

TELEWORK: A LOOK AT TECHNOSTRESS IN TEACHING AS AN EMERGING RISK

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Abstract

The pandemic compelled teleworking to become a priority modality, confronting workers with challenging situations. That tested their ability to perform their duties. This new reality, which has become a permanent feature of the labor landscape, has triggered emerging psychosocial impacts such as techno – stress. The main objective of this research was to examine the psychometric properties of the Technostress Network Scale in a sample of Ecuadorian teachers, confirming the factor structure proposed by Llorens et al. (2011). Additionally, the relationships between the dimensions of technostress were explored according to the sociodemographic and professional characteristics of the population analyzed. The instrument was applied a sample of 327 Ecuadorian educators (including both university and secondary school teachers). The results underwent a psychometric analysis of the items and confirmatory factor analysis using structural equation modeling. These methods allowed for the identification of relationship between fatigue and anxiety and confirmed the regulatory role of anxiety within the broader framework of the categories studied.

Keywords – Telework, Technostress, Psychosocial risks.

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1. Background

Since the 1970's, telework has been adopted in the labor sphere as an option for performing work tasks using telephone resources (De-Vries et al., 2019). Telework has been widely used for more than five years in Europe and the United States, while in some Latin American countries, this modality has only recently been implemented sporadically (Osio-Havriluk, 2010). As a result, of the global public health emergency, the labor market underwent significant transformations, giving rise to new forms of work performance. Inevitably, this new labor reality and the evolving organization of work have involved closer integration with technology and communication. Under these new circumstances, telework re – emerged as a global

labor trend, even though many companies worldwide had already implemented it years before as a flexible alternative that allowed employees to better manage the work – family relationship (Ortiz-Soto et al., 2024). Data show that percentage of the population engaged in telework tripled from 11% to 48% in 2019; by 2020, it rose from 48% to 89%, and in 2021, the figures fluctuated between 87% and 93% (Eurostat, 2019; Eurofond, 2020; Berástegui, 2021).

In Ecuador telework emerged as an answer to the health crisis. However, it had not yet been formally included in the country's labor code. In May 2020, the Ecuadorian government issued a Ministerial Agreement MD'T – 2020 – 206, on October 1, 2020, which formally introduced telework as an emerging labor modality, outlining general conditions for its implementation without addressing specific regulations for various factors. These included working mothers with school – aged children, access to the technology by the population, proficiency in software use, household connectivity levels, and the accessibility and availability of organizational databases for workers (Rosero-Sarasty & Rengifo-Baos, 2024).

Moreover, during the pandemic, telework played a crucial role in ensuring the continuity of operations for Ecuadorians businesses and institutions. Nevertheless, this new reality imposed additional challenges on workers, who had to adapt to changing work conditions by developing skills to manage scenarios such as task interruptions due to multitasking, overflowing email inboxes, excessive workloads, task assignments outside established working hours, imbalances in work – life integration, and connectivity failures – all of which may lead to psychological distress (Chui et al., 2012). Given that the pandemic directly altered people's quality of life, it's essential to focus the analysis not only on productivity, but also on the psychosocial consequences experienced by the population in what has come to be known as the “new normal” (Ramírez-Ortiz et al., 2020).

Teleworking has been implemented in North America and Europe for a long time, and these countries have appropriate legislation regulating this work practice. However, there is limited evidence of its application in Latin American populations. Therefore, this research aims not only to describe the levels of technostress among Ecuadorian teachers, but primarily to validate the internal consistency and factor structure of the RED Scale in this specific context.

2. Telework

Telework, or remote work, is defined as a modality based on the delocalization of work using technology (Montalvo-Romero, 2020). It emerged as a new labor alternative in response to the need for continued work performance, allowing the implementation of social distancing measures and the rational use of human talent (González-Ortiz & Valdés-González, 2020). Telework refers to any work activity performed outside the company's physical premises, where the worker relies on information and communication technologies (Vicente et al., 2018). Furthermore, prior to the pandemic, telework had already been regarded as a flexible labor policy that fostered job satisfaction and organizational commitment among employees (De-Vries et al., 2019).

