Humanities & Social Sciences Communications

ARTICLE

https://doi.org/10.1057/s41599-026-06677-3 OPEN

Technostress in the ivory tower: a digital burden or a manageable challenge for senior academics

Sylwia Przytuła[1], Martina Rasticova[2], Natalia Versal[3] & Pawan Kumar Mishra[2]✉

Technological changes are inevitable and often occur at a rapid pace, as seen during the COVID-19 pandemic. Arising technostress, particularly within the academic environment, may be especially challenging for older employees who might find it more difficult to adapt to new digital demands. This study seeks to investigate senior academics' awareness of technostress and examine its impact on their academic work and work-life balance. Additionally, it explores their coping strategies and the level of available institutional support. The study involved semi-structured interviews with 15 senior academics aged 55+ from Poland, the Czech Republic, and Ukraine. Data was collected between November and December 2024, and analyzed using a coding procedure and content analysis with the assistance of NVivo software. The study found that senior academics negatively perceive technostress and experience anxiety concerning technological changes. Despite the moderate to high digital skills self-rating, the transition to online teaching during the COVID-19 pandemic was initially stressful, emotionally draining, and severely impacted work-life balance. However, respondents employed various coping strategies, including self-motivation, positive thinking, and screen time limitation. The findings highlight the ongoing challenge of technostress for senior academics and the need to implement comprehensive support systems tailored to individual needs in academia.

[1] Department of Organizational Management, Wrocław University of Science and Technology, Wrocław, Poland. [2] Department of Management, Faculty of Business and Economics, Mendel University in Brno, Brno, Czech Republic. [3] Department of Insurance, Banking and Risk Management, Taras Shevchenko National University of Kyiv, Kyiv, Ukraine. ✉email: Pawan.mishra@mendelu.cz

"So, I am an optimist - definitely for a digital future,

but only if it doesn't become a digital prison" (U5)

Introduction

Technostress is a well-established phenomenon that has been extensively studied in various organizational settings and among professionals, including business people (Leitner and Rašticová 2024), IT professionals (Carlotto et al. 2017; Satpathy et al. 2021), knowledge workers (Cadieux et al. 2021), and health professionals (Golz et al. 2021). Technostress has been researched among various stakeholders of academia: university students (Alvarez-Risco et al. 2021; Harefa and Sihombing 2021; Kulikowski et al. 2022b; Kulikowski et al. 2021; Sulaiman et al. 2021), teachers at different levels of education (Siddiqui et al. 2023), researchers (Estrada-Muñoz et al. 2021; Kulikowski et al. 2022a; Penado Abilleira et al. 2021; Upadhyaya and Vrinda 2021; Wang et al. 2024; Wang et al. 2020) and non-academic staff (Raja Zirwatul Aida et al. 2007).

However, there is a lack of research focusing specifically on technostress among senior academics, representing a unique population with distinct characteristics. The age variable of academics has not been sufficiently explored in the literature, yet it may serve as an advantage or a barrier across various academic domains. On the one hand, older scholars often leverage their extensive experience in research and teaching to achieve significant scientific contributions, thereby enhancing the reputation of their institutions in academic rankings. On the other hand, they may lack the digital competencies and agility that characterize the younger generation of scholars.

In today's academic environment, developing digital competencies is essential for scholars to effectively address curricular and pedagogical needs, facilitate global research, accelerate knowledge sharing, and support their students' digital competency development as part of their regular educational practices.

The relationship between age and digital competencies among academics remains a topic of ongoing debate and conflicting findings in the literature. Several studies have explored this association, yielding inconsistent results.

While some research suggests a negative correlation between age and digital competence, with older academics demonstrating lower levels of proficiency in digital tools and technologies (Basantes-Andrade et al. 2020; Fernández-Morante et al. 2023; Guillén-Gámez and Mayorga-Fernández 2019), other studies have not found a significant relationship between these variables (Dias-Trindade et al. 2020; Inamorato dos Santos et al. 2023; Nwankwor 2021). On the contrary, Benali et al. (2018) found that academics with more years of experience had better digital competence.

Moreover, while some studies suggest that older workers may be better equipped to handle stress due to their life experience (Galliart 2020), they may experience cognitive changes associated with aging, such as declines in fluid intelligence, which can impact their ability to learn and adapt to new technologies. Older employees may also be less likely to seek help or engage in informal learning strategies when faced with technological challenges (Singh et al. 2022).

The COVID-19 pandemic has accelerated the adoption of digital technologies in academic settings, with increasing reliance on technology for teaching, research, and administrative tasks (Gorrell 2023; Sułkowski 2023); therefore, this highlights the importance of understanding technostress and its coping mechanisms among academics particularly those who are older and may face greater challenges in adapting to new technologies (Galliart 2020). Academic employees have been forced to adjust to the introduction and use of Information and Communication Technologies (ICTs) in the workplace, which has brought unexpected negative consequences for individual physical and mental health (Hidalgo-Andrade et al. 2021) as well as in individual productivity (Tarafdar et al. 2007), performance (Salanova et al. 2010).

The purpose of this study is threefold: firstly, to explore the awareness of the technostress phenomenon and its implications on academic work among senior scholars. Secondly, to recognize their personal experiences of technostress, capturing the nuances and complexities of individual encounters with technological stressors. Additionally, to investigate the perception of institutional support available to senior academics in managing and mitigating technostress, providing insights into the potential need for tailored interventions or support mechanisms within academic institutions. The institutional support in three countries due to their level of digital development of academia helps to understand the personal experiences of coping with stress.

Defining technostress

Brod (1982) introduced the term "technostress," initially defining it as "…resistance to computer technology" (p. 753). A key aspect of this work is the recognition of the inevitability of technological progress while simultaneously understanding that the introduction of new technologies causes stress in people due to uncertainty about the future. This stress has consequences, including "…delayed schedules, decreased performance, and limited productivity" (p. 753). In a subsequent work, a broader definition of technostress was provided as "…a modern disease of adaptation caused by an inability to cope with new technologies in a healthy manner" (Brod 1984, p. 16). This definition perfectly fits the new technological revolution, where humanity has transitioned into the digital age: the development of technical tools (laptops, smartphones) combined with digital platforms (Internet, social networks) and digital tools (large language models like ChatGPT) has led to the emergence of a new term—digital stress (Reinecke et al. 2017; Lanzl et al. 2022). However, the concept of technostress is universal, as it encompasses all possible changes in technology, with digitalization being just one of them. Anything new can be intimidating because it changes individuals' lifestyles, worldviews, and habits. But in reality, technostress is a two-faced Janus, presenting both positive and negative effects on those who experience it. Literature analysis shows that some researchers focus specifically on the negative consequences of technostress, such as technophobia (Rosen and Weil 1995; Brosnan 1998), technostrain (Salanova et al. 2013), computer anxiety (Van Raaij and Schepers 2008), or internet anxiety (Thatcher et al. 2007), techno-exhaustion (Maier et al. 2015), and dark-side effects like emotional and cognitive overload (Rutkowski and Saunders 2018). Laspinas (2015) expanded this concept, emphasizing that technostress encompasses physical, emotional, behavioral, and psychological dimensions. Viewing technostress in a negative context has practical significance—its measurement indicates how prepared employees are for new technologies (Arnetz and Wiholm 1997). Earlier, Brod (1982) showed the negative consequences of companies ignoring their employees' technostress. Thus, acknowledging the problem will help minimize the negative impacts of implementing new technologies, allowing companies to develop practices for managing stress. On the other hand, other researchers emphasize the positive aspects of technostress. For instance, Tarafdar et al. (2019) showed the positive side of technostress, leading to higher work effectiveness and openness to innovation and validated techno-eustress creators as techno-mastery, techno-autonomy, techno-enrichment and techno-relatedness (Tarafdar et al. 2024).

When considering methodologies for assessing attitudes toward technology, it is essential to mention theories like the Technology Acceptance Model (TAM) developed by Davis (1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003). If focusing solely on technostress, relevant methodologies include Ragu-Nathan et al. (2008), which identifies technostress creators such as techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty, as well as Nimrod (2018), who mentioned overload, invasion, complexity, privacy, and inclusion as constructs of technostress.

A questionnaire aimed at identifying both the positive and negative aspects of implementing new technologies in the educational sphere amid the jeopardizing digitalization during the COVID era was designed following this review of technostress definitions.

