., 2023). Higher digital literacy lowers psychological distress (Maftei et al., 2023); limited skills increase anxiety (Khlaif et al., 2023a; Abilleira et al., 2021). Technostress is not always related to IT skills (Ibrahim et al., 2007). Many older professors still feel unprepared due to insufficient training (Pucinelli et al., 2022).

University professors face challenges in balancing multiple roles, including teaching, research, and administrative responsibilities (Bruggeman et al., 2022). Professors are expected to conduct research, secure funding, publish scientific articles, and mentor students, adding to their already demanding workload (Jena, 2015; Pucinelli et al., 2022). While online communication is often perceived positively, maintaining an equilibrium between educational duties and research activities remains problematic. Additionally, many older educators lack training in technical support, adding to their workload (Bruggeman et al., 2022). The cognitive demands of online teaching are significant, both qualitatively (requiring high intellectual effort) and quantitatively (due to high workloads and sustained attention). The mental fatigue caused by continuous work pressures can have serious implications for their cognitive and emotional well-being, reducing both efficiency and performance. A lack of autonomy further exacerbates stress, as rigid scheduling and bureaucratic evaluation systems dictate the pace of work, limiting flexibility and control over teaching practices (García-González et al., 2020).

Online education presents a double-edged effect regarding time management. Technological investments made during the transition to online teaching can lead to long-

term time savings, and the urgency of the crisis has accelerated the adoption of innovations. However, the initial design and preparation time for online courses is often insufficient, making the process more time-consuming for both older educators and students (Bruggeman et al., 2022). Another key stressor is the rigid deadlines associated with online teaching. This mode of instruction demands high cognitive and motivational effort while allowing limited flexibility. Time pressure arises when the available time to prepare and deliver content is insufficient to meet the required workload, leading to increased stress and decreased efficiency (García-González et al., 2020; Zhang et al., 2022). Support and resources play an important role in diminishing the technostress. Older faculty members appreciate institutional support, yet a clear vision for online education is often lacking, and more personalized assistance is needed to ensure smooth integration (Bruggeman et al., 2022). To successfully implement online teaching, internal (personal skills and competencies), external (technological tools and access), and organizational (institutional policies and support systems) resources are required (Jamaludin et al., 2023). While technology itself poses challenges, inefficient organizational policies regarding its use often intensify stress, affecting educators' well-being (Wang, Li, 2019). Adequate facilities and infrastructure play a crucial role in faculty acceptance of online teaching. Older academicians feel more confident and engaged when provided with well-equipped resources, whereas a lack of infrastructure can lead to feelings of inadequacy and resistance (Jamaludin et al., 2023) or to decreased job performance (Abilleira et al., 2021). Facilities and support services inspire lecturers to work (Gunasinghe,Nanayakkara, 2021), increasing their subjective well-being (Zhang et al., 2022).

The lack of a fixed schedule in online teaching is often linked to the time dynamics of the profession, where workload spikes, particularly during exams, lead to mental overload. This overload is especially burdensome for female professors, as it hinders their ability to maintain a work-life balance. The increased workload during peak periods, without additional time to manage it, can significantly impact female professors' motivation and exacerbate role conflict. These professors often feel pressured to extend their working hours into evenings and weekends, trying to juggle both work and family demands (García--González et al., 2020). Further findings indicate a significant gender difference in how academics experience workload, with female academics reporting more strain. This can be attributed to traditional gender roles, where women are expected to take on household duties in addition to their professional responsibilities, especially in regions with more conservative views (Khlaif et al., 2023a). In line with these findings, female professors were more likely to report that housework and childcare interfered with their teaching duties, a situation that was exacerbated during the pandemic (Pucinelli et al., 2022). Cultural and gendered expectations further compounded the difficulties faced by female faculty, as they were often responsible for household chores and family care while also teaching online. This dual responsibility led to significant stress and adverse effects, such as lack of family support, insufficient technology expertise, poor student engagement, and overwhelming preparation time, all contributing to the increased burden felt by female academics during the pandemic (Shaukat et al., 2022).