Evolution of telework has led to the identification of three main categories: 1) Home – based telework: in which the worker remained at home due to limitations in the mobility of computing resources, 2) Mobile telework, which allows any individual to work from home or a fixed remote location, and, 3) Virtual office, which does not require a specific physical workspace, thanks to the flexibility provided by digital platforms (Camacho-Solís, 2021). Globally, telework turn a key priority during the COVID-19 pandemic. Social distancing measures, mobility limitations and restricted interpersonal contact were crucial factors that led to a 324% increase in telework solutions and a 60% rise in distance education (Comisión Económica para América Latina y El Caribe [CEPAL], 2022). The population most affected by the shift in work modality and the integration of technology into daily professional tasks consisted primarily of middle – aged and older adults (aged 40 to 60). This group experienced notable challenges in adapting to the new work organization structure, particularly due to difficulties in prioritizing the use of ICTs (Araguez-Valenzuela, 2017). Most public and private institutions that did not implement the suspension of activities or reduce the workloads adopted telework practices. This shift meant that most remote work occurred from home

as part of the broader social isolation strategy. Consequently, many workers began to experience physical, psychological and psychosomatic issues, as well as symptoms of technological overload (Cuervo-Caravel et al., 2018)

Giving this circumstance, it became necessary to establish organizational processes to implement emergent telework. These processes needed to define the conditions of work organization, adapt internal communication dynamics, introduce control and task – monitoring mechanisms (Montalvo-Romero, 2020), and ensure the occupational safety and psychosocial well – being of employees. Since working from fixed, traditional workplaces became unfeasible, the implementation of technological processes for work performance turned into a critical priority (Osio-Havriluk, 2010). During the phases of social distancing and economic recovery, some companies adopted telework. However, the implementation of this modality led to the emergence of categories directly linked to this work arrangement, such as connection limits, work intensity, working hours, and task distribution (Rubini, 2012).

On the other hand, telework allows employees the freedom to plan their tasks, autonomy in decision – making, and the ability to manage their own schedules. Additionally, it brings advantages such as the potential reconcile professional and family responsibilities (Santillán, 2020), thereby contributing to improved quality of life. Nevertheless, research findings indicate that the abrupt shift to telework has significantly impacted individuals' lifestyles and working conditions (Eurofond, 2020). Moreover, the emergence of the “always – available worker” category – referring to employees constantly connected and accessible has led to overexposure and heightened risks of stress and technostress, conditions now equated with traditional occupational illnesses (Macías-García, 2019).

On the other hand, the application of this work modality, in an optimal way, without repercussions on the physical and mental health of the workers, requires fundamental conditioning factors such as: worker's self – discipline, personality and motivation for remote work. As well as the type of work performed and the ergonomic conditions available to the worker (Berastegui, 2021). Given that the negative consequences associated with technology and telework may offset their benefits, the lack of proper inhibitors increases the psychosocial risks of stress and technostress. Therefore, it becomes urgent to investigate the real impact of telework on workers (Salanova et al., 2013; Atanasoff & Venable, 2017).

3. Technostress

The global dominance of technology stems from the goal of streamlining communication processes and enhancing their effectiveness within organizational systems. Technological advancements have transformed productive processes, work organization, employment modalities the development of new workplace competencies, levels of efficiency, productivity, and flexibility in the workplace (Atanasoff & Venable, 2017). However, these new forms of work organization have also introduced occupational risks associated with technology (Cuervo-Caravel et al., 2018) and have had negative impacts on attitudes, thoughts, behaviors, bodily functions, and interpersonal and social relationships. Several scholars have defined technostress as a condition resulting from individuals' inability to adapt to technology use (Broad, 1984; Salanova et al., 2013). It is influenced by factors such as age, previous experiences, workload, perception, among others (Araoz et al., 2021).