Technostress and academia

Concerning the title of this paper, it should be explained that a challenge is typically seen as a task or situation that requires effort, skill, or determination to overcome. It can be motivating and is often viewed positively, as it presents an opportunity for growth, learning, or achievement. Conversely, a burden refers to something that is heavy or difficult to carry, often causing stress or hardship. It is usually perceived negatively, implying a weight hindering progress or well-being.

On the one hand, when considering the burden, older academics are particularly vulnerable to digital exclusion, as they may have had less exposure to digital technologies throughout their careers. The shift towards digital learning platforms, online research databases, and virtual communication tools requires a certain level of digital proficiency. Older academicians who lack these skills may find it challenging to keep up with their younger peers, impacting their ability to effectively engage with students and colleagues. This can result in a significant gap in digital literacy compared to younger colleagues (Basantes-Andrade et al. 2020).

On the other hand, older academicians face unique challenges. Integrating digital tools in teaching and research has transformed the academic landscape, necessitating continuous learning and adaptation. Many older academicians may feel that their extensive experience and traditional teaching methods are undervalued in favor of newer, technology-driven approaches (Cao et al. 2020). Ageism further compounds the insecurity experienced by older employees (Nelson 2016). Raveh et al. (2023) proposed the definition of "techno-pedagogy," which fully encapsulates the challenges in academia. It is important to reiterate that the rapid adoption of digital technologies, which require digital skills, is not the only challenge. Remote learning, which demands new teaching skills to keep students engaged in the learning process, is also a significant challenge. This was especially true for academia in Ukraine during the full-scale Russian invasion, when weak internet connections or power issues meant students could not turn on their cameras, leaving instructors uncertain whether anyone was on the other side of the camera or what their reactions were.

All these challenges can be summarized as "technology as an enabler as it helps… perform better" (Bourlakis et al. 2023). There is a strong understanding that technologies can simplify academic work if implemented and used wisely. Technostress can be addressed from both institutional and individual perspectives. The first approach explores various programs, policies, and tools that may reduce technostress among academic employees (Nagy and Dringó-Horváth 2024; Bourlakis et al. 2023). The individual perspective focuses on describing personal experiences (Li and Wang 2021), identifying the emotional and perceptual strain of academics working in digital universities. They also stressed that "the group comparison between young and senior university teachers suggested that literacy facilitation might more greatly boost two technostress creators (techno-overload and techno-complexity) for senior teachers than young teachers" (Li and Wang 2021, p. 315). As a result, in policy development, it is important to recognize that institutional support and personal characteristics influence perceptions of digital competence among scholars (Inamorato Dos Santos et al. 2023; Li and Wang 2021).

Method

Aim and research questions. The research adopted an interpretative-symbolic paradigm, which is characterized by a descriptive-explanatory methodology and a qualitative approach, aimed at explaining a poorly recognized phenomenon or when describing individual experiences of people, when the topic is new or has not been studied in relation to a specific group (Creswell and Creswell 2018), as it is the case with older academics.

Building on the aims outlined in the introduction, the following research questions were framed to better understand the experiences of senior academic staff:

RQ1. How would you define technostress?

RQ2. How do you assess your digital skills?

RQ3. What is the impact of technostress on your academic work?

RQ4. What is the impact of technostress on work-life balance?

RQ5. How do you cope with technostress in your work?

Participants. Purposeful selection of participants for interviews was used, which is considered an optimal approach in qualitative research (Kvale and Dziuban 2012; Aspers and Corte 2019). As the selection criterion was the respondents' age of more than 55 years old, 7 participants were in the range age 55–60, 7 of them were between 61 and 70 and 1 was over 70. Interviewees represented various disciplines: economy, management, law and epidemiology. 10 respondents assessed their IT competencies as "moderate", 5 of them as "rather high" and 1 person as "low" level. The parity of the sample was kept (there were 7 female academics). Semi-structured interviews were conducted from November 2024 to December 2024 with 15 scholars from Poland (5 – PL1-PL5), the Czech Republic (5 – CZ1-CZ5), and Ukraine (5 – UA1 – UA5). The number of interviews is explained, firstly, by the fact that this sample corresponds to the principle of convenience sampling (Stratton 2023). This was due to the limited time and resources for conducting the interviews (on average, about 4 h were spent on each person: 60–90 min of the interview, 10–20 min for correspondence or telephone communication, and traveling for interviews for about 3 h). Also, most of the scholars represent the largest universities in the countries selected for analysis. Secondly, the representation of academics over 55 years old at universities and their willingness to be interviewed. The biggest challenge is gender representation. For example, in Ukraine, two male professors refused to be interviewed without explaining their reasons, while women were more willing to be interviewed. Thirdly, the saturation point was achieved after 4–5 interviews per country.

In this study, authors applied the rule of triangulation (Denzin and Lincoln 2005) of researchers (3 researchers

Table 1 Example of open coding in interviews.

Thematic units in interviews	Open coding	Example of citation
Defining and understanding technostress	– Nervousness, fear, phobias of technologies – Lack of abilities and skills to cope with digitalization	*"It's the phobias of such technologies when a person starts to stress while using some technical tools, products"* (UA5, male) *"I associate it with some sort of nervousness when faced with new technology and new devices"* (PL4, female) *„Lack of ability to work with technical tools, in internet systems, mobile communication systems, and other systems"* (UA4, female)
Digital skills and competencies	– Learning and mastering new skills due to external factors (pandemia) – Learning and mastering new skills due to internal factors (self-motivation, self-education)	*"Pandemia made the sudden push to learn new technologies. I would never learn if I didn't have to. Before the pandemic I didn't even participate in any webinar, or conference online"* (CZ4, female) *"No pressure, it was just self-motivation. We wanted to do it and so we learned"*(CZ2, female) *"I think that, first of all, there should be self-education. Because if there is no desire to master it, it becomes even more complicated"* "(UA3, female)

In axial coding, topics and categories developed in the open coding process, were narrowing while re-reading the interviews. This step was undertaken to explore how the categories are related (Table 2).

conducted interviews) and contextual triangulation (interviews were conducted in Ukraine (UA), Poland (PL), and the Czech Republic (CZ) in both face-to-face and virtual formats), which allow for an intersubjective assessment of the cognitive value of the collected material. All interviews were conducted in respondents' native languages (in Polish, Czech and Ukrainian) and then back-translated in English by researchers. This procedure was used because many of the senior academics did not speak English enough to express their perception, to name their feelings and to describe exhaustively personal experiences. Ethics approvals were provided by the Committee on Bioethics of Scientific Research of Taras Shevchenko National University of Kyiv (Kyiv, Ukraine): decision No.06, 24.10.2024 and Research Ethics Committee of Mendel University in Brno (Brno, the Czech Republic): decision 2024_8_KELS, 10.10.2024 in accordance with declaration of Helsinki. All participants were fully informed that their anonymity is assured, the purpose of the research being conducted, how their data will be utilized, and if there are any risks to them of participating.

Data analysis. The material collected from interviews with 15 academics was subjected to a coding procedure (open, axial, and selective) (Sheppard 2020) and content analysis (See Supplementary Appendix 1). The NVivo 1.6.1 Release software was helpful in the process of aggregating and organizing the data. Most of the interviews were conducted face-to-face, allowing the researchers to obtain additional contextual information, such as emotions revealed during the conversation, verbal and non-verbal expressions of the interlocutor, as well as the appearance of the workplace, atmosphere, and office equipment, which were interesting and diverse. An important premise for conducting face-to-face interviews was also the desire to build an atmosphere of trust with the interlocutor, which fosters openness and honesty in the responses, which was difficult to recreate after the pandemic period and the forced online work in all dimensions.

Open coding was conducted by independently reviewing the transcripts line-by-line (on Google Docs) to identify meaningful units of data. These open codes were then compared and grouped based on conceptual similarity and relevance to the research questions, forming preliminary categories. Through iterative discussions among the research team, these categories were further refined and merged into higher-order themes that capture the core patterns in the data. Selective coding was applied by prioritizing themes that were recurrent, salient across participants, and directly related to the study aims. Tables 1 and 2 present an example of a coding procedure.

