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Neither 1, nor 3, Are 7! Analysis of Technostress Profiles in University Students through a Mixed Method

Ni 1, ni 3, ison 7! Análisis de los perfiles de tecnoestrés en estudiantes universitarios a través de un método mixto

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ABSTRACT

While technostress can affect anyone who uses ICTs (including employees and students) individuals experience it differently through anxiety, fatigue, addiction. This study aims to advance technostress research among students by identifying distinct profiles and examining differences between them through a mixed-method approach. The sample consisted of 224 university students (68.5% female) from different Spanish universities. Our findings revealed seven technostress profiles: Profile 1, Techno-anxious, Profile 2, Techno-fatigued, Profile 3, Techno-addicted, Profile 4, Techno-anxious-fatigued, Profile 5, Techno-anxious-addicted, Profile 6, Techno-fatigued-addicted, Profile 7, Techno-anxious-fatigued-addicted. Although student burnout did not significantly differentiate between profiles, qualitative analysis showed that insufficient digital competencies and information overload contributed to increased anxiety and technology resistance. Furthermore, prolonged screen exposure without adequate management led to mental and visual fatigue. These results highlight the need for targeted interventions to enhance digital literacy and promote

healthier technology use habits. Our findings have important theoretical implications for understanding technostress complexity and practical applications for developing more precise diagnostic tools and personalized support strategies.

KEYWORDS Technostress, University Students, Profiles, Mixed Methods Research, Student Burnout

RESUMEN

Aunque el tecnoestrés puede afectar a cualquier persona que utilice las TIC (incluyendo empleados y estudiantes), los individuos lo experimentan de manera diferente a través de ansiedad, fatiga o adicción. Este estudio pretende avanzar en la investigación del tecnoestrés en estudiantes mediante la identificación de perfiles distintivos y el análisis de las diferencias entre ellos utilizando un enfoque de métodos mixtos. La muestra estuvo formada por 224 estudiantes universitarios (68,5 % mujeres) de diferentes universidades españolas. Los resultados revelaron siete perfiles de tecnoestrés: Perfil 1, Tecno-ansioso, Perfil 2, Tecno-fatigado, Perfil 3, Tecno-adicto, Perfil 4, Tecno-ansioso-fatigado, Perfil 5, Tecno-ansioso-adicto, Perfil 6, Tecno-fatigado-adicto, Perfil 7, Tecno-ansioso-fatigado-adicto. Aunque el burnout estudiantil no discrimina entre los perfiles, el análisis cualitativo mostró que las competencias digitales insuficientes y la sobrecarga de información contribuyeron a aumentar la ansiedad y la resistencia hacia la tecnología. Además, la exposición prolongada a pantallas sin una gestión adecuada provoca fatiga mental y visual. Estos resultados destacan la necesidad de intervenciones específicas para mejorar las competencias digitales y promover un uso más saludable de la tecnología. Los resultados tienen importantes implicaciones teóricas para comprender la complejidad del tecnoestrés y aplicaciones prácticas para desarrollar herramientas de diagnóstico más precisas y estrategias de apoyo personalizadas.

PALABRAS CLAVE tecnoestrés, estudiantes universitarios, perfiles, método mixto, agotamiento en estudiantes

1. INTRODUCTION

1.1. The shift of technostress from work to study environments

In an increasingly digitalised world, the impact of information and communication technologies (ICT) on the daily lives is undeniable. In fact, it can be argued that the use of digital tools has transformed the way people work, study, shop, and live, while also giving rise to different ways of interacting with Information and Communication Technologies (ICT; e.g., Hong et al., 2023). These experiences are often referred to as technoflow (a positive experience) or technostress (a negative experience; Salonova et al., 2014).

Initially proposed by Broad (1984) and later expanded by various authors (e.g., Ragu-Nathan et al., 2008; Salanova et al., 2014), technostress can be understood as a negative job experience (e.g., disease, kind of stress, psychological state) associated with the use of ICT. It is characterised by a perceived mismatch between different technological demands and users' skills or resources. Its consequences are diverse and well-documented, including physical and emotional symptoms (Sanjeeva-Kumar, 2024), as well as behavioural effects such as intention to quit (Harris et al., 2022).

Although technostress was originally identified in workplace settings (e.g., Muhametjanova et al. 2024), this psychosocial phenomenon has also been observed in academic environments, affecting students who rely heavily on technology for their learning process (Saleem et al. 2024). As early as 1989, Hudiburg suggested that students might also be vulnerable to technostress when using computers. Since then, research has increasingly highlighted this issue, pointing to the combination of high academic demands and intensive

use of digital technologies as key contributors to students' technostress (Asensio-Martínez et al., 2023). Over the years, the consequences of technostress among students have been found to mirror those observed in workers, including physical pain and emotional discomfort (Villavicencio-Ayub et al. 2024).

