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Determinants of technostress in the teaching profession: A cross-sectional analysis

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Abstract

Research objectives and problems: The main objective of this study is to analyze the causes and relationships associated with technostress experienced by teachers with varying levels of professional experience and demographic characteristics. The study addresses the following research questions: What is the level of technostress among in-service and pre-service teachers? To what extent is the level of technostress among in-service and pre-service teachers differentiated by socio-demographic variables such as gender, place of residence, age, and length of service?

Research methods: The data were collected through a cross-sectional, questionnaire-based study conducted during the summer semester of the 2024–2025 academic year. The study sample included 60 in-service teachers and 394 pre-service teachers.

Process of argumentation: In recent years, scientific research has increasingly focused on the concepts of technostress – stress resulting from the use of information and communication technologies (ICT) and technophobia, understood as anxiety related to technology and its application. These phenomena affect not only teachers' well-being but also their professional functioning by reducing work efficiency, job satisfaction, and the quality of their relationships with students. Consequently, they may negatively impact teachers' overall professional success and their ability to meet the expectations of their educational environment. This paper analyzed the above-mentioned assumptions.

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Research findings: The study revealed that both in-service and pre-service teachers reported generally low levels of technostress. However, in-service teachers experienced significantly higher abilities-demands technostress than pre-service teachers. Age and work experience were positively correlated with technostress, but only among in-service teachers. Place of residence significantly influenced technostress levels in this group as well, with the highest levels observed among those living in medium-sized cities. No significant gender or residence-related differences were found among pre-service teachers.

Conclusions: The study highlights important differences in technostress levels among teachers related to their experience, age, and living environment. Understanding these variations can help inform strategies to better support teachers in adapting to technological demands in education.

Introduction

The teacher's role today goes far beyond traditional knowledge transmission. Teachers are now seen as guides in the information-rich world, mentors fostering students' social, emotional, and digital skills, and active participants in the school's social and cultural life (Hejnicka-Bezwińska & Śliwerski, 2015; Michalski, 2024; Zbróg & Bałachowicz, 2024). Rising societal expectations also require ongoing professional development (Szempruch, 2022). Following the outbreak of the COVID-19 pandemic, teachers encountered new challenges, particularly with remote learning,including digital skills (teachers and students), equipment access, the quality and acceptance of digital materials, a lack of experience in online teaching and assessment, and the social and psychological difficulties linked to digital education (Bielak et al., 2021).

The constant pressure to adapt to rapidly changing technology can cause negative psychological effects. Research increasingly refers to technostress (stress from usinginformation and communication technologies, or ICTs) and techno-anxiety (fear of technology use) (Fernández-Batanero et al., 2021; Kumar, 2024). These issues impact teachers' well-being and professional lives by reducing their effectiveness, job satisfaction, and relationships with students (Wang et al., 2024). In turn, they may hinder overall professional success and the ability to meet societal expectations (Aktan & Toraman, 2022).

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Understanding how digital challenges affect teachers' emotional well-being is now a key area of interdisciplinary research, linking pedagogy, occupational psychology, and technology. This paper explores the regularities in technostress experiences among teachers, accounting for differences in levels of work experience and demographic background.

Technostress in educational research

Stress refers to a psychological strain resulting from situations in which an individual's coping resources are insufficient to meet external demands (Colman, 2015). When these demands stem from technology, the resulting strain is termed 'technostress' (El Kiassi & Jahidi, 2023).

The inability to cope with ICT and the resulting tension are effectively explained by person-environment (P-E) fit theory (Rademaker et al., 2025; Ragu-Nathan et al., 2008). According to this framework, technostress arises from the interaction between personal characteristics and environmental demands. The environment is multidimensional, shaped by organizational cultures, expectations, and diverse interpersonal dynamics, and requires individuals to collaborate and meet responsibilities across various contexts.