Results

To reflect the heterogeneity of the study participants, a set of findings is presented that deliberately integrate voices across national contexts, gender identities, and disciplinary domains, thereby offering a textured understanding of how technostress manifests among senior academics. Concerning research questions, the content analysis of 15 interviews revealed a set of patterns (selective codes) that were meaningful for respondents (Table 3) (Farrow et al. 2020; Sheppard 2020).

RQ1 How would you define technostress?. According to respondents, technostress was defined as emotional and cognitive strain (selective code), where the majority of them pointed on feeling negative emotions, nervousness, stress from technology, phobias or fear of technologies as expressed in the following words:

> *"It's the phobias of such technologies when a person starts to stress while using some technical tools, products"* (UA5, male, banking)

> "*I associate it with some sort of nervousness when faced with new technology and new devices"* (PL4, female, law)

They also noticed that technostress appears due to a lack of appropriate IT skills, knowledge and competencies in this domain, as mentioned by the respondent:

> *„Lack of ability to work with technical tools, in internet systems, mobile communication systems, and other systems"* (UA4, female, statistics)

RQ2 How do you assess your digital skills?. When asked about the level of digital competencies of respondents, the majority of them (12 persons) declared moderate and high level and three persons on low level of IT skills. It should be highlighted that they performed a very ambitious approach to acquire, learn, and master those skills. They pointed to various external sources of learning and mastering digital skills, like the COVID-19 pandemic that pushed and forced them to learn new digital tools, familiarize themselves with advanced technologies, and attend webinars and tutorials.

Table 2 Example of axial and selective coding of interviews.

Open coding-example of codes	Axial coding	Selective coding
– *Nervousness, fear, phobias of technologies* • Phobias of technologies • Stress from technology • Fear of new technological tools • Nervousness when faced with new technology • Feeling that you can't do something with technology	Negative feelings, emotions	Emotional and cognitive strain
– *Lack of abilities and skills to cope with digitalization* • Lack of ability to cope with IT technologies • Technologies can be very challenging to learn • New and terrible word	Lack of skills, knowledge and competencies	
– *Learning and mastering new skills due to external factors (pandemia)* • Pandemia pushed to learn new skills • Learn digital tools • Watched tutorials and webinars • IT skills increased • Teaching management does not require advanced technologies	External factors of learning and mastering digital skills	Sources of learning and mastering digital skills/competencies
– *Learning and mastering new skills due to internal factors (self-motivation, self-education),* • Being a cybernetician by education helped • Keep trying to learn AI • Learning new software is easy • Use other innovations in personal life - I am an expert, very fluent in this • It should be self-mastering • Want to deepen my skills • English is a barrier at this age • Age conservatism is a barrier - it is scary at the beginning • No willingness not learn • Not an advanced user • Skills increased, have grown • Techno literacy increased	Internal factors of learning and mastering digital skills	

Table 3 Results of content analysis concerning research questions.

Research questions	Selective codes
RQ1. *How would you define technostress?*	• Emotional and cognitive strain
RQ2. *How do you assess your digital skills?*	• External and internal sources of learning and mastering digital skills
RQ3. *What is the impact of technostress on your academic work?*	• Psychological and emotional disruptions • Lower effectiveness of teaching
RQ4. *What is the impact of technostress on work-life balance?*	• Problem with work-life boundaries • Health condition • Psychological outcomes • Searching for balance
Factors increasing technostress	• Social relations and networking • Agism • IT/techno agility • Techno devices
RQ5. *How do you cope with technostress in your work?*	• Institutional support • Individual strategies • No using IT devices in personal life

"*Pandemia made the sudden push to learn new technologies. I would never learn if I didn't have to. Before the pandemic, I didn't even participate in any webinar or conference online*" (CZ1, female, law)

But all interviewed senior academics learned and mastered new skills due to their internal self-motivation, self-education, and individual trials to learn new software to increase techno literacy and digital skills:

"No pressure, it was just self-motivation. We wanted to do it and so we learned" (CZ2, female, epidemiology)

"I think that, first of all, there should be self-education. Because if there is no desire to master it, it becomes even more complicated" (UA3, female, economics)

"*I learned new software, but it was very easy, if you use Teams once you try 2 or 3 times you basically know what it is about"* (CZ3, male, management)

RQ3. What is the impact of technostress on your academic work?. Technostress appeared during COVID-19 and the global shift in higher education institutions to remote and emergency modes of e-learning. Respondents' personal perceptions highlighted many difficulties and problems at the beginning of facing such global turmoil. The beginning was stressful and complicated and brought confusion and fear, which caused psychological and emotional challenges. Interviewees underlined in their responses mostly negative and emotionally exhausted feelings and emotions (anxiety, not harmonious, worries, draining situation).

"*It's more about anxiety. I think you need to adapt. If you feel that you have gaps, you should look for opportunities to improve*" (UA4, female, statistics)

"*It didn't annoy me, but there was a moment of worry*" (UA4)

For two senior academics, this stressful situation was normal, natural:

"*There is no specific pressure because it is a natural thing. If you cannot teach on-site, then you simply have to find a way*" (CZ3, female, management)

"Not negative pressure, norm, and my scientific work was shaped in a different period and era,al way, no stress" (CZ2, male, epidemiology).

"Not negative pressure, normal way, no stress" (CZ2, epidemiology).

It was also noted that digital tools are used in teaching and research but in a limited way because senior scholars got used to traditional workshops:

"I use such tools to a limited extent. If such a need arises, but I am old and my scientific work was shaped in a different period and era and these habits have inevitably remained. Although ICT technology is not alien to me and when necessary I use it, but I approach it traditionally" (PL1, male, management).

The responses also showed that technostress lowered the effectiveness of teaching because the less attractive online classes caused the absence of many students. Besides, some academics were not competent enough to cope with control tests and quizzes, so they made mistakes in the evaluation of students' exams and it made remote assessment less effective:

"As for the masters' students, it was more problematic due to low attendance. But I arranged additional classes for them" (UA4, female, statistics)

"Once I made a mistake in an e-test, and many students had the same test. So you need to be careful and know all the options of these technological tools" (CZ1, female, law)

"The quality of education has been deteriorated due to online learning because each activity requires control. Remote control is much more difficult and less effective than direct supervision" (UA2, female, economics)

"I turn on Zoom, I see myself, then black squares, and I look at myself, and I don't have visual contact with the audience. And these are very serious problems too. Because you're essentially talking to yourself, it's very difficult. This greatly reduces the effectiveness of teaching" (UA5, male, banking)

RQ4 What is the impact of technostress on work-life balance?. Analyzing data from interviews concerning the impact of technostress on work-life balance (WLB), four key themes can be distinguished: a) problems with work-life boundaries, b) health condition, c) psychological outcomes, and d) methods for finding balance.

RQ4a. First, respondents pointed out difficulties and confusion with the demarcation of work and home spaces, saying that such remote mode of working is neither at home nor at work, it disturbs the peace at home, interferes with life harmony, and causes never-ending working and being all the time at work:

"*It's hard to separate personal space from work, but it must be done in any case. This is a drawback*" (UA5, male, banking).

"The remote work brought me not uncomfortable situations in some areas - you were part of the family and you shared the same flat, space. So you are not fully engaged in both parts" (CZ5, male, management)

"A big minus in remote work is maintaining the boundary between the private sphere, but I don't feel it because I'm focused on work all the time. But it definitely disturbs the peace at home" (PL3, male, managemnt)

RQ4b. The consequences of technostress concerned and overloaded also the respondents' health conditions, causing worse eyesight, back pains and a feeling of a heavy head:

"*We open a laptop or phone, and two hours fly by. The head feels heavy, and it's all in vain. You want to find something new, but it's the same: it repeats and repeats. And you get distracted. It takes a lot of time, energy, and nerves. I started to get tired, especially from the phone. After reading, my eyes hurt; there's a kind of fatigue that makes you want to rest. It needs to be minimized*" (UA1, male, economics)

"So the only negative is in organizing for oneself, that it's impossible to change the picture for oneself. You sit at the computer, you give a lecture, then you check the students' works. After checking, then you communicate with students online. In the same place, your back hurts, it's impossible to walk. It's not always possible to go outside" (UA2, female, economics)

RQ4c. Respondents listed many personal and psychological hindrances of technostress and working online, like being more nervous and getting distracted of the uncomfortable situation:

„I saw many distractions - I should clean, wash etc I needed to see the results of my works, but through so many distractions I couldn't see them, it was never-ending working" (CZ4, female, management)