The reviewed articles do not focus extensively on physical health issues, however, several challenges were identified. Older academics working online face physical health challenges due to sedentarism, prolonged screen time, and inadequate ergonomic setups. Spending excessive time in front of a computer without breaks increases the risk of musculoskeletal disorders and visual fatigue. Furthermore, non-ergonomic workspaces and furniture, especially when working from home, exacerbate these issues (García-González

et al., 2020). The findings indicated an increase in psychological stress positively linked to vocal symptoms. Specifically, individuals with low prior psychological stress showed a weaker association between stress and vocal symptoms, whereas those with high prior psychological stress experienced a significantly stronger connection between the two (Besser et al., 2022). Gender differences in stress levels were evident, with female faculty members experiencing significantly higher stress than their male counterparts, although one study yielded contradictory results (Maftei et al, 2023). Women scored higher in five of eight stress measures, including nonwork activity, supervisor and coworker support, work hazards, and job stressors. Additionally, they reported more somatic health issues than male faculty. Employment status also played a role, as full-time faculty experienced significantly higher job stress and worse health outcomes compared to adjunct faculty (Cameron et al., 2016). Academics with pre-existing physical or mental health conditions reported higher burnout and technostress symptoms, indicating that prior health challenges intensify the negative effects of online work (Marrinhas et al., 2023). Additionally, the research shows that due to remote work, 42.1% of participants experienced worsened physical health and 26.3% reported deteriorated mental health. Married academics reported greater negative effects, though the difference was not statistically significant (Mosleh et al., 2022).

These findings highlight the multifaceted health risks associated with online academic work and emphasize the need for institutional support, ergonomic improvements, and mental health interventions to mitigate these challenges.

3.2.3. How do older academics cope with the difficulties caused by technology?

The integration of digital tools in higher education has brought some challenges for older faculty members. Understanding how they cope with these difficulties is critical for improving their general health and effectiveness at work. However, most reviewed studies provide recommendations for faculty members to deal with the difficulties caused by technology rather than detailing specific coping strategies.

A few articles mentioned that older academics' use of digital tools and resources helps control their workloads and reduce technostress. Faculty members who actively seek solutions for incorporating technology into teaching experience lower levels of negative technostress (Gil-Cordero et al., 2023). Lessened technostress among older educators was achieved by raising their awareness of data protection and online pedagogy (Chou, Chou, 2021). Increased digital literacy not only reduces technostress but also improves teaching effectiveness and occupational self-efficacy (Maftei et al., 2023). Comprehensive training for faculty members in various technologies and their integration in the pedagogical process is crucial for enhancing teacher proficiency and alleviating technostress (Abilleira et al., 2021). Specialized training and support for senior teachers, who face greater challenges in integrating information and communication technologies in their work, promote prosocial behaviours and foster teamwork(Wang, Li, 2019). Most of the studies suggest that universities provide training and support in using technological resources, set realistic expectations, and reduce workloads to help older lecturers deal with technostress (Bruggeman et al., 2022; Jena, 2015; Khlaif et al., 2023a; Marrinhas et al., 2023; Pucinelli et al., 2022; Siddiqui et al., 2023); For instance, Mosleh and colleagues (2022) recommended investing in online-related sessions and training for staff to stay updated on adequate pedagogical approaches using online technologies.

To address isolation and balance work with personal activities, faculty members have adapted their schedules and leveraged platforms such as smartphones for voice and text

messaging, as well as video conferencing capabilities (Cameron et al., 2016). This approach was beneficial for regular personal interactions and reduced the stress associated with immediate physical presence, contributing to overall job satisfaction. Flexible hours enabled older staff to practice better time management, with lower stress levels and improved work-life balance (Cameron et al., 2016).

Staying informed about new technological developments, avoiding resistance to change, and using stress-management techniques are recommended to minimize technostress (Jena, 2015). Furthermore, Dahabiyeh et al. (2022) propose that viewing technostress as an opportunity for personal growth can help faculty members integrate sudden changes in teaching methods with positive outcomes, thereby reducing the emotional and psychological distress. In Truta et al. (2023), collaboration between managers and HR specialists is deemed essential for implementing stress-reduction strategies and supporting employees in adapting to technological work procedures; hence, HR departments can play a pivotal role by defining programs that combat stress through health and mindfulness initiatives. Gil-Cordero et al. (2023) also suggested that managing rather than eliminating technostress is crucial, as moderate stress can enhance academic perceptions and mental well-being when coupled with proactive approaches to technology integration in classrooms. Balancing traditional methods with technological advancements is key to preventing overwhelming technological dominance in universities, while also considering gender differences in technology adoption (Gil-Cordero et al., 2023). Reinterpreting technostress as an opportunity and providing early mindset preparation and technology training were recommended as effective strategies to manage stress (Dahabiyeh et al., 2022). It was also recommended to use different resources and mindfulness techniques to overcome university teachers' stress: faith, feelings, socialization, imagination, thinking, physiological activity (Kostikova et al., 2023).