1.2. Profile of technostress

In the evolving field of technostress research (Sanjeeva Kumar, 2024), some models have focused on identifying its various causes and consequences (Ragu-Nathan et al., 2008), while others have aimed to better understand the subjective nature of the experience itself (Salanova et al., 2014). One influential line of work conceptualises technostress as a multi-dimensional construct, combining emotional (e.g., anxiety, fatigue), cognitive (e.g., self-efficacy), and behavioural (e.g., addiction) dimensions. Salanova and colleagues (2004, 2012) confirmed that individuals can experience these dimensions simultaneously, depending on their interaction with technology. Based on this, they identified three core technostress profiles: 1) Techno-anxiety: a negative emotional state characterised by anxiety during the use ICTs; 2) Techno-fatigue: physical and psychological exhaustion caused by information overload and persistent technological demands; and 3) Techno-addiction: excessive and compulsive use of ICTs, marked by a constant need to interact with them.

Although this classification has contributed to a more precise comprehension of technostress (Penado-Abilleira et al., 2021), it may not fully capture the complexity of real-life experiences. From a conceptual standpoint, individuals are likely to experience combinations of these profiles. This suggests the existence of mixed technostress profiles, such as techno-anxious-fatigued or techno-fatigued-addicted.

Some recent studies have attempted to explore this issue, yest most still rely on discrete classifications (i.e., techno-functional, techno-strained, and techno-addicted; Rosa et al., 2025), based on the intensity of technostressors (Ficapal-Cusí et al., 2024), or maladaptive ICT use (Díaz-López et al., 2020); However, these approaches often overlook the subjective combination of symptoms, the student perspective, and the potential value of qualitative insights.

To address this gap, our study is grounded in three key foundations: First, anxiety, fatigue and/or addiction can co-occur. Several studies have reported significant positive correlations between anxiety and fatigue (Kim & Kang, 2017; van Dam, 2016; Villanueva Ramírez et al., 2023). Moreover, Fekih-Romdhane et al. (2023) found that smartphone, internet and Facebook addiction can trigger or intensify anxiety symptoms.

Second, self-efficacy, defined as one's beliefs in their ability to organize and execute specific actions (Bandura, 1997), serves as a protective factor against technostress (Salanova et al., 2014). However, as highlighted by Social Cognitive Theory (Bandura, 1997), self-efficacy is domain-specific: a user may feel confident writing emails but feel uncapable of controlling their overall use of ICT. In line with this, studies that analyse the role of specific self-efficacy (e.g., self-efficacy for online teaching) have emerged, as did Levante et al. (2025). Also, Chang et al. (2024) found that technical self-efficacy modulated emotional reactions to AI-driven technostress, reducing anxiety and enhancing positive affect depending on whether the stressor was perceived as a challenge or a hindrance.

Thirdly, based on Lazarus and Folkman's transactional model of stress (1984), and its application to technostress (Salanova et al., 2014; Sharma & Gupta, 2023), stress occurs when perceived demands exceed one's coping reources. Individuals may use emotion-focused coping to manage anxiety or frustration from technological demands, while also engaging in problem-solving by continuing to use technology compulsively to meet academic or professional goals. This dynamic can generate contradictory experience within the same person.

In summary, constant interaction with multiple digital tools may lead to ambivalent states. For example, dependence on technology for studying or working may coexist with fatigue due to the overuse and frustration when outcomes do not meet expectations. Therefore, we formulated the first research question:

- **Research Question 1 (RQ1)**: Are there mixed profiles of technostress among university students?

1.3. Technostress and student burnout

The relationship between burnout and technostress among university students has received growing attention in recent research, particularly considering the increasing reliance on digital technologies for academic purposes. Burnout refers to a psychological state of prolonged response to chronic stress (Maslach & Jackson 1981), characterised by emotional exhaustion, cynicism or depersonalization, and reduced personal accomplishment. Approximately one-third of high-level students report symptoms that negative affective their academic performance and mental well-being (Rosales-Ricardo et al., 2021).

Research indicates that technostress contributes to burnout development. Galvin et al. (2022) found that excessive demands from technology-driven academic environments increase burnout risk by intensifying emotional exhaustion and reducing motivation. Similarly, Vallone et al. (2023) suggest that high technostress levels lead to burnout symptoms that hinder academic engagement and performance.

This relationship became particularly evident during the rapid transition to online learning, when studies identified several technostress creators as being positively correlated with both behavioural stress (Upadhyaya & Vrinda, 2021), and emotional exhaustion (Álvarez-Risco et al. 2021). Additionally, Zhao et al. (2022) reported that technostress negatively affects students' sleep quality and academic performance.