One of them pointed out the "addictive effect" of online working:

"I'm not a person of social networks. I'm registered on Facebook and that's it. Sometimes I'm interested. But honestly. I read networks, but, firstly, it's addictive and sometimes it happens" (UA2, male, economics)

RQ4d: Some respondents shared with their methods and efforts to find balance through communicating with others or avoiding using IT devices:

"When you're plunged into a stressful situation, and you need to communicate with others, then you will see some progress" (UA5, male, banking)

"I want to find a balance between positives and negatives, stress and a nice comfortable situation to share, to communicate" (CZ5, male, management)

"As a rule, I don't use my phone on the metro. Making a call – yes. But sitting and reading - don't" (UA1, male, economics)

One person said that she would rather preserve the balance:

"I'm just thinking about it… I guess the proportions are preserved" (PL4, female, law)

Respondents were also asked about factors increasing technostress that are very challenging and make it difficult /decrease the effectiveness of their coping strategies. These challenges include maintaining social relations and networking, agism issues, IT/techno agility, and techno devices. All respondents frequently highlighted challenges related to weak interpersonal connections, particularly the lack of eye contact and face-to-face interactions with students and colleagues, which online activities could not fully replace. Senior academics especially missed seeing the person's face, eyes, and reactions. This longing for the "human factor" was a recurring theme throughout all the interviews:

"Satisfaction decreased precisely because of psychological factors, because you don't see the eyes of the students, the interlocutors. You don't see their reactions" (UA3, female, economics)

"Probably the worst problem was the lack of an image of the person. All these kittens and teddy bears in avatars bothered me a bit. I need to see a person's face. So I missed that" (PL3, male, management)

Many responses indicated that factors increasing technostress were linked to the respondents' age, such as conservatism, conformity, and a lack of trust or willingness to adapt.

"[…] the method of assessment - I do not trust these electronic methods. Our students are not mature enough to do this" (PL4, female, law)

"The only thing is, due to age and conservatism, it's still unknown. It's not that it's scary, but you just don't want to. You start to procrastinate to begin mastering it. But then everyone says it's simple. Then you see that everyone is using it. You subconsciously understand that if everyone is using it, it means it's simple" (UA2, female, economics)

The other stressors come from respondents' cognitive abilities, such as their lack of IT knowledge and understanding of software systems, problems with logging in and registering, and difficulty remembering many passwords and logins.

"The most challenging part is that we don't fully understand how this system works. Technical problems like turning it on, switching screens, or sending slides. Once it was set up, there were no issues with communicating with students. Registering and logging in were difficult at first. Google Sheets change, and why they do so is unclear. That was frustrating for me. It takes a lot of time. Someone who knows what they're doing can do it in 5 minutes, but you spend an hour on it" (UA1, male, economics)

"*You know how many problems there are in every system, how many new passwords, logins… it's too much for a person. Unless someone lives this, starts a password book. I wasn't taught this. Maybe it's easier for those who know one system. But we had to learn many systems, and each of them was good, unique"* (PL2, male, management)

Senior academics also pointed to technology-related stressors, such as unstable internet connections, a lack of IT devices (like computers, microphones, and cameras), frequent changes in the functionality of platforms like Zoom and Teams, and limitations in software and program capacity.

"*Sometimes stability of the internet connection was a problem. Sometimes it was about my lack of skills and technical problems with computers*" (CZ4, female, management)

"It was difficult to have a stable internet connection in the mornings-from 8-12.00 there were problems, and the system was frozen" (CZ5, male, management)

"Yes, a stable internet connection could be a problem" (CZ1, female, law)

"I tried to reorganize my life and I must say that from the point of view of efficiency it was not the best period because I had 1 stationary computer at the university without a camera or headphones. I didn't have equipment that would allow me to conduct classes properly" (PL2, male, management)

"In Teams there were continuous changes every day with functionalities so new functions appeared every day. Also the license for Microsoft because at the beginning we couldn't store our materials longer than 30 days. Then it became possible for longer, then they changed it again, the conditions of usage" (CZ3, male, management)

"It was unclear which platforms to use. We already had the Moodle platform, but it was complicated there. So we started using Zoom. Initially, the free version was limited to 40 minutes and up to 100 participants. Restarting each time was difficult for us and for the listeners" (UA3, female, economics)

RQ5 How do you cope with technostress in your work?. Respondents were also asked about factors decreasing their level of technostress. They mentioned: a) institutional support (no pressure, support from students, colleagues and managerial staff), b) individual strategies (self-motivation, personality, learning at own pace; c) positive thinking (neutralize stress; look for positives); d) limited usage of digital devices in private life

There were some factors following from institutional approach, the strategy and organizational culture of universities and supportive students which help to cope with techno strain. Majority of interviewees said they didn't experience any pressure to learn fast new skills, they had autonomy in arranging remote teaching:

"We were free to choose, to do whatever we wanted to provide lectures. It was good because were not pushed to do something they didn't like. They were usually happy with that. It was not significant pressure" (CZ3, male, management)

"All colleagues and students supported me with this technological challenge. There were no complaints, and the students were very tolerant" (UA1, male, economics)

Two respondents said that it was a hidden pressure- not explicitly expressed by the university authority to learn new IT systems and acquire digital competencies. But between the lines, it was demanded to be digitally competent to attend university meetings, department meetings:

"There wasn't great pressure, but it was a different kind of hidden pressure: either you join this process, or goodbye, the road is closed" (UA1, male, economics)

"There was not explicit pressure from university but all meetings were organized via Zoom or Teams so you had to learn by yourself to be present on these meetings" (CZ4, female, management)

To cope with digital challenges at the university, all respondents emphasized that they felt increased individual pressure to keep up, learn new tools, and stay motivated. Their own self-motivation and ambition fueled this drive:

"I felt maybe more mine own pressure, not from university. I was frightened so it was my personality. So it was no pressure, it was just self-motivation" (CZ4, female, management)

"Now I am trying to learn this artificial intelligence, there are also applications that are very helpful in this. It's just starting, so I'm trying to get a handle on it. Maybe this will be useful" (P4, female, law)

The interviews revealed another coping strategy of senior academics such as positive thinking in stressful situations:

"I try to think positively because the state of military stress today is extremely high. If you don't find some positive effects, a person can't cope. You just have to try to neutralize it by yourself" (UA4, female, statistics)

Due to the demanding nature of working online, whether fully or in a hybrid system, respondents mentioned that they consciously avoid using digital devices in their private lives to maintain mental and social well-being. They view IT devices and innovations as work-related tools and place greater value on face-to-face interactions:

"*Back then, when I had to and held public functions, I had these tools - telephones, Messenger, etc. Now I don't. And I use them when I have to. I am at a stage of life withdrawing… to an ashram so this philosophy means that these tools prevent me from maintaining harmony and reflection and departing from the world"* (PL3, male, management)

"I treat it as a tool. I think we have to control it. Just like a person has to learn to drive a car, I think it's a necessity today. But not in terms of fun, but rather in terms of supporting me in my work. However, I practically do not use the Internet for entertainment purposes, such as surfing or checking something. I don't have FB or Instagram, this is my first tool for work" (PL5, female, economics)

"No-it is work, not entertainment for me. It is a must for me" (CZ1, female, field). In sum, the reported experiences reflect a diverse cohort of senior academics, with national, disciplinary, and gendered perspectives shaping both the perception and management of technostress. This variability underscores the need for context-sensitive institutional responses.