Effective management of organizational demands and the provision of appropriate resources were crucial in mitigating technostress in the reviewed articles. Creating a healthy work environment that fosters engagement in academic activities, physical exercise, and creative collaborations is important. Older faculty members were able to ease anxiety associated with online teaching by fostering a job environment with sufficient resources and lower demands, emphasizing the importance of improving subjective well-being to cope effectively with technological challenges (Zhang et al., 2022). In Gil-Cordero et al. (2023), institutions were recommended to raise awareness and implement mechanisms to support older faculty well-being, particularly post-COVID-19, where technological demands shifted behaviours. Flexible work schedules and advanced communication tools can help reduce stress levels and enhance overall job satisfaction (Besser et al., 2022).

Implementing gender-specific support is recommended to address psychosocial risks for university professors (García-González et al., 2020; Gil-Cordero et al., 2023; Pucinelli et al., 2022; Shaukat et al., 2022). Several studies suggested training programs that focus on the specific needs of women, but also on organizational changes, such as realistic adjustments to teaching loads and deadlines (García-González et al., 2020; Gil-Cordero et al., 2023; Pucinelli et al., 2022; Shaukat et al., 2022). Garcia-Gonzalez et al. (2020) recommended combining remote work with on-site work to help maintain social contact and prevent isolation. Similarly, Shaukat et al. (2022) recommended establishing virtual chat environments for female teachers to support each other during emergent situations like the COVID-19 pandemic, a measure that can enhance psychological flexibility and resilience.

The reviewed studies considered providing mental health support for faculty members, conducting regular audits, and monitoring service quality as essential in reducing technostress. Implementing comprehensive training and wellness programs to reduce stress and enhance the well-being of faculty members is widely recommended in the reviewed articles. These programs should focus on providing technical training, promoting mental health, and organizing stress-relief sessions (Besser et al., 2022; Gil-Cordero et al., 2023).

Gil-Cordero (2023) found that academics' perceptions of their mental health significantly influence their ability to manage technostress, thus faculty members with a more positive perception of their mental health tend to have a stronger academic self-perception and experience lower levels of stress. However, the same study mentions notable gender differences in the way positive mental health interacts with other factors (Gil-Cordero et al., 2023). Male academics generally reported higher positive mental health scores, indicating a more positive perception of their mental well-being compared to their female colleagues. In contrast, female academics exhibited a stronger correlation between positive mental health and organizational commitment, suggesting that their stress level is more contingent on institutional support and work environment (Gil-Cordero et al., 2023). Gunasinghe and Nanayakkara (2021) recommended recognizing individual differences (e.g., age and gender) in designing interventions to support faculty members struggling with technology use.

Offering psychological counselling is also considered to improve older academics' work-family balance and well-being during and after the pandemic (Shaukat et al., 2022). Additionally, reevaluating policies and plans for training and support was recommended as essential in minimizing the negative impact of technology enhancement.

Support from colleagues is also found to be essential for coping with technostress. Insufficient support can exacerbate stress levels, highlighting the need for robust social support systems within universities (Wang, Li, 2019). Fostering positive and inclusive workplace experiences can help faculty members navigate technological pressures more effectively (Gil-Cordero et al., 2023; Wang,Li, 2019). In addition, institutional commitment plays a key role, particularly for female academics, as they are more sensitive to changes in the organizational environment (Gil-Cordero et al., 2023). Engaging in physical activities and creative pursuits was recommended as helping academics to manage the emotional toll of technological challenges. This approach emphasizes the importance of improving subjective well-being to cope effectively with difficulties in online teaching and enhance overall academic performance (Zhang et al., 2022). Family members also can play a crucial role in helping academics manage the challenges posed by technology (Khlaif et al., 2023a; Wang,Li, 2019). In Wang et al. (2023), it was recommended that faculty members actively communicate with their family members because social support from home can buffer work-home conflict. The presence of a supportive social network, including family and friends, is critical in alleviating technostress (Kostikova et al., 2023).

The reviewed literature provides comprehensive recommendations for managing technostress among faculty members. These suggestions include strategies for understanding and addressing digital anxiety, fostering supportive organizational practices, enhancing mental health and well-being, leveraging social support and creative strategies, and improving digital literacy and continuous professional development (Appendix 1). These recommendations aim to create a balanced and effective approach to integrating technology in academic settings, ultimately enhancing the well-being and productivity of educators.

4. DISCUSSION

The findings from the scoping review align with broader literature on technostress among older academics. Our review identifies four distinct categories of technologies contributing to technostress among older academics: communication technologies, administrative and teaching technologies, research technologies, and mobile technologies.