On the other hand, it is necessary to recognize that the work performance is influenced by various organizational factors that operate within the labor context and directly affects outcomes. Multiple theories confirm that attitudes, behaviors, and results are shaped by the work environment (Edwards, 1996), as well as the relationship between health and motivation, which plays a key role in employee engagement and identification (Llorens et al., 2006). Given the new demands posed by technological progress in the workplace, it is critical to examine how technology affects quality of work life (Rodríguez-Vásquez et al., 2021), as well as its impact on individual exhaustion, decreased performance, and job satisfaction (Palma-Silva, 2021).

Technostress is defined as overexposure to technology, which generates dependence (Lee & Lee, 2017). Related to the ability of individuals to cope with continuously changing technological demands and the evolving requirements of cognitive needs and new job skills to meet the demands (Broad, 1984; Ragu-Nathan et al., 2008; Sellberg & Susi, 2014; Nimrod, 2018). When the technological demands exceed individual capacity to meet them, this leads to a deterioration in quality of life – both professionally and personally. Framing it within organizational behavior, as an interrelationship of psychosocial constructs that negatively impact workers, an imbalance that also affects organizational outcomes (Atanasoff & Venable, 2017). It has also been linked to issues such as depression, identity crises, fatigue, musculoskeletal disorders, sleep disorders, difficulty concentrating, social isolation, decreased job satisfaction, reduced organizational commitment, diminished performance, anxiety, fear, and loss of resilience (Hwang & Cha, 2018; Karr-Wisniewski & Lu, 2010; Atanasoff & Venable, 2017; Salazar Concha et al., 2020; Payá-Castiblanque & Calvo-Palomares, 2020; Li & Wang, 2021). On the other hand, Weil and Rosen (1997) established that technostress, from a psychological point of view, has a significant negative impact on human cognition, emotions, physiology, behavior and conduct, stemming directly or indirectly from excessive and inadequate use of technology.

As technostress has become an emerging risk, several authors including Ragu-Nathan et al. (2008); Marchiori et al. (2019); Cuervo-Caravel et al. (2018); Li & Wang (2021) have identified five key motivators or contributors to its development: technological overload, technological invasion, technological complexity, insecurity and uncertainty. These are associated with workplace demands for speed, extended working hours, constant connectivity, continuous skill updating, and the need for new technological competencies to keep pace with technological evolution. Additional stressors include the fear of being replaced by more technologically skilled workers, the pressure of long and intensive workdays, the lack of flexibility in choosing work hours, and limited control over the number of hours worked (Payá-Castiblanque & Calvo-Palomares, 2020).

Several theoretical frameworks support the study of technostress. Notably, the Theory of Reasoned Action (TRA) focuses on predicting human behavior through attitudes, beliefs, social pressure, and conduct (Salazar-Concha, 2019). Another relevant model is Ajzen's (1991) Theory of Planned Behavior (TPB), which analyzes individuals' intentions based on the outcome they seek, and on factors such as personal attitudes, social norms, and perceived behavioral control (Sanchez-Medina et al., 2010). The person environment fit theory has also been considered in technostress research, highlighting the congruence between individuals and their work context as a critical factor. When this congruence is disrupted by environmental changes, mismatch may occur, leading to stress (Salazar-Concha et al., 2022).

On the other hand, this research has also focus on inhibiting factors: which are defined as conditions that reduce the negative effects of technostress on individuals (Fuglseth & Sørebo, 2014; Ragu-Nathan et al., 2008; Tarafdar et al., 2011). These inhibitors typically grouped into three categories: Provision of technical support, Facilitation of access to ICTs for workers, and active participation of employees in technology related processes (Cuervo-Caravel et al., 2018) these are closely related to the development of digital competencies, digital literacy, and access to technical assistance to address questions or difficulties with technology use.