Discussion

Participants were invited to reflect on the question, "How would you define technostress?" Older academics expressed a shared emotional vocabulary—marked by anxiety, inadequacy, and a fear of becoming obsolete. These sentiments align with Ayyagari et al. (2011), who found that rapid technological change often induces psychological strain by eroding confidence on one's skills and job security. Several respondents described the continual need to adapt to new digital tools as exhausting and as gradually eroding their sense of professional competence. These reflections reveal that technostress is experienced not simply as technological overload but as an existential disruption to professional identity. Although our qualitative data were not designed for statistical comparison, distinct national differences emerged in how technostress was articulated. Ukrainian participants situated stress within infrastructural fragility and the psychological toll of ongoing wartime disruption (Mamediieva and Moynihan 2023; Mishra and Rašticová 2024). In contrast, Czech respondents tended to view technostress as internally driven, shaped by high self-expectations and a culture of pedagogical excellence (Wang et al. 2020). Polish academics, meanwhile, pointed to institutional ambiguity and insufficient support, describing an atmosphere of implicit pressure to adapt (Bhatt and Kothari 2022). These reflections reveal that technostress is experienced not simply as technological overload but as an existential disruption to professional identity. This regional variation supports earlier research (Rašticová et al. 2024), showing that technostress is not merely an individual burden but a socially and institutionally mediated phenomenon. As Tarafdar et al. (2019) observe, meaningful mitigation requires strategies attuned to infrastructural, organizational, and socio-political context. Older academics appear especially vulnerable to technostress-induced insecurity. As accelerating pace of technological change can heighten fears about their ability to remain relevant and effective in their roles. Czaja and Sharit (2013) note that older workers often experience anxiety about learning and integrating new technologies, leading to diminished job satisfaction and greater stress. Future quantitative research, such as using the methodology proposed by Nimrod (2018), could clarify how the intensity of technostress differs between older and younger academics.

When reflecting on their digital competencies, most older academics described themselves as moderately to highly skilled. Yet such self-assessment remains subjective and often conceals disparities between perceived and actual competence. Digital proficiency in academia extends beyond operational familiarity to encompass pedagogical adaptation and critical engagement with technology. Reliable assessment of digital competence is essential for designing targeted and meaningful professional development. While countries like Poland and the Czech Republic employ DESI-based assessments of digital competence (Stofkova et al. 2022), comparable frameworks remain underdeveloped in Ukraine. Inclusive academic environments that recognize the expertise of senior scholars and promote lifelong learning are key to reducing technostress. Such initiatives can mitigate technostress while enhancing satisfaction and engagement among older academics. The evolving demands of digital academia highlight the importance of tailored training programs that address the distinct cognitive and motivational profiles of older academics. Effective programs should consider cognitive and motivational dimensions-including processing speed, working memory, attention control and integrative capacity (Kraiger 2017; Basilotta-Gómez-Pablos et al. 2022). Older academics frequently perceive themselves as moderately competent in digital domains, but self-assessment alone may obscure gaps between perceived and pedagogically required competence (Kirkwood and Price 2013).

Technostress exerts a significant impact on the emotional and psychological well-being of senior academics. The abrupt transition to online teaching during the COVID-19 pandemic intensified anxiety and disorientation, compounded by the need to adapt to new digital tools quickly. These observations correspond with prior studies linking rapid technological change to psychological strain (Ayyagari et al. 2011), anxiety stemming from perceived skill inadequacy (Consiglio et al. 2023), techno fatigue and cognitive overload (Bahamondes-Rosado et al. 2023). Reports of emotional exhaustion and overwhelm underscore the

importance of designing more supportive and gradual digital transitions. The data-based evidence also suggests that technostress diminishes the quality of academic work, particularly in teaching contexts. This pattern aligns with Hernández-Sánchez et al. (2022), who observed that the shift to online education can impair teaching quality—especially when reliance on traditional pedagogies coincides with the stress of mastering new technologies, further hindering the delivery of high-quality instruction.

Maintaining clear boundaries between professional and personal life emerged as a significant challenge, particularly in remote work contexts. This aligns with existing literature, which suggests a clear link between technostress and extended working hours, blurred boundaries, and work–family conflict (Bourlakis et al. 2023, Harunavamwe and Kanengoni 2023). For senior academics, the difficulty of adapting to emerging technologies exacerbates stress and renders psychological detachment from work increasingly difficult. Respondents reported both physical and psychological effects, such as eye strain, back pain, and increased anxiety, indicating that technostress negatively impacts overall well-being (Mishra and Rašticová 2024). These findings are also consistent with studies that have linked prolonged use of digital devices to physical discomfort and mental health challenges (Salanova et al. 2013).

Several senior academics developed personal coping mechanisms—limiting screen use during personal time, cultivating positive thinking, and engaging in social or leisure activities—mirroring the strategies identified by Hidalgo-Andrade et al. (2021). Scholars argue that meaningful support must extend beyond training to include involvement in the design of digital initiatives and ongoing recognition of diverse learning trajectories (Bohle Carbonell et al. 2013; Feeney and Bozeman 2008; Czerniewicz et al. 2020). Our findings underscore the need for context-sensitive, age-inclusive approaches that cultivate digital resilience without pathologizing ageing. The persistence of these challenges highlights the ongoing need for sustained institutional support. Institutions can consider offering training on managing work-life boundaries and embedding well-being initiatives within digital transformation policies (Stankevičiūtė 2022).

Beyond theoretical insights, the findings offer several practical implications for institutional policy. Digital training initiatives benefit from tiered, discipline-sensitive approaches that recognize how competence and motivation vary across academic career stages. These differences are not deficits but reflections of diverse pedagogical needs and professional trajectories. Modular pathways tailored to specific tools (e.g., synchronous teaching platforms versus assessment systems) may be more effective than standardized offerings. Equally vital is the inclusion of senior academics in the co-design of digital transformation processes. Their participation transforms reform from a top-down mandate into a collegial dialogue about epistemic values and pedagogical practice. Such inclusion builds institutional trust while recognizing the epistemic as well as experiential value of their contributions (Feeney and Bozeman 2008). The recurring disjunction between perceived digital competence and the pedagogical expertise required for meaningful online engagement underscores the need to move beyond notions of basic literacy. Digital mastery in higher education must become pedagogically situated—embedded in course design, learner interaction, and reflective practice (Kirkwood and Price 2013). Equally revealing was the spontaneous emergence of well-being practices—most notably deliberate digital disengagement—as forms of self-protection and adaptation. These personal strategies point to a collective need for institutions to embed reflective spaces that nurture resilience and sustain professional vitality, particularly among later-career scholars (Jandrić 2020).

The analysis explored how senior academics experience and respond to technostress amid the accelerated digital transformation during and after the COVID-19 pandemic. Five interrelated themes emerged from the inquiry, each illuminating a different dimension of how academics negotiated digital change. Five research questions guided the inquiry, and the findings offer the following conclusions.

Participants consistently described technostress as a multidimensional and largely adverse experience—rooted in anxiety, insecurity, and cognitive overload amid continual technological change. Rather than indicating a simple lack of digital competence, their responses highlighted how technostress is shaped by deeper structural and cultural factors, particularly institutional expectations, age-related stereotypes, and the psychological burden of continuous adaptation. This underscores that technostress extends beyond functional strain, touching the professional identity and overall well-being.

When discussing their digital skills, most participants portrayed themselves as moderately to highly competent, though this confidence was often tempered by hesitation and self-doubt. Though many noted that technical proficiency did not necessarily translate into confidence or ease of use. Despite the initial challenges, senior academics demonstrated a proactive and ambitious attitude toward digital upskilling. While the COVID-19 pandemic acted as a catalyst, requiring urgent engagement with digital platforms, it was ultimately intrinsic motivation that sustained their learning efforts. Many described a period of self-directed learning—attending webinars, experimenting with new tools, and reframing digital literacy as part of their evolving academic identity. Intrinsic motivation and commitment to self-education were the real driving forces behind their progress. All respondents highlighted that their improvement in digital skills was primarily due to personal initiative and a desire to stay relevant in a rapidly changing academic environment.

Technostress emerged as a pervasive influence on academic work, shaping daily routines, emotional balance, and perceptions of teaching quality. Participants of the emotional toll of digital adaptation, disruptions to teaching routines, and concerns about diminishing educational quality. The early transition was described as disorienting and emotionally taxing, marked by confusion, apprehension, and a perceived loss of control. Many respondents described the experience as emotionally draining, citing feelings of anxiety, worry, and a lack of harmony in their work. However, a smaller group viewed the disruption as a necessary stage of professional evolution, emphasizing adaptability and innovation as integral to academic life. Furthermore, the respondents noted that while they used digital tools in teaching and research, their reliance on traditional teaching methods limited the effectiveness of these tools. Assessment and evaluation were sources of strain, as many struggled to maintain fairness and control in online settings, heightening concern over compromised educational quality.