P-E fit occurs when personal traits align with environmental demands, boosting well-being and satisfaction. Conversely, P-E misfit induces stress, harming individuals' well-being and performance. Technostress arises from the interplay between personal traits, such as low competence, and environmental stressors, such as techno-overload, insecurity, invasion, uncertainty, and complexity (Fernández-Batanero et al., 2021; Qi, 2019).

Technostress has been studied systematically since the mid-1980s. Initially defined by Brod (1984) as a modern adaptation disease caused by the inability to cope with computer technologies, it is now seen more holistically. Current views highlight the psychological effects of technology overload, stressing its negative impact on well-being and attitudes due to uncertainty about adapting to tech demands (Kumar, 2024; Salanova et al., 2013).

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Viewing technostress as a disease is justified given its harmful impact on functioning. Its physiological, psychological, and social effects include fatigue, insomnia, mental overload, frustration, skepticism, low self-efficacy, reduced satisfaction and commitment to work and family, lower productivity, and impaired work-life balance (Kumar, 2024).

Functional relevance of technostress in teachers' professional work

Technostress can be managed in more or less functional ways. Based on Lazarus and Folkman's (1984) classification, three coping strategies can be distinguished. The first – task-oriented coping – involves active problem-solving and planning. The two less functionalmethods – emotion-focused coping and avoidance – involve seeking support or distancing oneself and waiting out the problem. Task-oriented coping improves with stronger personal resources. In the case of technostress and related technophobia, teachers' professional knowledge and skills are key (Brivio et al., 2018; El Kiassi & Jahidi, 2023).

According to Salanova et al. (2013), technological anxiety is one of three technostress dimensions alongside techno-addiction and techno-strain. The first involves ICT use generating fear, apprehension, and arousal. Anxiety here includes insecurity arising from needing to use technology and the fear of losing important information.

The second dimension relates to workaholism – being unable to disconnect from ICT devices and compulsively working outside normal hours. Technology addiction causes a fear of disconnection, as seen through constant notification checking, loss of control over use, motivational conflict with other activities, and anger when interrupted. The final dimension, techno-strain, involves tension experienced during ICT interaction. This stress can reduce willingness to engage in unpleasant tasks (Salanava et al., 2013).

It is difficult to determine how much anxiety causes technostress and how much technostress causes anxiety. The relationship is two-sided,

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with both factors strongly affecting performance, either negatively when they paralyze action or positively when they accelerate it. In the first case, arousal is too low or too high; in the second, it is optimal, considering the teacher's nervous system endurance to strong stimulation and the complexity of classroom activity (Strelau, 1998). The curvilinear relationship between arousal and performance is described by the Yerkes-Dodson Law (1908), a principle established almost 120 years ago.

We may feel insecure when using ICT. Limited competence in operating techno-tools can cause negative tension. Fear of failure and stress may prompt us to reject new solutions in favor of familiar but less effective ones. A key emotional antecedent to technostress is low self-efficacy, stemming from a poor self-assessment of one's ability to act effectively. According to Bandura (2006), knowing how to act is not enough – one must also believe the goal is achievable. In the wider population, self-efficacy in using ICT varies greatly, from deep skepticism and doubt to confidence and technoenthusiasm (Wang et al., 2020a).

Besides personal antecedents like low self-efficacy, several non-personal technostress triggers can be identified. These relate to the context of technology use and tools' characteristics, which – due to their growing complexity – can evoke feelings of inadequacy (Wang et al., 2020b). Salanova et al. (2013) argue that research on technostress sources often points to specific features of technology or its implementation. Thus, technostress creators may include techno-overload, techno-insecurity, techno-invasion, techno-uncertainty, and techno-complexity.

These factors affect both private and professional life. In the case of techno-overload, we receive large amounts of information from multiple channels at once, making it hard to process – especially when the data is ambiguous. With techno-insecurity, people may fear losing status within or outside the workplace due to an inability to stay "up to date" with technological innovations.