Giving the growing concern over this emerging risk, several authors have developed instruments designed to better understand the causes and effects of technostress. Among the most widely used tools are: The Technostress Creators and Inhibitors Questionnaire by Ragu-Nathan et al., (2008), later adapted by Cuervo-Caravel et al., (2018), which identifies potential contributing factors. The Technostress Scale by Tarafdar et al., (2011), aimed at measuring reductions in technostress related to adaptation and decreasing computer related phobias. And the RED Technostress Scale by Llorens et al., (2011), which focuses on analyzing the effects of technostress.

4. Methodology

This study employed a quantitative methodology. To determine the reliability of the instrument, a pilot test was conducted, which allowed the researchers to assess its internal consistency. Once confirmed, the instrument was applied to the target population. Inclusion and exclusion criteria were established to define participant eligibility. Regarding age, the sample focused on individuals between 28 and 65 years old an age range representative of Ecuador's economically active population. Participants were required to have experience with telework, belong to the economic sectors of higher education and general education (university and school level educators), and possess a minimum of two years of experience in virtual education.

4.1. Participants

The sample consisted of 327 educators from both public and private sectors: 133 university professors and 194 teachers from primary and secondary education (schools and colleges). The sample was composed of 220 women (67.27%) and 107 men (32.72%). Participation was voluntary and anonymous.

4.2. Procedure

This research was designed as a cross – sectional, non – experimental, and casual comparative study. The main objective was to examine the psychometric properties of the Technostress Network Scale in a sample of Ecuadorian teachers to confirm the factor structure proposed by Llorens et al. (2011). Additionally, the relationships between the dimensions of technostress were explored according to the sociodemographic and professional characteristics of the analyzed population. The adaptation process involved a semantic validation stage, during which three teachers were invited to evaluate the clarity and comprehension of the questionnaire items. These educators assessed the instrument based on parameters such as clarity, consistency, coherence, relevance, contextual applicability, and accuracy in the scale used.

This study was conducted considering that no prior research existed on the adaptation and validation of this questionnaire in Ecuador. The main objective was to establish the level of psychosocial impacts experienced by Ecuadorian educators working in virtual settings. Data collection was carried out using the online platform Google Forms.

4.3. Instrument

To measure technostress, the Technostress Network Scale by Llorens et al. (2011) was applied. This instrument consists of 22 items designed to assess the psychosocial distress associated with the use of information and communication technologies (ICTs) in work environments. The items are grouped into five dimensions: skepticism (negative attitudes or lack of interest in technology use), fatigue (a feeling of mental exhaustion after prolonged ICT use), anxiety (tension or nervousness when working with digital tools), inefficacy (a perception of low competence or insufficient performance in technology-mediated tasks), and addiction (a compulsive need to stay connected). The instrument records responses using a six-point Likert scale, from 0 (Never) to 6 (Always), with higher values indicating greater levels of technostress.

4.4. Data Analysis

Prior to the application of the instrument, a pilot study was conducted to validate the clarity of the items and the initial reliability of the RED Technostress Scale for use in the Ecuadorian educational context. The pilot study included 130 teachers, representing 39.7% of the total sample. The teachers who participated in the pilot met the same inclusion and exclusion criteria established for the study (experience in teleworking, belonging to the teaching field, and a minimum of two years of experience in online teaching). Considering that the RED Technostress Scale has a theoretical structure previously established and validated in previous studies, composed of five dimensions (skepticism, fatigue, anxiety, ineffectiveness, addiction), a confirmatory factor analysis (CFA) was applied to identify correlations and covariances, this allowed us to verify whether the original model proposed by Llorens et al. (2011) is

adequately adapted to the Ecuadorian teaching population. To evaluate reliability, the overall Cronbach's Alpha coefficient was calculated at .949, indicating a high level of internal consistency. This result confirmed that the instrument is well structured and valid for use as a data collection tool. Correlation levels were established among the identified categories (Table 2).