Technostress also redefined boundaries between work and home, producing personal strain, prolonged screen exposure, and a persistent blurring of professional and personal life boundaries. Participants consistently emphasized how digital work blurred the temporal and spatial boundaries of their professional and private lives, creating an enduring sense of being perpetually "on duty." This blurring also had physical manifestations—eye strain, musculoskeletal discomfort, and general fatigue were recurrently mentioned as symptoms of sustained digital immersion. Psychologically, technostress generated restlessness and distraction, eroding concentration and heightening emotional vulnerability. In response, many adopted intentional coping practices—communicating with colleagues to relieve tension, limiting device use

during personal hours, and deliberately cultivating moments of rest and disconnection.

Several compounding factors intensified technostress: weakened social connectedness, age-related cognitive strain, and recurring technical malfunctions. A recurrent motif was the longing for the "human factor" that digital mediation could not replace—the inability to read students' expressions or colleagues' reactions left many feeling detached from the emotional texture of academic life.

Coping with technostress involved a dynamic interplay between personal resilience, peer support, and institutional flexibility. Participants distinguished between institutional and personal strategies. Many appreciated that their universities allowed a degree of autonomy in organizing remote teaching, which helped mitigate pressure to master new technologies abruptly. Collegial and student support were also vital buffers against stress, reinforcing a sense of community during isolation. However, a few respondents noted that there was a subtle, unspoken expectation to be digitally competent. Self-motivation and personality traits were repeatedly cited as central coping resources. Participants described learning at their own pace, driven by professional pride and a recognition that digital competence had become integral to academic legitimacy. Intrinsic motivation frequently outweighed external pressures. Several participants consciously reframed technostress as an opportunity for renewal, adopting constructive mindsets and emphasizing balance as a form of professional self-care. Some participants set explicit boundaries on digital use in their personal lives, recognizing the need to preserve psychological and social well-being.

Taken together, these narratives reveal technostress as more than an individual strain—it is a structural and institutional phenomenon that demands nuanced, inclusive, and context-sensitive policy responses. The discussion underscores that technostress has enduring consequences for senior academics—beyond the immediate crisis of the pandemic—challenging institutions to sustain well-being and professional effectiveness in the long term. Addressing this requires institutional empathy and investment in differentiated forms of support—initiatives that go beyond technical training to foster reflective practice, peer mentoring, and adaptive digital pedagogy. In sum, the experience of technostress among senior academics offers a window into the evolving moral and cultural landscape of higher education. It reveals not merely a tension between humans and technology, but an ongoing negotiation between institutional expectations and personal meaning. The capacity to adapt, learn, and preserve one's professional identity amid digital acceleration is less a matter of technical competence than of institutional empathy and individual resilience. As universities continue to digitize, the challenge is to ensure that technological progress remains anchored in the human dimensions of academic life—care, connection, and purpose

Study limitations

While this study offers valuable insights into the experiences of senior academics with technostress, several limitations should be noted. First, the sample size was relatively small, consisting of senior academics from only three countries. This limited scope may affect the generalizability of the findings to a broader population of academics across different regions or disciplines.

The second limitation lies in the reliance on self-reported data collected through interviews. This approach can introduce various biases, such as participants potentially underestimating or overstating their experiences due to social desirability or memory recall issues. Consequently, the subjective nature of the responses means that perceptions of technostress and coping strategies may differ significantly among individuals, potentially impacting the study's findings.

Further research

Given this study's limitations, further research is needed to deepen the understanding of technostress among academics, particularly in different age groups and professional contexts. Comparative studies that include younger academics would be valuable to better understand the unique aspects of technostress experienced by senior academics. This approach would help to identify which aspects of technostress are specific to older age groups and which are common across all age groups. Such insights could inform the development of more targeted support strategies for different demographics within academic institutions.

Since this study focused on academics from specific countries, expanding the research to include academics from a broader range of cultural and institutional contexts could offer insights into how different environments and support systems influence the experience and management of technostress.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Received: 6 March 2025; Accepted: 2 February 2026;
Published online: 26 February 2026

References

Alvarez-Risco A, Del-Aguila-Arcentales S, Yáñez JA, Rosen MA, Mejia CR (2021) Influence of technostress on academic performance of University Medicine Students in Peru during the COVID-19 pandemic. Sustainability 13(16):8949. https://doi.org/10.3390/su13168949

Arnetz BB, Wiholm C (1997) Technological stress: psychophysiological symptoms in modern offices. J Psychosom Res 43(1):35–42. https://doi.org/10.1016/S0022-3999(97)00083-4

Aspers P, Corte U (2019) What is qualitative in qualitative research. Qualitative Sociol 42(2):139–160. https://doi.org/10.1007/s11133-019-9413-7

Ayyagari, Grover, Purvis (2011) Technostress: technological antecedents and implications. MIS Q 35(4):831. https://doi.org/10.2307/41409963

Bahamondes-Rosado ME, Cerdá-Suárez LM, Dodero Ortiz De Zevallos GF, Espinosa-Cristia JF (2023) Technostress at work during the COVID-19 lockdown phase (2020–2021): a systematic review of the literature. Front Psychol 14: 1173425. https://doi.org/10.3389/fpsyg.2023.1173425

Basantes-Andrade A, Cabezas-González M, Casillas-Martín S (2020) Digital competences relationship between gender and generation of university professors. Int J Adv Sci Eng Inf Technol 10(1):205–211. https://doi.org/10.18517/ijaseit.10.1.10806

Basilotta-Gómez-Pablos V, Matarranz M, Casado-Aranda L-A, Otto A (2022) Teachers' digital competencies in higher education: a systematic literature review. Int J Educ Technol High Educ 19(1):8. https://doi.org/10.1186/s41239-021-00312-8

Benali M, Kaddouri M, Azzimani T (2018) Digital competence of Moroccan teachers of English. Int J Educ Dev Using ICT 14(2):99–120

Bhatt N, Kothari TP (2022) Determinants of technostress: a systematic literature review. Eur J Bus Sci Technol 8(2):159–171

Bohle Carbonell K, Dailey-Hebert A, Gijselaers W (2013) Unleashing the creative potential of faculty to create blended learning. Internet High Educ 18:29–37. https://doi.org/10.1016/j.iheduc.2012.10.004

Bourlakis M, Nisar TM, Prabhakar G (2023) How technostress may affect employee performance in educational work environments. Technol Forecast Soc Change 193: 122674. https://doi.org/10.1016/j.techfore.2023.122674

Brod C (1982) Managing technostress: optimizing the use of computer technology. Pers J 61:753–757

Brod C (1984) Technostress: the human cost of the computer revolution. Addison-Wesley Publishing Company, Reading, USA

Brosnan MJ (1998) Technophobia: the psychological impact of information technology. London. Routledge

Cadieux N, Fournier P-L, Cadieux J, Gingues M (2021) New techno-stressors among knowledge professionals: the contribution of artificial intelligence and