When considering the seven different technostress profiles identified in our study, it is possible to theorise distinct patterns of association with burnout dimensions. For instance, techno-anxious students may be more prone to emotional exhaustion, while techno-fatigued students might show higher levels of cynicism. In contrast, techno-addicted students may present a unique pattern in which high academic efficacy coexists with emotional exhaustion.

The mixed profiles suggest more complex interactions. Students experiencing both anxiety and fatigue may be vulnerable to emotional exhaustion and cynicism, whereas those combining addiction with either anxiety or fatigue might present patterns of high engagement coupled with psychological distress.

Based on these theoretical relationships, we propose that burnout dimensions can serve as discriminating factors across technostress profiles. Specifically, each profile may be characterised by distinct

patterns in: (1) Emotional exhaustion, as an indication of psychological strain; (2) Cynicism, as a potential coping mechanisms, and (3) Academic efficacy, reflecting different patterns of engagement with technology. This leads to our second research question:

- **Research Question 2 (RQ2):** Are there any significant differences in student burnout (emotional exhaustion, cynicism, and academic efficacy) across the seven identified technostress profiles?

1.4. Technostress and the use of ICT in the academic context

ICTs have become essential tools in the academic field, significantly transforming teaching and learning dynamics. In higher education, these technologies offer a wide range of possibilities, from access to online educational resources to digital platforms that facilitate collaborative and personalized processes. However, students' perception of ICT use can be both positive and negative, depending on the benefits or challenges students may experience.

Understanding how students perceive the use of ICT is essential for optimising their integration into educational processes, particularly in increasingly diverse contexts. Numerous studies have highlighted the benefits of ICT, including enhanced access to academic resources, improved collaboration between teachers and students, and the facilitation of personalised learning paths that support academic outcomes (Aguilar y Xiang, 2023; Agudelo-Velásquez y Salinas, 2020; Castro, 2023). Moreover, the development of digital competencies among university students is crucial for transforming ICT into inclusive learning tools (Parody-García et al., 2024). In this sense, ICT not only promote accessibility through the principles of Universal Design for Learning (Calle-Córdoba et al., 2024), but also contribute to the development of communication skills, student autonomy, and active participation, particularly among learners with functional diversity, thus fostering equitable and innovative pedagogical approaches (Parody-García et al., 2022).

Nonetheless, despite the numerous advantages, several studies have identified challenges associated with their implementation. On the one hand, a lack of adequate training or digital literacy within the academic community can hinder the effective use of these tools (Sangeeta & Tandon, 2020). On the other hand, unequal access to devices and connectivity remains a significant barrier, especially in socioeconomically vulnerable contexts (Villao & Matamoros, 2024). Furthermore, the intensive use of digital technologies may result in distractions and cognitive overload, negatively impacting students' well-being and academic performance. As such, the perception of ICT can vary depending on students' personal resources and their ability to cope with these demands (Llorens et al., 2007; Salanova et al., 2011).

Considering these complexities, this study aims to explore university students' perceptions of ICT use through a qualitative approach, with the goal of providing a more contextualised view of the role these tools play in their academic lives. Accordingly, the third research question is formulated as follows:

- **Research Question 3 (RQ3):** What are university students' perceptions of the use of technology during their studies?

2. METHOD

2.1. Sample and procedure

The sample consisted of 224 university students (68.5% female) from different Spanish universities (university 1, 70.1%; university 2, 15.6%; other universities, 14.3%), aged between 18 and 43 years (M = 22; SD = 3.75). They represented a variety of academic disciplines, including health sciences (40.6%), humanities (33.9%), natural sciences (18.9%), and social sciences (7.5%). Most participants (88.2%) were enrolled in undergraduate programs.

Data were collected through an online questionnaire developed using the Google Forms platform. A snowball sampling technique was employed to disseminate the questionnaire among university students. Participation was entirely voluntary and non-remunerated. In accordance with the ethical standards of the Declaration of Helsinki, all participants provided written informed consent. Anonymity and confidentiality were maintained throughout the research process.

In addition to standardized instruments, the questionnaire included two open-ended questions aimed at capturing students' subjective perceptions and experiences regarding the use of ICT in academic contexts.

2.2. Variables and instruments

Technostress in students was assessed using an adaptation of the RED-Technostress or RED-ICT for students (Eidman & Basualdo, 2021). Also, the five-factor structure of the RED-ICT scale has been confirmed through confirmatory factor analysis in prior research (e.g., Eidman & Basualdo, 2021). The RED-ICT is composed of 22 items divided into 5 subscales: Anxiety (4 items; e.g., "I feel tense and anxious when studying with technologies"); Fatigue (4 items; e.g., "I find it difficult to relax after a day of studying using them"); Scepticism (4 items; e.g., "I doubt the outcome of studying with these technologies"); Inefficacy with technologies (4 items; e.g., "In my opinion, I am ineffective using technologies"); and Addiction (6 items; e.g., "I think I over use technologies in my life"). All items rated on 7-point Likert scale ranging from 0 ("never") to 6 ("every day"; Salanova, et al., 2004).