Cases	N	%
Valid	130	100
Excluded	0	0
Total	130	100

Note. Listwise deletion is based on all variables in the procedure.

Table 1. Case processing summary pilot

Measure	Value
Cronbach's α	.948
Cronbach's α (standardized items)	.949
Number of items	22

Note. Values are reported following APA 7 conventions.

Table 2. Reliability statistics

On the other hand, the correlation process between the categories was applied and a strong positive correlation between skepticism-fatigue was observed, determining the possibility that skeptical people may show greater fatigue. The fatigue variable presents strong positive correlations with anxiety, allowing to establish the direct link between the two categories, establishing that chronic fatigue and exhaustion are closely related to the level of anxiety generated in teachers. Regarding the anxiety category, it correlates moderately and strongly with the addiction category. In addition, this category is highly correlated with the ineffectiveness category and with the anxiety category with which it establishes a strong direct correlation, which could imply that those who feel ineffective may be more likely to develop technology addictive behaviors.

Moreover, the addiction category demonstrated strong internal correlations with the anxiety, fatigue, and inefficacy categories, reinforcing the notion that anxiety may be a key determinant in the development of technological addiction. The results indicate a direct interdependence among the variables, suggesting they do not operate in isolation. Notably, both fatigue and addiction act as direct moderators for the other categories, regulating their overall level of impact. Given its strong positive correlations, the anxiety category emerges as a high – risk factor that may lead to addictive behaviors in educators. These findings are further detailed in Table 3.