Constant ICT connectivity without temporal or spatial limits keeps teachers continually available for work. As a result, techno-invasion, along with technology addiction, can threaten work-life balance. Techno-uncertainty arises from changes in the nature of the job and the introduction of

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new ICTs, causing tension and detachment from the work environment. Techno-complexity reflects the discomfort of facing technologies that, regardless of one's efforts, feel unmanageable.

Research problems

This paper attempts to answer the following research questions:

Q1: What level of technostress characterizes in-service and pre-service teachers?
Q2: To what extent does the level of technostress among in-service and pre-service teachers vary according to socio-demographic variables such as gender, place of residence, age, and seniority?

Materials and methods

Data were collected using a cross-sectional questionnaire survey administered in the summer semester of the 2024–2025 academic year among in-service and pre-service teachers.

Participants

The sample was recruited using a convenience-voluntary scheme (Gravetter & Forzano, 2010). In-service teachers (n = 60; 59 women, 1 man) and pre-service teachers (n = 394; 309 women, 85 men) were included based on the following criteria: (1) participants provided written consent to take part in the study, and (2) they had school-related experience – i.e., they were employed as teachers or were currently undertaking/had previously completed an internship at a school.

The average age of in-service teachers was 35.62 (SD = 9.27), while that of pre-service teachers was 24.58 (SD = 6.92). In-service teachers' places of residence were fairly evenly split between rural areas (23%), cities with up to 50,000 residents (25%), cities with 51,000 to 100,000 residents (25%), and cities with over 100,000 residents (27%). Among pre-service

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teachers, the respective percentages were 32%, 16%, 9%, and 43%. The average length of service of in-service teachers was 6.54 years (SD = 8.67).

Instruments and materials

Teachers' technostress was measured using Wang et al.'s (2020a) 8-item Person-Environment Fit Scale of Technostress (P-EFST). The tool assesses two components of technostress as mismatches in the dimensions: abilities-demands misfit (ADT, 4 items) and needs-supplies misfit (NST, 4 items). Statements were rated on a 5-point scale from 0 (strongly disagree) to 4 (strongly agree). Cronbach's alpha for the entire scale was 0.920; for ADT and NST, it was 0.883 and 0.876, respectively. The Polish version was translated by the authors following Hambleton et al.'s (2004) guidelines. Selected socio-demographic variables were also included. Participants reported their gender, place of residence, age, and length of service.

Research and analytical procedures

The data were collected online. When participants were asked to complete the questionnaire, they were informed about the study's purpose, their anonymity, and that participation was voluntary. They then provided informed consent before taking part in the survey. All data were collected during a single session of the cross-sectional survey.

Variables were described using basic descriptive statistics – arithmetic means and standard deviations. The internal consistency of the P-EFST was assessed using Cronbach's alpha coefficients. Relationships between variables were examined using correlation analysis, the Mann–Whitney U test, and ANOVA. All analyses were conducted using JASP v. 0.19.3.

Results

The average levels of technostress, comprising ADT, NST, and total technostress, were quite low in both groups: 1.301 (SD = 1.010), 1.466 (SD = 1.097), and 1.386 (SD = 0.985), respectively, based on raw scores from the P-EFST scale (0–4 range).

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Next, technostress levels were compared between pre-service and in-service teachers. Due to unequal group sizes, the non-parametric Mann–Whitney test was applied. A significant difference emerged for the ADT component – in-service teachers (M = 1.567; SD = 1.091) experienced greater mismatches in the abilities-demands dimension than pre-service teachers (M = 1.261; SD = 0.993) (MW test = 13697.50, p = 0.046, Cohen's d = 0.159). No significant differences were found for the needs-supplies dimension or total technostress (M = 1.471 vs. 1.466; SD = 1.260 and 1.072; MW test = 11569.50; p = 0.791, and M = 1.521 vs. 1.365; SD = 1.125 and 0.962; MW test = 12597.00; p = 0.411, respectively).