Student burnout was measured using the Maslach Burnout Inventory-Student Survey (MBI-SS, Schaufeli et al., 2002). This scale includes three subscales: Emotional exhaustion (5 items; e.g., "I am emotionally drained from doing this grade"), Cynicism (4 items, e.g., "I have become more cynical about the usefulness of my studies"), and Efficacy with studies (6 items; e.g., "I can effectively solve problems related to my studies."). All the items had a 7-point Likert response format ranging from 0 ("never") to 6 ("every day").

Additionally, two open-ended questions were included to explore students' subjective perceptions of ICT use during their studies: 1) *"What is your opinion on the use of technology during your studies?"*; and 2) *"What do you think are the reasons for the difficulties in using technologies?"*.

2.3. Data analysis

Data were analysed using the SPSS 23.0 (IBM Corp, 2015) and ATLAS.ti version 24 software. Prior to the main analyses, data were screened for missing values, and descriptive statistics, reliability indices, and bivariate correlations were calculated for all dimensions included in the study.

Technostress profiles were constructed based on participants' scores in the five technostress dimensions: anxiety, fatigue, inefficacy, scepticism, and addiction. The classification criteria followed the framework established by Salanova et al. (2004), as well as the normative thresholds proposed by Peñalver and Ventura (2024). According to this classification, the techno-anxiety profile was assigned to students scoring high or very high on anxiety, inefficacy, and scepticism; the techno-fatigue profile to those scoring high or very high on fatigue, inefficacy, and scepticism; and the techno-addiction profile to students scoring high or very high on the addiction dimension.

To examine whether differences in student burnout levels emerged across the identified technostress profiles, an analysis of variance (ANOVA) was conducted. This allowed for the comparison of emotional exhaustion, cynicism, and academic efficacy among the seven technostress profiles.

The qualitative data, derived from two open-ended questions, were analysed using a content analysis approach that combined both deductive and inductive strategies (Saldaña, 2009). Deductive coding was based on pre-established thematic categories, while inductive coding allowed for the emergence of new, data-driven subcategories. This hybrid approach enabled a richer and more contextualised understanding of students' experiences with ICT in academic settings. To enhance the robustness of the analysis, triangulation techniques were applied, integrating the written responses, categorical descriptors, and technostress profiles to support a multi-faceted interpretation of the data (Flick, 2004). A critical-interpretative perspective was also adopted, allowing for deeper reflection on the contextual and theoretical dimensions of students' responses.

To ensure anonymity and confidentiality, an alphanumeric coding system was used. The letter "S" indicated a student, followed by a number representing their assigned participant ID (e.g., S6 refers to student number 6).

3. RESULTS

3.1. Quantitative results

Listwise deletion of missing data was applied, resulting in a data loss rate of less than 5% data (Fichman & Cummings, 2003), no participants were excluded from the analyses. Based on the recommendations of Finney and DiStefano (2006), the skewness and kurtosis values for all dimensions indicated that the assumption of normality was not violated. The results also revealed statistically significant correlations among the study dimensions, except for emotional exhaustion and efficacy with studies, which showed weaker associations with the rest of the dimensions. Regarding internal consistency, Cronbach's alpha coefficients indicated good reliability across all dimensions. Descriptive statistics, reliability indices, and intercorrelations are presented in Table 1.

TABLE 1. Descriptive, reliably and bivariate correlations

Variables	M	SD	S	K	α	2	3	4	5	6	7	8
1. Anxiety	2.07	1.48	.50	-.54	.83	.63**	.56**	.35**	.75**	.23**	.21**	-.06
2. Fatigue	2.68	1.65	.13	-1.05	.89		.43**	.43**	.48**	.33**	.22**	.02
3. Scepticism	1.92	1.26	.52	-.44	.78			.21**	.53**	0.12	.15*	.00
4. Addiction	3.26	1.35	-.15	-.56	.86				.34**	.26**	.30**	.04
5. Inefficiency with technologies	1.68	1.29	.89	.49	.80					.12	.16*	-.14*
6. Emotional exhaustion	2.77	1.51	.13	-.71	.92						.67**	.03
7. Cynicism	1.84	1.62	.80	-.14	.90							-.14*
8. Efficacy with studies	3.80	1.32	-.48	-.34	.86							

Note: M= Mean, SD= Std. deviation, S= Skewness, K= Kurtosis, α= Cronbach's index, *p<.05,**p<.01

The categorisation process identified seven technostress profiles based on students' levels of anxiety, fatigue, scepticism, inefficacy with technologies, and addiction: Profile 1, Techno-anxious; Profile 2, Techno-fatigued; Profile 3, Techno-addicted; Profile 4, Techno-anxious-fatigued; Profile 5, Techno-anxious-addicted; Profile 6, Techno-fatigued-addicted; Profile 7, Techno-anxious-fatigued-addicted. A total of 51.1% of students did not meet the criteria into any of the seven profiles.