It was confirmed in other studies that communication tools like email, video conferencing platforms (e.g., Zoom), and instant messaging apps essential for academic collaboration can lead to techno-overload and techno-invasion (Wang et al., 2024). Moreover, studies reveal that older academics often struggle with the constant connectivity and rapid pace of communication these tools demand. The expectation of being available 24/7 through communication technologies exacerbates stress levels, particularly among older users who may not adapt quickly to such demands (Agbu,Olubiyi, 2011). Additionally, the fear of inadequacy in using communication tools is more prevalent in older academics comparative to younger colleagues, as they are less familiar with digital-native practices (Wang et al., 2024). Technologies used for administrative tasks (e.g., learning management systems like Moodle) and teaching (e.g., virtual classrooms) critical for modern education can also be overwhelming. Older academics often report higher levels of techno-complexity when navigating these platforms, as they require frequent updates and advanced digital skills (Moorhouse, 2023). Specialized software for data analysis (e.g., SPSS, NVivo) or digital libraries which can be daunting for older researchers who may not have received formal training in these tools(Todd et al., 2020). A lack of institutional training programs further compounds this issue, leaving older researchers feeling alienated from technological advancements in their fields of research.

When working online and utilizing various technologies, older academics encounter a diverse array of challenges related to: connections with students, relationships with colleagues, digital threats, role ambiguity, time pressure, support and resources, work and family conflict, health challenges. It is aligned with other studies showing that the most problematic issues are time pressure, role ambiguity, and health challenges(Idris, 2011).

The integration of new technologies requires significant time to learn, adapt, and incorporate into existing workflows. This “double innovation” problem – understanding how technology works and then integrating it into teaching – adds to the already demanding schedules of older academics. Further, the shift to online work blurs traditional academic roles, creating confusion about responsibilities and duties in teaching, research, administrative duties, and now technology-related tasks (Johnson et al., 2016). Older adults are particularly vulnerable because of pre-existing health conditions or lower levels of digital literacy, with further implications for mental health such as anxiety or burnout (Fox,Felkey, 2014).

Research highlights several effective coping strategies that older faculty members employ to mitigate the negative effects of technostress: leveraging technology to enhance teaching and streamline administrative tasks, fostering a supportive and positive work environment, implementing adaptable work schedules, and embracing advanced communication tools. Among these strategies, leveraging technology and fostering a positive work environment appear to be the most impactful for reducing technostress.

According to studies grounded in Lazarus' stress theory, older workers are more likely to adopt problem-focused coping strategies over time, such as active engagement with technology. These strategies not only reduce strain but also enhance their ability to adapt to evolving technological demands(Hauk et al., 2019; Lazarus, Folkman, 1987). Studies

show also that social coping strategy like seeking help from colleagues or mentors, can mitigate feelings of isolation and inadequacy, which are common among older academics navigating unfamiliar technologies. The same authors noticed that using modern communication tools like video conferencing software or instant messaging platforms simplify older scholars' interactions and reduce barriers caused by physical distance or unfamiliarity with digital communication methods(Murray et al., 2022).

The interplay between age, coping strategies, and technostress reveals that older academics possess unique strengths – such as resilience and emotional regulation – that enable them to adopt functional coping mechanisms over time. However, institutional support remains crucial for maximizing the effectiveness of these strategies (Hauk et al., 2019).

Given the ongoing digitalization of higher education, technostress in academia represents an important and still evolving area of research.

5. CONCLUSION

The scoping review identifies four categories of technologies contributing to technostress among older academics: communication technologies, administrative and teaching technologies, research technologies, and mobile technologies. These tools, while essential for modern academic work, present significant challenges, including difficulties in maintaining connections with students, strained relationships with colleagues, digital threats, role ambiguity, time pressure, inadequate support and resources, work-family conflict, and health-related issues. Despite these challenges, older academics employ several effective coping strategies to mitigate the impact of technostress. These include leveraging technology to enhance teaching and streamline administrative tasks, fostering a supportive and positive work environment, adopting flexible work schedules to balance professional and personal responsibilities, and embracing advanced communication tools.

This study has some limitations. Firstly, we only included peer-reviewed papers written in English, which explains the shortage of papers in other languages. Their inclusion could have resulted in larger number of themes identifies. Nevertheless, approximately 90% of the scientific communication, including research papers are published in English (MacKenzie, 2015), therefore we consider having identified the relevant trends on the topic. Secondly, the eligible papers analysed all age groups, including teachers over 50 years old. Studies focusing on older academics only are scarce. However, when extracting the data we took into consideration this limitation of the studies and we selected the results applicable to our population of interest. Hence, we results are relevant for above 50 years old teachers in academia.

The scoping review highlights several key recommendations to help older academics manage technostress effectively. These strategies focus on addressing digital anxiety, fostering supportive organizational practices, enhancing mental health and well-being, leveraging social support and creative strategies, and improving digital literacy through continuous professional development.