websites that misinform clients. Int J Electron Commer 25(2):136–153. https://doi.org/10.1080/10864415.2021.1887695
Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, Zheng J (2020) The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Res 287: 112934. https://doi.org/10.1016/j.psychres.2020.112934
Carlotto MS, Wendt GW, Jones AP (2017) Tecno-estrés, compromiso con la carrera, satisfacción con la vida y la interacción trabajo-familia en trabajadores de la información y tecnologías de la comunicación. Actualidades En Psicolía 31(122):91. https://doi.org/10.15517/ap.v31i122.22729
Consiglio C, Massa N, Sommovigo V, Fusco L (2023) Techno-stress creators, burnout and psychological health among remote workers during the pandemic: the moderating role of E-work self-efficacy. Int J Environ Res Public Health 20(22):7051. https://doi.org/10.3390/ijerph20227051
Creswell JW, Creswell JD (2018) Research design: qualitative, quantitative, and mixed methods approaches, 5th ed. Thousand Oaks. SAGE
Czaja SJ, Sharit J (2013) Designing training and instructional programs for older adults. Boca Raton. CRC Press
Czerniewicz L, Agherdien N, Badenhorst J et al (2020) A wake-up call: equity, inequality and COVID-19 emergency remote teaching and learning. Postdigital Sci Educ 2(3):946–967. https://doi.org/10.1007/s42438-020-00187-4
Davis FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q 13(3):319. https://doi.org/10.2307/249008
Denzin NK, Lincoln YS (eds) (2005) The Sage handbook of qual itative research, 3rd ed.Thousand Oaks. Sage Publications Ltd
Dias-Trindade S, Moreira JA, Gomes Ferreira A (2020) Assessment of university teachers on their digital competences. Qwerty, 15(1). https://doi.org/10.30557/QW000025
Estrada-Muñoz C, Vega-Muñoz A, Castillo D, Müller-Pérez S, Boada-Grau J (2021) Technostress of Chilean Teachers in the context of the COVID-19 pandemic and teleworking. Int J Environ Res Public Health 18(10):5458. https://doi.org/10.3390/ijerph18105458
Farrow R, Iniesto F, Weller M, Pitt R (2020) Research methods handbook. The Open University
Feeney MK, Bozeman B (2008) Mentoring and network ties. Hum Relat 61(12):1651–1676. https://doi.org/10.1177/0018726708098081
Fernández-Morante C, López BC, Casal-Otero L, León FM (2023) Teachers' digital competence. The Case of the University System of Galicia. J N Approaches Educ Res 12(1):62–76. https://doi.org/10.7821/naer.2023.1.1139
Galliart JM (2020) Baby boomers in technology-rich environments: using PIAAC to study the association of workplace learning with technology competency. University of Arkansas. https://scholarworks.uark.edu/etd/3850
Golz C, Peter KA, Zwakhalen SMG, Hahn S (2021) Technostress among health professionals – a multilevel model and group comparisons between settings and professions. Inform Health Soc Care 46(2):137–149. https://doi.org/10.1080/17538157.2021.1872579
Gorrell A (2023) The impact of digital transformation on academic work. Stud Technol Enhanced Learn 3(2). https://doi.org/10.21428/8c225f6e.8efe18a1
Guillen-Gamez FD, Mayorga-Fernández MJ (2019) Prediction and explanation of factors that affect the digital competence of lecturers: a case study at Spanish University. Int J Learn High Educ 26(2):107–117. https://doi.org/10.18848/2327-7955/CGP/v26i02/107-117
Harefa S, Sihombing GLA (2021) Students' perception of online learning amidst the Covid-19 pandemic: a study of junior, senior high school and college students in a remote area. F1000Research 10:867. https://doi.org/10.12688/f1000research.52152.1
Harunavamwe M, Kanengoni H (2023) Hybrid and virtual work settings; the interaction between technostress, perceived organisational support, work-family conflict and the impact on work engagement. Afr J Econ Manag Stud 14(2):252–270. https://doi.org/10.1108/AJEMS-07-2022-0306
Hernández-Sánchez I, Romero Caballero S, Acuña Rodríguez M, Rocha Herrera G, Acuña Rodríguez J, Ramírez J (2022) Traditional face-to-face educational modality vs. remote face-to-face: its impact on academic performance in the context of the Covid 19 pandemic. In: Meiselwitz G, Moallem A, Zaphiris P, Ioannou A, Sottilare RA, Schwarz J, Fang X (eds) HCI International 2022—Late Breaking Papers. Interaction in New Media, Learning and Games, Vol. 13517. Springer Nature Switzerland. pp. 266–275. https://doi.org/10.1007/978-3-031-22131-6_20
Hidalgo-Andrade P, Hermosa-Bosano C, Paz C (2021) Teachers' mental health and self-reported coping strategies during the COVID-19 pandemic in ecuador: a mixed-methods study. Psychol Res Behav Manag 14:933–944. https://doi.org/10.2147/PRBM.S314844
Inamorato Dos Santos A, Chinkes E, Carvalho MAG, Solórzano CMV, Marroni LS (2023) The digital competence of academics in higher education: Is the glass half empty or half full?. Int J Educ Technol High Educ 20(1):9. https://doi.org/10.1186/s41239-022-00376-0
Jandrić P (2020) Postdigital research in the time of COVID-19. Postdigital Sci Educ 2(2):233–238. https://doi.org/10.1007/s42438-020-00113-8
Kirkwood A, Price L (2013) Technology-enhanced learning and teaching in higher education: what is 'enhanced' and how do we know? A critical literature review. Learn, Media Technol 39(1):6–36. https://doi.org/10.1080/17439884.2013.770404
Kraiger K (2017) Designing effective training for older workers. In: Parry E, McCarthy J (eds) The Palgrave handbook of age diversity and work. Palgrave Macmillan UK. pp. 639–667, https://doi.org/10.1057/978-1-137-46781-2_26
Kulikowski K, Przytula S, Sulkowski L (2021) Emergency forced pandemic e-learning – feedback from students for HEI management. Open Learn J Open Distance e-Learn 36(3):245–262. https://doi.org/10.1080/02680513.2021.1942810
Kulikowski K, Przytuła S, Sułkowski Ł (2022a) E-learning? Never again! On the unintended consequences of COVID-19 forced e-learning on academic teacher motivational job characteristics. High Educ Q 76(1):174–189. https://doi.org/10.1111/hequ.12314
Kulikowski K, Przytuła S, Sułkowski Ł, Rašticová M (2022b) Technostress of students during COVID-19—A sign of the time?: Technostress of students. Hum Technol 18(3):234–249. https://doi.org/10.14254/1795-6889.2022.18-3.3
Kvale S, Dziuban A (2012) Prowadzenie wywiadów (Wyd. 1-3 dodr). Wydawnictwo Naukowe PWN
Lanzl J, Manner-Romberg T, Nüske N, Gimpel H (2022) Digitaler Stress in Deutschland: Eine Befragung von Erwerbstätigen zu Belastung und Beanspruchung durch Arbeit mit digitalen Technologien. In: Manzei-Gorsky A, Schubert C, Von Hayek J (eds) Digitalisierung und Gesundheit. Nomos Verlagsgesellschaft mbH & Co. KG, pp. 265–302. https://doi.org/10.5771/9783748922933-265
Laspinas LM (2015) Technostress: trends and challenges in the 21st century knowledge management. Eur Sci J 11(2):205–217
Leitner I, Rašticová M (2024) Exploring technostress dynamics in consulting companies in Germany: a mixed-methods approach. Probl Perspect Manag 22(2):586–599. https://doi.org/10.21511/ppm.22(2).2024.46
Li L, Wang X (2021) Technostress inhibitors and creators and their impacts on university teachers' work performance in higher education. Cognit Technol Work 23(2):315–330. https://doi.org/10.1007/s10111-020-00625-0
Maier C, Laumer S, Eckhardt A (2015) Information technology as daily stressor: pinning down the causes of burnout. J Bus Econ 85(4):349–387. https://doi.org/10.1007/s11573-014-0759-8
Mamediieva G, Moynihan D (2023) Digital resilience in wartime: the case of Ukraine. Public Adm Rev 83(6):1512–1516. https://doi.org/10.1111/puar.13742
Mishra PK, Rašticová M (2024) Role and status of biomarkers in technostress research: a systematic review. Psychol Res Behav Manag 17:1961–1972. https://doi.org/10.2147/PRBM.S446782
Nagy JT, Dringó-Horváth I (2024) Factors influencing university teachers' technological integration. Educ Sci 14(1):55. https://doi.org/10.3390/educsci14010055
Nelson TD (2016) Promoting healthy aging by confronting ageism. Am Psychologist 71(4):276–282. https://doi.org/10.1037/a0040221
Nimrod G (2018) Technostress: measuring a new threat to well-being in later life. Aging Ment Health 22(8):1086–1093. https://doi.org/10.1080/13607863.2017.1334037
Nwankwor NA (2021) Application of ICT-based facilities for teaching and learning among technology education lecturers in Nigerian Tertiary Institutions in North-East, Nigeria. In: Dr GSK (ed) New visions in science and technology, Vol. 6. Book Publisher International (a part of SCIENCEDOMAIN International). pp. 84–97, https://doi.org/10.9734/bpi/nvst/v6/4853F
Penado Abilleira M, Rodicio-García M-L, Ríos-de Deus MP, Mosquera-González MJ (2021) Technostress in Spanish University Teachers During the COVID-19 Pandemic. Front Psychol 12: 617650. https://doi.org/10.3389/fpsyg.2021.617650
Ragu-Nathan TS, Tarafdar M, Ragu-Nathan BS, Tu Q (2008) The consequences of technostress for end users in organizations: conceptual development and empirical validation. Inf Syst Res 19(4):417–433. https://doi.org/10.1287/isre.1070.0165
Raja Zirwatul Aida RI, Azlina AB, Siti Balqis MN (2007) Techno stress: a study among academic and non academic staff. In: Dainoff MJ (ed) Ergonomics and Health Aspects of Work with Computers, Vol. 4566. Springer Berlin Heidelberg. pp. 118–124. https://doi.org/10.1007/978-3-540-73333-1_15
Raveh I, Morad S, Shacham M (2023) Sense of competence and feelings of stress of higher education faculty in the transition to remote teaching: what can we learn from COVID-19 pandemic in the long run. Sustainability 15(5):4027. https://doi.org/10.3390/su15054027
Reinecke L, Aufenanger S, Beutel ME, Dreier M, Quiring O, Stark B, Wölfling K, Müller KW (2017) Digital stress over the life span: the effects of communication load and internet multitasking on perceived stress and psychological health impairments in a German probability sample. Media Psychol 20(1):90–115. https://doi.org/10.1080/15213269.2015.1121832