To examine potential differences in burnout across these profiles, a one-way analysis of variance (ANOVA) was conducted. However, the results did not indicate any statistically significant differences in emotional exhaustion (F = 0.464, p = .802), cynicism (F = 0.325, p = .897), or academic efficacy (F = 0.658, p = .656) across the profiles. It should be noted that Profile 6 (Techno-fatigued-addicted) included only one participant; therefore, it was excluded from the ANOVA due to insufficient sample size.

TABLE 2. Descriptive analysis for student burnout in the 7 profiles of technostress

Variables		Emotional exhaustion		Cynicism		Efficacy with studies	
Profile	**%**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Profile 1, Techno-anxious	1.3	2.53	0.64	1.50	1.50	3.78	1.35
Profile 2, Techno-fatigued	.9	2.10	0.99	1.63	1.24	3.67	1.41
Profile 3, Techno-addicted	34.5	3.24	1.52	2.27	1.77	1.23	1.23
Profile 4, Techno-anxious-fatigued	3.6	2.85	1.41	1.63	1.41	4.21	0.75
Profile 5, Techno-anxious-addicted	1.8	1.52	1.52	2.31	2.59	3.21	1.33
Profile 6, Techno-fatigued-addicted	.4	3.00	-	1.75	-	3.5	-
Profile 7, Techno-anxious-fatigued-addicted	6.3	2.91	1.80	2.18	1.92	3.50	1.74

Note: M= Mean, SD= Std. deviation.

3.2. Qualitative results

As shown in Table 3, the different technostress profiles perceive both positive and negative aspects of using ICT. Students with a techno-fatigue profile view ICT as beneficial in areas such as calculations, teaching, and communication, while also highlighting challenges such as difficulties concentrating during digital reading and mental and visual fatigue caused by prolonged device use.

TABLE 3. Categories by technostress profiles. What is your opinion on the use of technology during your studies?

Profile	Category	Emerging Subcategory
Tecno-fatigued	Positive perceptions	• Usefulness in mathematical calculations • Facilitates academic work • Facilitates communication **Example:** "*I think they are necessary (...) for certain calculations. Also, for teaching and making video conferences.* (S5)
	Negative Perceptions	• Difficulty concentrating • Preference for physical format for studying • Mental and visual fatigue **Example:** *"When I read an article or a book, if I do it digitally, I am unable to keep my focus on what I am reading (...) After using technology for a while, when I want to refocus on my studies, I first need to rest, my eyes and mind. I need to have the article in physical form in order to study it well."* (S5)
Techno-addict	Positive perception	• Access to educational resources • Facilitation of collaboration • Optimisation of time management • Improvement in learning quality **Example:** *"Technologies are very useful (...) I have access to digital books and articles."* (S7); *"I believe they facilitate and optimise tasks. For me, it's all advantages because everything is very accessible."* (S33)
	Negative perception	• Mental and physical fatigue • Distractions and lack of concentration • Information overload • Privacy concerns • Concerns about excessive use **Example:** *"You spend a lot of time with electronic devices... and it ends up exhausting you mentally and physically."* (S11); *"They generate physical and mental exhaustion."* (S22);*"You can get distracted by looking at anything."* (S28); *"Technologies represent a work monitoring that can border on a lack of privacy."* (S39)
Techno-anxious-fatigued	Positive perceptions	• Facilitate academic work • Accessibility and flexibility **Example:** "*They make it much easier to create assignments."* (S87); *"It can be useful since it allows all students to have the same material at hand."* (S83)
	Negative perceptions	• Fatigue • Concern about replacing traditional methods • Lack of effort **Examples:** "*I feel more tired after using technology for so long."* (S85); *"It's useful, but it should never completely replace physical or in-person materials*." (S89)

Techno-anxious-addicted	**Positive perception**	• Necessary for professional development • Facilitate academic work **Example:** "*For my career, translation, they are completely necessary for our professional future.*" (S91); *"It's really a great help and makes the job easier..."* (S92)
	Negative perception	• Concern about future availability • Discomfort in use **Examples:** "*The impermanence and future availability*" (S94); *"(...) its use sometimes drives you a little crazy*" (S92)
Techno-anxious-fatigued-addicted	**Positive perception**	• Facilitate academic work • Accessibility and flexibility • Facilitate communication **Examples:** *"The use of technology during studies is very useful because it saves paper, space, and weight... It also allows quick* communication with professors and classmates." (S97); *"Technological resources are very good because they facilitate the work and are accessible."* (S102)
	Negative perceptions	• Physical and visual fatigue • Dependence on technology • Technical and connection issues • Anxiety • Frustration **Examples:** *"I feel that they take a lot of my energy and my eyes get tired, in fact, I've started wearing glasses because of it."* (S100); *"Creating dependency on technology is very easy, we literally just finished studying or taking notes, meaning 2 or 3 hours in front of the computer, and right after we pick up the phone..."* (S105)

Students with a techno-addict profile highlight the educational benefits of using ICT, such as increased accessibility to resources and improved communication and collaboration. However, they also acknowledge the negative aspects, such as privacy issues, information overload, excessive use of technology, mental and physical fatigue, distractions, and decreased concentration.