	E1	E2	E3	E4	F5	F6	F7	F8	A9	A10	A11	A12	I13	I14	I15	I16	ADC17	ADC18	ADC19	ADC20	ADC21	ADC22
E1	1.000	0.417	0.034	0.467	0.391	0.342	0.402	0.437	0.401	0.409	0.448	0.471	0.398	0.462	0.415	0.400	0.353	0.286	0.272	0.305	0.317	0.318
E2	0.417	1.000	0.011	0.568	0.510	0.409	0.479	0.521	0.530	0.526	0.564	0.628	0.540	0.549	0.594	0.514	0.581	0.374	0.431	0.651	0.662	0.725
E3	0.034	0.011	1.000	-0.033	0.001	-0.020	0.005	-0.020	-0.012	-0.027	-0.024	0.014	-0.037	-0.012	-0.009	0.011	0.069	0.045	0.073	0.098	0.092	0.058
E4	0.467	0.568	-0.033	1.000	0.531	0.419	0.507	0.560	0.579	0.611	0.653	0.675	0.591	0.579	0.537	0.512	0.456	0.273	0.211	0.391	0.363	0.399
F5	0.391	0.510	0.001	0.531	1.000	0.686	0.634	0.663	0.663	0.552	0.529	0.563	0.492	0.551	0.435	0.441	0.492	0.431	0.386	0.388	0.399	0.489
F6	0.342	0.409	-0.020	0.419	0.686	1.000	0.757	0.743	0.685	0.569	0.546	0.543	0.424	0.529	0.391	0.405	0.486	0.518	0.440	0.395	0.388	0.416
F7	0.402	0.479	0.005	0.507	0.634	0.757	1.000	0.820	0.777	0.702	0.593	0.651	0.475	0.545	0.445	0.489	0.558	0.463	0.392	0.449	0.430	0.466
F8	0.437	0.521	-0.020	0.560	0.663	0.743	0.820	1.000	0.819	0.702	0.634	0.687	0.489	0.606	0.464	0.497	0.538	0.449	0.365	0.407	0.424	0.449
A9	0.401	0.530	-0.012	0.579	0.663	0.685	0.777	0.819	1.000	0.733	0.663	0.710	0.552	0.631	0.504	0.525	0.554	0.387	0.311	0.413	0.406	0.455
A10	0.409	0.526	-0.027	0.611	0.552	0.569	0.702	0.702	0.733	1.000	0.748	0.719	0.612	0.631	0.557	0.589	0.525	0.330	0.282	0.400	0.397	0.425
A11	0.448	0.564	-0.024	0.653	0.529	0.546	0.593	0.634	0.663	0.748	1.000	0.775	0.656	0.665	0.620	0.618	0.433	0.278	0.199	0.400	0.356	0.381
A12	0.471	0.628	0.014	0.675	0.563	0.543	0.651	0.687	0.710	0.719	0.775	1.000	0.699	0.701	0.672	0.649	0.554	0.333	0.270	0.457	0.438	0.524
I13	0.398	0.540	-0.037	0.591	0.492	0.424	0.475	0.489	0.552	0.612	0.656	0.699	1.000	0.802	0.733	0.635	0.454	0.283	0.250	0.410	0.354	0.415
I14	0.462	0.549	-0.012	0.579	0.551	0.529	0.545	0.606	0.631	0.665	0.701	0.802	1.000	0.723	0.660	0.660	0.463	0.307	0.274	0.404	0.342	0.425
I15	0.415	0.594	-0.009	0.537	0.435	0.391	0.445	0.464	0.504	0.557	0.620	0.672	0.733	0.723	1.000	0.683	0.498	0.263	0.246	0.455	0.379	0.443
I16	0.400	0.514	0.011	0.512	0.441	0.405	0.489	0.497	0.525	0.589	0.618	0.649	0.635	0.660	0.683	1.000	0.498	0.314	0.298	0.417	0.374	0.403
ADC17	0.353	0.581	0.069	0.456	0.492	0.486	0.558	0.538	0.554	0.525	0.433	0.554	0.454	0.463	0.498	0.498	1.000	0.565	0.506	0.585	0.569	0.637
ADC18	0.286	0.374	0.045	0.273	0.431	0.518	0.463	0.449	0.387	0.330	0.278	0.333	0.283	0.307	0.263	0.314	0.565	1.000	0.819	0.477	0.486	0.490
ADC19	0.272	0.431	0.073	0.211	0.386	0.440	0.392	0.365	0.311	0.282	0.199	0.270	0.250	0.274	0.246	0.298	0.506	0.819	1.000	0.511	0.568	0.567
ADC20	0.305	0.651	0.098	0.391	0.388	0.395	0.449	0.407	0.413	0.400	0.400	0.457	0.410	0.404	0.455	0.417	0.585	0.477	0.511	1.000	0.740	0.731
ADC21	0.317	0.662	0.092	0.363	0.399	0.388	0.430	0.424	0.406	0.397	0.356	0.438	0.354	0.342	0.379	0.374	0.569	0.486	0.568	0.740	1.000	0.792
ADC22	0.318	0.725	0.058	0.399	0.489	0.416	0.466	0.449	0.455	0.425	0.381	0.524	0.415	0.425	0.443	0.403	0.637	0.490	0.567	0.731	0.792	1.000

Table 3. Correlation matrix between items

5. Results

The gender distribution by teaching category is presented in Table 4. By analyzing the highest values in each category, certain meaningful observations can be drawn. The data suggest a strong female presence in the higher education sector, possibly reflecting the historical tendency of women to dominate certain educational disciplines. Furthermore, there is a notable balance in the number of male teachers in both secondary and university level positions. However, the pattern shifts when focusing on the secondary education sector, where women significantly outnumber men – 138 compared to 56. This may be linked to societal preconceptions regarding the appropriateness of female teachers for certain educational levels. Such disparity may indicate hiring preferences or reflect a historical gender imbalance in mid – level teaching roles.

Gender	University Professors	Secondary Teachers	Total
Male	51	56	107
Female	82	138	220
Total	133	194	327

Note. Totals correspond to the full sample (N = 327).