Although this scoping review maps the existing literature, the heterogeneity of the included studies highlights the need for further empirical, qualitative, and mixed-method research to develop a deeper understanding of older academics' experiences across specific organizational and cultural contexts. Also more in-depth studies could investigate how technostress evolves over time among older academics as they adapt to new technologies. This could provide insights into whether coping strategies become more effective with

experience or if cumulative stress worsens over time. Research could explore how structured support systems – such as mentoring programs or dedicated IT assistance – impact the ability of older academics to manage technological demands. In broader sense to contribute more to theory of agism, comparative analyses between older academics and their younger counterparts could be investigated to identify age-specific challenges and coping mechanisms. This could help tailor interventions more effectively for different demographic groups.

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Appendix 1. Template of thematic analysis for research questions

Theme	Authors
RQ.1 Technological tools causing technostress	
Communication technologies	(Cameron et al., 2016; Cazan et al., 2024; Dahabiyeh et al., 2022; Khlaif et al., 2023a; Marrinhas et al., 2023; Wang & Li, 2019)
Administrative and pedagogical technologies	(Abilleira et al., 2021; Bruggeman et al., 2022; Dahabiyeh et al., 2022; Khlaif et al., 2023b; Shaukat et al., 2022; Siddiqui et al., 2023; Wang & Li, 2019)
Research technologies	(Abilleira et al., 2021; Dahabiyeh et al., 2022; García-González et al., 2020; Shaukat et al., 2022; Siddiqui et al., 2023)
Mobile technology	(Dahabiyeh et al., 2022; Khlaif et al., 2023a,b)

RQ2: Types of health and educational challenges	
Connection with students	(Bruggeman et al., 2022; García-González et al., 2020; Jamaludin et al., 2023; Jena, 2015; Zhang et al., 2022)
Relationship with colleagues	(Bruggeman et al., 2022; García-González et al., 2020; Khlaif et al., 2023b)
Digital threats	(Abilleira et al., 2021; Bruggeman et al., 2022; Dahabiyeh et al., 2022; García-González et al., 2020; Jamaludin et al., 2023; Khlaif et al., 2023b; Pucinelli et al., 2022)
Role ambiguity	(Bruggeman et al., 2022; García-González et al., 2020; Jena, 2015; Pucinelli et al., 2022)
Time pressure	(Bruggeman et al., 2022; García-González et al., 2020; Zhang et al., 2022)
Support and resources	(Abilleira et al., 2021; Bruggeman et al., 2022; Gunasinghe et al., 2021; Jamaludin et al., 2023; Wang & Li, 2019; Zhang et al., 2022)
Work and family conflict	(García-González et al., 2020; Khlaif et al., 2023a; Pucinelli et al., 2022; Shaukat et al., 2022; Wang et al., 2024)
Health challenges	(Besser et al., 2022; Cameron et al., 2016; García-González et al., 2020; Marrinhas et al., 2023; Mosleh et al., 2022)
RQ3. Coping strategies	
Utilizing to digital tools and resources	(Chou&Chou, 2021; Gil-Cordero et al., 2023)
Creating a supportive and positive job environment	(Gil-Cordero et al., 2023; Khlaif et al., 2023a; Wang & Li, 2019; Zhang et al., 2022)
Adopting flexible work schedules and advanced communication tools	(Cameron et al., 2016)
Recommendations	
Understanding and addressing digital anxiety	(Dahabiyeh et al., 2022; Gunasinghe &Nanayakkara, 2021; Jamaludin et al., 2023; Jena, 2015; Khlaif et al., 2023b; Truța et al., 2023)
Fostering supportive organizational practices	(Bruggeman et al., 2022; García-González et al., 2020; Gil-Cordero et al., 2023; Jena, 2015; Khlaif et al., 2023a; Marrinhas et al., 2023; Pucinelli et al., 2022; Shaukat et al., 2022; Siddiqui et al., 2023; Wang et al., 2023; Wang & Li, 2019)
Enhancing mental health and well-being	(Besser et al., 2022; Dahabiyeh et al., 2022; Gil-Cordero et al., 2023; Mosleh et al., 2022; Shaukat et al., 2022)
Leveraging social support and creative strategies	(Khlaif et al., 2023; Kostikova et al., 2023; Wang & Li, 2019; Zhang et al., 2022)
Improving digital literacy and continuous professional development	(Abilleira et al., 2021; Gunasinghe& Nanayakkara, 2021; Maftei et al., 2023; Shaukat et al., 2022; Wang & Li, 2019)