Students with a techno-anxious-fatigued profile combine positive perceptions, such as ease and efficiency, with concerns about technology replacing traditional methods and encouraging passive learning. They also report experiencing mental and physical fatigue due to excessive use.

Students with a techno-anxious-addicted profile recognise the usefulness of technology for academic and professional tasks, but express concerns about its impermanence, the constant need to adapt to new ICT, and the uncertainty regarding its future availability. Those students in the techno-anxious-fatigued-addicted profile appreciated the positive role of ICT in facilitating academic tasks, enhancing accessibility, and improving communication.

At the same time, they were aware of the potential negative impacts including performance disruption due to technical failures or connectivity issues, increased information overload, technological dependence, visual fatigue, anxiety, and frustration.

As shown in Table 4 (see next page), students' reported difficulties with technology vary according to their technostress profiles. Students with a techno-fatigued profile primarily emphasised the need for additional training, citing a lack of proficiency in specific software tools. They also reported experiencing information overload, which negatively affected their concentration. Similarly, students with a techno-addicted profile expressed frustration from not knowing how to use specific tools and being distracted by prolonged technology use. Additional difficulties included coping with constant system updates and restricted access to essential resources, often due to financial barriers or limited availability of devices.

TABLE 4. Categories by technostress profiles. What do you think are the reasons for the difficulties in using technologies?

Profile	Category	Description
Techno-fatigued	Training needs	• Lack of skills to use certain software programs. **Example:** *"I want everything done for me without having to read how to use a program correctly."* (S5)
	Information overload	• Feeling of saturation caused by excessive information. **Example:** "*Sometimes an excess of information causes me to lose focus."* (S5)
	Distractions	• Problems arising from lack of concentration due to technology. **Example:** *"Technologies cause me to lose focus."* (S5)
Techno-addict	Training needs	• Lack of knowledge to use specific technological tools. **Example:** *"We haven't been taught how to use them."* (S12); *"I lack training in specific programs, in general."* (S8); *"Little knowledge about their use, learning in a self-taught way."* (S66)
	Information overload	• Feeling of saturation caused by excessive information and excessive usage time. **Example:** *"Sometimes they overwhelm me a bit."* (S39); *"The distraction from the original focus as time goes on."* (S81).
	Constant updates	• Difficulty adapting to technological advancements, such as artificial intelligence. **Example:** *"The constant changes in technology, lately it happens to me with artificial intelligence."* (S40)
	Distractions	• Problems arising from lack of concentration or distraction when using technologies. **Example:** *"The distraction from the original focus as time passes."* (S81); *"I waste time with different platforms, etc."* (S63)
	Lack of access to specific resources	• Limitations due to the absence of programs, licenses, or necessary educational resources. **Example:** "*I need specific qualitative analysis programs, but I don't have access to them because the university doesn't pay for the license.*" (S34); *"Sometimes it's not easy to access them because they require subscriptions."* (S68)
Techno-anxious-fatigued	Training needs	• Lack of knowledge and skills to use software programs. **Example:** *"I struggle when I don't have a good grasp of programs."* (S84); *"The little training on programs that are constantly updated."* (S85); *"Anxiety due to insecurity about participating in something I don't know."* (S87)
	Constant updates	• Difficulty adapting to the constant technological evolution. **Example:** "*To the constant evolution of them."* (S88)
	Lack of interest in technology	• Lack of motivation to use technology. **Example:** *"Due to a lack of interest in technology and its use."* (S86); *"Low usage."* (S91)
Techno-anxious-addict	Technical problems	• Problems with the functionality of technological tools. **Example:** *"Sometimes, especially in career-specific apps, the interfaces* are very old and hard to understand." (S92)
	Technological distrust	• Technology facilitates academic work, but some users express distrust toward its use. **Example:** *"I feel distrust toward them, and it biases me when interacting with them."* (S95)
Techno-anxious-fatigued-addict	Training needs	• Lack of knowledge and skills to use technologies, and lack of information. **Example:** *"Lack of technological skills."* (S99); *Lack of formation."* (S110)
	Constant updates	• Difficulty adapting to rapid technological changes. **Example:** *"Lately everything moves so fast, and we can't fully adapt."* (S109)

Students classified under the techno-anxious-fatigued profile described increased anxiety when using unfamiliar programs and difficulties in adapting to frequent updates. This, combined with a lack of interest, leaded to reduced motivation to use technology.