Subsequently, the extent to which technostress varied according to selected socio-demographic characteristics was examined. Participants' age correlated with both components and the overall technostress score. For ADT, the correlation coefficient was r = 0.264 ($p < 0.01$); for NST, r = 0.143 ($p < 0.01$); and for the total score, r = 0.215 ($p < 0.01$). As age increased, respondents reported a stronger sense of mismatch between their abilities, resources, needs, and the demands of information technology in the work environment. Interestingly, these relationships disappeared among pre-service teachers but remained significant among in-service teachers. Among the latter, the strongest correlation was again observed for the ADT component (r = 0.262, $p < 0.01$), followed by total technostress (r = 0.220, $p < 0.01$) and NST (r = 0.152, $p < 0.01$).

The observed relationships were also replicated for the seniority variable. Among in-service teachers, higher seniority was associated with increased technostress (ADT: r = 0.257; NST: r = 0.271; total score: r = 0.277; $p< 0.05$). This result is unsurprising, given the naturally strong positive correlation between seniority and age. Notably, the association between age and the NST component was almost twice as weak as that with seniority (r = 0.152 vs. 0.271).

Differences in technostress levels between females and males were also examined, but only within the pre-service teacher group, as there was only one male among the in-service teachers. Females reported higher levels of technostress than males (ADT: M = 1.359 vs. 0.815, SD = 1.015 and 0.815, MW test = 16537.00, $p < 0.01$, Cohen's d = 0.259;

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NST: M = 1.536 vs. 1.209, SD = 1.057 and 1.092, MW test = 15684.50, $p < 0.01$, Cohen's d = 0.194; total: M = 1.450 vs. 1.058, SD = 0.973 and 0.858, MW test = 16168.50, $p < 0.01$, Cohen's d = 0.231).

Finally, technostress levels were compared according to respondents' place of residence: rural areas, cities with up to 50,000 residents, and cities with 51,000–100,000 residents. Among pre-service teachers, place of residence showed no significant link with ADT [$F(3,390) = 2.296$; $p = 0.077$], NST [$F(3,390) = 1.087$; $p = 0.354$], or total technostress [$F(3,390) = 1.785$; $p = 0.150$]. However, for in-service teachers, place of residence significantly affected ADT [$F(3,56) = 2.287$; $p = 0.046$; $\eta^2 = 0.132$] and total technostress [$F(3,56) = 2.869$; $p = 0.044$; $\eta^2 = 0.133$], but not NST [$F(3,56) = 2.459$; $p > 0.05$].

The highest levels of ADT were reported by participants living in cities with 51,000–100,000 residents (M = 2.150; SD = 1.149), followed by those in cities with over 100,000 residents (M = 1.594; SD = 1.099), rural areas (M = 1.464; SD = 1.168), and cities with up to 50,000 residents (M = 1.050; SD = 0.689). A significant difference was found between those living in cities with up to 50,000 residents and those living in cities with 51,000–100,000 residents [$t(56) = 2.887$; p Tukey = 0.027]. A similar trend appeared for totaltechnostress, with the highest levelagain in cities with 51,000–100,000 residents (M = 2.159; SD = 1.099), followed by cities with over 100,000 residents (M = 1.511; SD = 1.088), rural areas (M = 1.502; SD = 1.219), and cities with up to 50,000 residents (M = 0.961; SD = 0.824).

Discussion

This study had two main objectives: to assess technostress levels among pre-service and in-service teachers and to examine the relationships between these levels and the respondents' socio-demographic variables.

The results indicate medium to low levels of technostress in the analyzed groups. Significant differences appeared in the ADT component, which affected in-service teachers more than pre-service ones. In-service

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teachers experienced greater discomfort in the ADT dimension, while no significant intergroup differences were found in the NST dimension or total technostress score.

This supports the notion of technonativity (Prensky, 2001) among younger generations, who, having grown up with technology, do not fear it or perceive a mismatch with its requirements and functionalities. In contrast, older generations may feel discomfort not only with the tools themselves but also with the broader philosophy of technology's role in life, e.g., AI's function and relationship with humans. Still, the sense of mismatch in the ADT dimension proved a stronger source of technostress than the NST dimension (Penado Abilleira et al., 2021; Saltan et al., 2024).