Table 4. Gender by economic sector

Additionally, Table 5 presents detailed data on gender distribution across academic levels required for teaching roles. By examining the most significant values in each category, several key conclusions emerge. For the academic level labeled “Technology” a degree accepted for secondary level teaching male participation outnumbers female by a ratio of 2 to 1, reinforcing the pattern of male predominance in technological fields. At the “Tertiary” level, no significant gender difference is observed. However, at the “Postgraduate” level, female dominance is evident, with a 4 to 1 ratio in favor of women.

Gender	Technology	Tertiary	Postgraduate	Total
Male	22	47	38	107
Female	12	48	160	220
Total	34	95	198	327

Note. Totals correspond to the full sample (N = 327).

Table 5. Gender by academic degree

The table provides detailed data on the gender distribution at different levels of education that are considered minimal in the teaching function. By analyzing the highest values in each category, some key conclusions can be drawn. Regarding the academic grade “Technologies”, which is accepted in middle level teaching, the male gender prevails 2 to 1. In the “Tertiary” academic degree, there is no significant difference between men and women; while in the “Postgraduate” academic level, the difference and the predominance of the female gender is marked with a percentage of 4 to 1 over the male gender.

The Table 6 presents data on central tendency measures specifically the mean and median for various psychological dimensions across male and female participants. Fatigue shows higher levels among women, possibly due to greater workloads or stress related to family responsibilities. This highlights the importance of examining the concept of dual presence (work and family) to complement these findings. Regarding the skepticism category, there are no significant gender differences; both men and women display similar levels of distrust or resistance toward technology use. In the anxiety category, higher levels are observed among women, suggesting that the use of technology may be more stressful for them. The inefficacy category follows a similar trend, with women again showing higher levels, maintaining a direct correlation with anxiety and fatigue. Although scores in the addiction category are quite close between genders, women again score slightly higher. This may indicate a greater need for connectivity and a higher dependency on technological devices among female teachers.

Gender		Skepticism	Fatigue	Anxiety	Inefficacy	Addiction
Male	Valid	107	107	107	107	107
	Mean	2,4276	2,5818	2,2570	2,1075	2,7461
	Median	2,2500	2,2500	2,0000	1,7500	2,5000
Female	Valid	220	220	220	220	220
	Mean	2,4205	2,9580	2,5398	2,2443	2,8220
	Median	2,2500	2,7500	2,2500	2,0000	2,6667

Note. Means and medians are reported with three decimals for consistency across categories.

Table 6. Mean and median scores by gender for each category

Table 7 presents central tendency measures based on the distribution by economic sector in which teachers perform their duties. The results indicate that, in the skepticism category, secondary level teachers show a higher level of impact. This may be attributed to the lower frequency of technological tool usage in secondary education compared to higher education, where such applications are more commonly integrated. In the fatigue category, while the difference in means is not substantial, the median value shows that university level professors reach a score of 3.00, suggesting greater concentration of responses. This could reflect the more demanding nature of digital planning and management tasks performed by university educators. Regarding anxiety, secondary level teachers experience a higher level of impact. This may be explained by their limited training in educational technologies, compared to university educators who often receive ongoing development in this area. In the inefficacy category, secondary level teachers again show higher scores, both in mean and median, suggesting that they feel less capable, competent, and effective when using technological tools. Moreover, addiction shows higher values among university educators, possibly due to greater connectivity demands linked to the variety of pedagogical and curricular responsibilities they manage. Overall, the results suggest that fatigue and addiction are categories with the highest average scores.

Economic Sector Statistic		Skepticism	Fatigue	Anxiety	Inefficacy	Addiction
University Professors	Valid	133	133	133	133	133
	Mean	2,394	2,880	2,356	2,047	3,033
	Median	2,250	3,000	2,000	1,750	3,000
Secondary Teachers	Valid	194	194	194	194	194
	Mean	2,550	2,949	2,638	2,378	2,738
	Median	2,375	2,750	2,500	2,000	2,583

Note. Means and medians are reported with three decimals for consistency across categories.