Students within the techno-anxious-addicted profile reported technical issues, such as software malfunctions and outdated interfaces, along with a general mistrust of technology.

Finally, those in the techno-anxious-fatigued-addicted profile identify a lack of digital knowledge and skills as the main source of difficulty, further intensified by the ongoing need to adapt to constant technological updates.

4. DISCUSSION

This study adopted a mixed-method approach to provide a comprehensive understanding of the impact of technology on Spanish university students, addressing three research questions.

Regarding RQ1, our findings lead to a twofold conclusion. On the one hand, approximately half of the sample met the full criteria for at least one technostress profile, indicating that one in two students experienced some form of technostress. It is worth noting that this figure only includes those who fully met the criteria and does not account for the students who scored high or moderately high on individual dimensions and may be a risk. These prevalence results are consistent with previous studies. For instance, Suria (2023) reported that 53.9% of student presented high levels of technostress.

On the other hand, although previous research has attempted to classify technostress profiles (Díaz-López et al., 2020; Ficapal-Cusí et al., 2024; Rosa et al., 2025), none have proposed a categorisation as comprehensive as the one presented here, which conceptualises technostress as a mixed experience from the student perspective. Our study identified seven different profiles: three "pure" types (Techno-anxious, Techno-fatigued, and Techno-addicted) and four mixed types (Techno-anxious-fatigued, Techno-anxious-addicted, Techno-fatigued-addicted, and Techno-anxious-fatigued-addicted).

These results are in line with the three theoretical premises guiding this research. First, the identification of mixed profiles reinforces the idea that technostress is not a unidimensional phenomenon but rather a co-occurrence of states such as anxiety, fatigue, and compulsive technology use. This is supported by previous findings showing significant correlations between anxiety and fatigue (Kim & Kang, 2017; van Dam, 2016; Villanueva Ramírez et al., 2023) and by evidence suggesting a reciprocal relationship between anxiety and technology-related addictions (Fekih-Romdhane et al., 2023).

Second, the diversity of profiles may reflect differences in domain-specific self-efficacy, which, according to Social Cognitive Theory (Bandura, 1997), shapes how individuals perceive and respond to technological demands. As shown by Levante et al. (2025) and Chang et al. (2024), specific types of self-efficacy, such as efficacy for online teaching or technical problem-solving, can buffer the emotional impact of technostress and influence whether stressors are interpreted as challenges or hindrances.

Third, the coexistence of emotional and behavioural patterns within profiles is consistent with the transactional model of stress (Lazarus & Folkman, 1984), which posits that stress results from the interaction

between perceived demands and coping resources. This framework helps explain how students may simultaneously engage in emotion-focused coping (e.g., avoidance, frustration) and problem-focused coping (e.g., compulsive use to meet academic requirements), supporting the notion of technostress as a dynamic and multidimensional experience (Sharma & Gupta, 2023).

Concerning RQ2, although the literature consistently reports a positive association between technostress and burnout (Galvin et al., 2022), our data showed that burnout did not significantly differentiate between the identified technostress profiles. This may be because burnout reflects a broader and more long-term outcome of technostress (Li, 2025; Llorens et al., 2007). As noted by Nastjuk et al. (2023), psychological responses to technostress tend to emerge earlier, while behavioural outcomes such as burnout require prolonged exposure. From a methodological perspective, the instrument used (MBI-SS) may have lacked the sensitivity to detect subtle profile differences, particularly in a sample with low variability. Recent work has shown that broader tools like the Burnout Assessment Tool (BAT) provide more comprehensive coverage of burnout dimensions (Schaufeli et al., 2020). While recent studies have explored technostress (Ficapal-Cusí et al., 2024; Rosa et al., 2025) and burnout profiles (Boone et al., 2022), integrated approaches remain rare. Finally, individual factors such as digital self-regulation (Hromalik & Koszalka, 2018) or personality traits (Pflügner et al., 2021) may further shape how technostress and burnout are experienced.

Finally, RQ3 revealed varied perceptions regarding ICT use across different techno-stress profiles. Although the more integrative profiles (i.e., those including multiple dimensions of technostress) shared some perceptions, students' views showed meaningful differences. Those with a techno-fatigue recognised technology benefits in areas such as mathematical calculations, teaching, and communication, but highlighted difficulties including lack of software training and information overload. Prolonged digital device exposure caused mental and visual fatigue along with concentration difficulties. These findings align with research showing that information overload can induce "information fatigue," affecting cognitive processing and potentially leading to anxiety and reduced decision-making quality (Ji, 2023), while negatively impacting academic performance and creating burnout (Subramanyam et al., 2013).