Several previous studies have indicated a strong link between teachers' need to continuously keep up with technological advances in education and their emotional responses, such as anxiety and stress (Betoncu & Ozdamli, 2019; Fernández-Batanero et al., 2021). Consequently, technostress negatively impacts teachers' job satisfaction (Estrada-Muñoz et al., 2020) and, in turn, their beliefs about education and professional development (Aktan & Toraman, 2022).

The present study revealed associations between technostress and selected socio-demographic characteristics. Among in-service teachers, feelings of inadequacy in abilities, resources, and needs to meet ICT demands in the workplace increased with age – an effect not observed among pre-service teachers. Similar findings regarding apositive relationship between technostress, seniority, and teacher age have been reported by other researchers (Penado Abilleira et al., 2021; Ram & Kannaujiya, 2025; Wang et al., 2023).

In this study, technostress levels varied by gender among pre-service teachers. It is difficult to determine the extent to which the observed differences stem from females' objectively lower proficiency with modern technologies (Koh et al., 2015; Scherer et al., 2017) or from gender stereotypes. While men may overestimate their technological competence or mask feelings of inadequacy in meeting technological demands, women may underestimate their competence in using modern technologies.

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Topal and Akgün (2015) have shown that male pre-service teachers have significantly higher self-efficacy perceptions of Internet use for educational purposes than female pre-service teachers. In contrast, Wang et al. (2023) found that male primary school teachers felt greater technostress than female teachers. The authors attribute this result to an imbalance in the gender distribution in elementary schools, where male teachers may be perceived as more familiar with technology and are given more technology-related tasks. This thread seems remarkably interesting and worthy of further exploration.

Finally, in our study, technostress was significantly associated with place of residence among in-service teachers. Higher levels of technostress were observed among those living in larger cities than among those in rural areas and smaller towns. One possible explanation for this is that schools in more populous urban areas may place greater demands on digital competence, making the work environment more taxing than in rural or smaller-city schools. This assumption requires further investigation, although similar findings were reported by Wahab et al. (2022). However, their results concern Malaysian teachers, so cultural differences should be considered when making comparisons.

Limitations and Conclusions

The present study has certain limitations that should be acknowledged. First, it employed a cross-sectional design, with variables measured at a single point in time. As a result, it is not possible to assess the stability of the technostress diagnoses among pre- and in-service teachers or to determine their sensitivity to contextual factors such as location, timing, or participant characteristics (Gravetter & Forzano, 2010). A related limitation concerns the substantial overrepresentation of females in the analyzed subgroups. Gender-related characteristics – such as the typically higher levels of neuroticism observed among females (Weisberg et al., 2022) – may have influenced the results and potentially biased the findings.

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The study's cross-sectional nature precludes inferring causal processes. However, it is worth emphasizing that, according to the developers of the P-EFST scale (Wang et al., 2020a), technostress is a relational phenomenon. Therefore, it is difficult to determine the extent to which the variables measured in the study are related. It is only possible to infer their co-occurrence or co-variation.

Second, the study was conducted via an online questionnaire. As a result, the level of participant engagement in completing the survey may have been suboptimal, potentially reducing the quality of the collected data (Jaeger & Cardello, 2022). Finally, the sample was recruited through a volunteer-based approach. Consequently, any generalizations based on the collected empirical material apply only to those who participated in the study rather than to the population at large.

Despite the acknowledged limitations, the results of this exploratory study are noteworthy. Interest may arise from the observed relationships between participants' gender, place of residence, and levels of technostress. Moreover, the findings have practical value, as they can inform the development of empirically grounded interventions aimed at reducing technostress in school settings (Zhao & Song, 2021). It is also important to note that teachers are the primary agents of technology-enhanced education, often serving as designers, administrators, and decision-makers simultaneously. Without the active engagement of teachers who feel confident using ICT, the effective implementation of technology-supported education remains unlikely (Woodlands & Dart, 2023).

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