Rosen LD, Weil MM (1995) Computer availability, computer experience and technophobia among public school teachers. Comput Hum Behav 11(1):9–31. https://doi.org/10.1016/0747-5632(94)00018-D
Rutkowski A-F, Saunders CS (2018) Emotional and cognitive overload: the dark side of information technology, 1st ed. Routledge. https://doi.org/10.4324/9781315167275
Salanova M, Llorens S, Cifre E (2013) The dark side of technologies: technostress among users of information and communication technologies. Int J Psychol 48(3):422–436. https://doi.org/10.1080/00207594.2012.680460
Salanova M, Schaufeli W, Martínez I, Bresó E (2010) How obstacles and facilitators predict academic performance: the mediating role of study burnout and engagement. Anxiety Stress Coping 23(1):53–70. https://doi.org/10.1080/10615800802609965
Satpathy S, Patel G, Kumar K (2021) Identifying and ranking techno-stressors among IT employees due to work from home arrangement during Covid-19 pandemic. Decision 48(4):391–402. https://doi.org/10.1007/s40622-021-00295-5
Sheppard V (2020) Research methods for the social sciences: an introduction. British Columbia/Yukon Open Authoring Platform
Siddiqui S, Arif I, Hinduja P (2023) Technostress: a catalyst to leave the teaching profession - a survey designed to measure technostress among teachers in Pakistan during COVID-19 pandemic. E-Learn Digital Media 20(1):53–79. https://doi.org/10.1177/20427530221107506
Singh P, Bala H, Dey BL, Filieri R (2022) Enforced remote working: the impact of digital platform-induced stress and remote working experience on technology exhaustion and subjective wellbeing. J Bus Res 151:269–286. https://doi.org/10.1016/j.jbusres.2022.07.002
Stankevičiūtė Ž (2022) The dark side of technology use: the relationship between technostress creators, employee work-life balance, and job burnout while working remotely during the COVID-19 lockdown. In: Ivascu L, Cioca L-I, Filip FG, eds, Intelligent techniques for efficient use of valuable resources, vol. 227. Springer International Publishing. pp. 119–138. https://doi.org/10.1007/978-3-031-09928-1_8
Stofkova J, Poliakova A, Stofkova KR, Malega P, Krejnus M, Binasova V, Daneshjo N (2022) Digital skills as a significant factor of human resources development. Sustainability 14(20):13117. https://doi.org/10.3390/su142013117
Stratton SJ (2023) Population Sampling: Probability and Non-Probability Techniques. Prehosp Disaster Med 38(2):147–148. https://doi.org/10.1017/S1049023X23000304
Sulaiman NA, Nor Shaid NA, Mohd Kamaruzaman F (2021) Content validity and reliability of questionnaire on students' perception towards online learning during Covid-19 pandemic. Int J Acad Res Bus Soc Sci 11(7):Pages 519-528. https://doi.org/10.6007/IJARBSS/v11-i7/10234
Sułkowski Ł (2023) Managing the Digital University: Paradigms, Leadership, and Organization, 1st ed. Routledge. https://doi.org/10.4324/9781003366409
Tarafdar M, Cooper CL, Stich J (2019) The technostress trifecta - techno eustress, techno distress and design: theoretical directions and an agenda for research. Inf Syst J 29(1):6–42. https://doi.org/10.1111/isj.12169
Tarafdar M, Stich J, Maier C, Laumer S (2024) Techno-eustress creators: conceptualization and empirical validation. Inf Syst J, isj.12515. https://doi.org/10.1111/isj.12515
Tarafdar M, Tu Q, Ragu-Nathan BS, Ragu-Nathan TS (2007) The impact of technostress on role stress and productivity. J Manag Inf Syst 24(1):301–328. https://doi.org/10.2753/MIS0742-1222240109
Thatcher JB, Loughry ML, Lim J, McKnight DH (2007) Internet anxiety: an empirical study of the effects of personality, beliefs, and social support. Inf Manag 44(4):353–363. https://doi.org/10.1016/j.im.2006.11.007
Upadhyaya P, Vrinda (2021) Impact of technostress on academic productivity of university students. Educ Inf Technol 26(2):1647–1664. https://doi.org/10.1007/s10639-020-10319-9
Van Raaij EM, Schepers JJL (2008) The acceptance and use of a virtual learning environment in China. Comput Educ 50(3):838–852. https://doi.org/10.1016/j.compedu.2006.09.001
Venkatesh V, Morris MG, Davis GB, Davis FD (2003) User acceptance of information technology: toward a unified view. MIS Q 27(3):425–478. https://doi.org/10.2307/30036540
Wang Q, Zhao G, Yao N (2024) Understanding the Impact of Technostress on University Teachers' online teaching during the COVID-19 pandemic with the transactional theory of stress (TTS). Asia Pac Educ Res. 33(1):187–198. https://doi.org/10.1007/s40299-023-00718-0
Wang X, Tan SC, Li L (2020) Technostress in university students' technology-enhanced learning: an investigation from multidimensional person-environment misfit. Comput. Hum Behav 105: 106208. https://doi.org/10.1016/j.chb.2019.106208

Acknowledgements

This work was supported by European Cooperation in Science and Technology, COST Action CA21107 'Work Inequalities in Later Life Redefined by Digitalization' (DIGI-net). The authors Pawan kumar Mishra and Martina Rasticova acknowledge the support from project "On Our Own: Opportunities and Risks of the Individualisation of Society" (reg. no. CZ.02.01.01/00/23_025/0008710), implemented in 2025–2028 within the Jan Amos Komenský Operational Programme, under the priority Social Sciences and Humanities: Humanity and Humankind in the Global Challenges of the Contemporary World.

Author contributions

Conceptualization: SP, MR. Writing—original draft preparation: SP, MR, NV, PKM. Conducting interviews: SP, MR, NV. Methodology, research questions, content analysis of material: SP. Writing—discussion, review and editing: NV, MR, PKM. All authors have read and agreed to the published version of the manuscript.

Competing interests

The authors declare no competing interests.

Ethics approval

All procedures performed in studies involving human participants were conducted in accordance with the ethical standards of the responsible institutional and national research committees and in compliance with the principles of the Declaration of Helsinki (1964) and its later amendments or comparable ethical standards. Ethical approval for the study protocol, including the study design, data collection instruments, recruitment procedures, and data management and anonymization procedures, was obtained prior to the commencement of the research from the Committee on Bioethics of Scientific Research of Taras Shevchenko National University of Kyiv (Kyiv, Ukraine; Decision No. 6, approved on 24 October 2024) and from the Research Ethics Committee of Mendel University in Brno (Brno, Czech Republic; Decision No. 2024_8_KELS, approved on 10 October 2024).

Informed consent

Written informed consent was obtained from all participants prior to their participation in the study through an offline consent form administered by the research team. Informed consent and data collection were conducted after receipt of institutional ethics approval and took place between November and December 2024. Participants were informed about the purpose of the research, the voluntary nature of participation, the procedures involved, the anonymized use of data for academic publication, and the absence of foreseeable risks. Consent covered participation in the study, processing and analysis of anonymized data, and publication of aggregated results. No personally identifiable information was collected, anonymity was assured, and the study did not involve minors or vulnerable individuals.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1057/s41599-026-06677-3.

Correspondence and requests for materials should be addressed to Pawan Kumar Mishra.

Reprints and permission information is available at http://www.nature.com/reprints

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

© The Author(s) 2026