Students with techno-anxious-fatigued profiles expressed exhaustion from constant ICT use and concerns about technology replacing traditional teaching methods, potentially fostering passive learning attitudes. Their lack of interest combined with insecurity from unfamiliarity with certain programs aligns with research highlighting digital skills deficiency as a key obstacle to digital transformation (Ala-Mutka, 2011). Mental fatigue further affects willingness to learn new digital tools (Müller et al., 2021).

In contrast, techno-addiction students expressed a more negative view of excessive technology use. While acknowledging ICT benefits in education, they identified problems like information overload leading to mental and physical fatigue, and distractions (Aziz et al., 2024). Students with a techno-anxious-addicted profile perceived that excessive ICT use and adaptation to technological innovations causes anxiety. This constant need for updates and compulsive technology use aligns with the techno-addict profile characteristics (Llorens et al., 2011). Similarly, research with higher education teachers found excessive classroom technology led to technological fatigue and stress from adapting to constant digital tool changes (Halupa & Bolliger, 2020).

Lastly, students with a combined profile of techno-fatigued-addicted perceived both positive and negative aspects, as seen in the previous profiles, with particular emphasis on visual fatigue caused by excessive

ICT use. Previous studies have shown that prolonged digital screen exposure can trigger symptoms including eye strain, dry eyes, and headaches (Halim et al., 2024).

5. CONCLUSIONS

This study provides an innovative perspective on technostress among university students by identifying seven distinct profiles based on combinations of anxiety, fatigue, and technological addiction. These profiles reflect not only varying degrees of discomfort but also differences in emotional appraisal and coping processes, suggesting that technostress is not a homogeneous experience but rather a diverse and context-dependent phenomenon (Lazarus & Folkman, 1984; Sharma & Gupta, 2023).

Unlike previous studies that have focused on more general approaches (Díaz-López et al., 2020; Ficapal-Cusí et al., 2024; Rosa et al., 2025), this work adopts a person-centered approach by combining quantitative analysis with a qualitative exploration that directly incorporates students' voices. This mixed-methods strategy allows for a deeper understanding not only of the impact of technostress but also of how students perceive and experience it, thereby enhancing both the ecological validity and practical relevance of the findings.

From an applied perspective, the results underscore the importance of designing targeted interventions tailored to each identified profile. For instance, students with techno-anxious or techno-fatigued profiles may benefit from socio-emotional development programs, while those with a techno-addicted profile may require interventions focused on digital time management and the promotion of healthy digital habits (Llorens et al., 2011).

At the institutional level, these findings may inform the design of personalised training strategies and support policies aimed at mitigating the effects of technostress on students' academic experiences. In this regard, the literature supports the implementation of a comprehensive techno-pedagogical approach that not only facilitates the effective integration of technology into educational settings but also promotes robust digital competence training. Such interventions have been shown to enhance academic performance and significantly reduce levels of techno-anxiety (Martínez-Márquez et al., 2025; Muñoz et al., 2017).

Moreover, the need to foster a more conscious, balanced, and healthy use of digital technologies is emphasised. This includes practices such as taking regular breaks, limiting screen time, and engaging in critical reflection on digital habits. Adopting these practices may help prevent mental and visual fatigue and contribute to students' overall well-being. These findings could inform the implementation of concrete actions within university psychological and academic counselling services, aimed at creating more sustainable and student-centred learning environments.

Taken together, this study reinforces the importance of addressing technostress through a comprehensive and multidimensional lens that simultaneously considers personal, emotional, and contextual factors. The implications of this research open new avenues for the development of more inclusive, preventive, and responsive educational policies, aligned with the evolving demands of increasingly digitalised academic environments.

5.1. Limitations and Future Research

Some limitations of the present study should be noted. First, a convenience sample was used, which might restrict the generalisability of these findings. However, the sample is heterogeneous because it includes students from different universities, fields of study, and degrees. Second, sample size could be considered small, especially when participants need to be classified into profiles; therefore, future research should use larger sample to replicate the findings. Third, data were collected from self-report measures, which might have caused common method variance bias. However, considering the nature of the psychological experiences evaluated (i.e., technostress, student burnout), it is difficult to employ other measures (e.g., objective). Finally, although our research focused on documenting technostress profiles and the relation with student burnout and perceptions of the use of ICT during their studies, future research should examine other discriminant variables such as sociodemographic (e.g., age differences, Tomczyk et al., 2023), psychological (e.g., Psycap, Peñalver et al., 2024), and physical (e.g., biomarkers, Mishra & Rašticová, 2024).

6. AUTHOR CONTRIBUTION

Author 1: Conceptualization, Data curation, Supervision, Formal analysis, Methodology, Investigation, Writing – original draft, Writing – review & editing. Author 2: Data curation, Formal analysis, Writing – original draft, Writing – review & editing. Author 3: Data curation, Investigation. Author 4: Data curation, Writing – original draft, Writing – review & editing.

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