Table 7. Mean and median scores by economic sector for each category

Table 8 analyzed the highest mean for each educational level across the psychological dimensions studied, revealing several notable patterns. The skepticism category was highest among teachers with a technology level academic background and decreased among those with tertiary and postgraduate education. This suggests that teachers with lower academic qualifications tend to be more skeptical about technology. In the fatigue category, a decreasing pattern was observed as academic level increased, implying that teachers with higher educational backgrounds have better task management and time organization skills. Similarly, anxiety was highest among those with only technological training and decreased as academic level rose, suggesting that lower academic levels may struggle more to manage anxiety associated with telework. The same downward trend was found in the inefficacy category, where those with less academic preparation perceived themselves as less effective in performing remote work tasks. In contrast, addiction scores peaked among teachers with tertiary level education and decreased at the postgraduate level. This pattern indicates that less academically prepared teachers may develop greater dependency on technology without establishing adequate self – regulation strategies.

Education Level		Skepticism	Fatigue	Anxiety	Inefficacy	Addiction
Technology	Valid	34	34	34	34	34
	Mean	3,0833	3,8333	3,5000	3,0000	3,2778
	Median	2,2500	4,5000	3,0000	1,7500	2,5000
Tertiary	Valid	95	95	95	95	95
	Mean	2,8594	3,2500	3,0000	2,7813	3,3333
	Median	2,8750	2,7500	2,5000	2,6250	3,0833
Postgraduate	Valid	198	198	198	198	198
	Mean	2,4857	2,8361	2,5348	2,2111	2,7158
	Median	2,5000	2,6250	2,2500	2,0000	2,3333

Nota. Means and medians are reported with three decimals for consistency across categories.

Table 8. Mean and median scores by educational level

The results confirm the relationship between all the dimensions considered: skepticism, fatigue, anxiety, ineffectiveness and addiction, as all the correlations are positive and significant (Table 9). The results show that the strongest correlation develops between the category anxiety and fatigue, which is evidence that anxiety generates fatigue in teachers, considering that the mental and emotional burden of excessive work generates exhaustion. Another strong relationship is developed between the categories anxiety and ineffectiveness, the results show that when one increases, the other also increases, which may indicate that when teachers have high levels of stress and work overload, they feel less productive and effective in the development of their work. The skepticism-anxiety relationship is the third with the highest score; the results show that the use of technologies generates greater concern and stress. On the other hand, it is necessary to determine that anxiety is presented as the most critical factor of technostress when it is directly correlated with fatigue and inefficiency. It is also important to consider that technostress can generate technology addiction.

	Variables	Skepticism	Fatigue	Anxiety	Inefficacy	Addiction
Skepticism	Pearson Correlation	1	,578**	,678**	,643**	,596**
	Sig. (2 - tailed)		,000	,000	,000	,000
	N	327	327	327	327	327
Fatigue	Pearson Correlation	,578**	1	,806**	,613**	,608**
	Sig. (2 - tailed)	,000		,000	,000	,000
	N	327	327	327	327	327
Anxiety	Pearson Correlation	,678**	,806**	1	,786**	,537**
	Sig. (2 - tailed)	,000	,000		,000	,000
	N	327	327	327	327	327
Inefficacy	Pearson Correlation	,643**	,613**	,786**	1	,511**
	Sig. (2 - tailed)	,000	,000	,000		,000
	N	327	327	327	327	327
Addiction	Pearson Correlation	,596**	,608**	,537**	,511**	1
	Sig. (2 - tailed)	,000	,000	,000	,000	
	N	327	327	327	327	327

Note. ** $p < .01$ (two-tailed). N = 327.

Table 9. Pearson correlations between study variables

To complement the confirmatory factor analysis, an exploratory factor analysis was performed using principal component extraction with Varimax rotation. The results (Table 10) show a factor structure consistent with the original theoretical model proposed by Llorens et al. (2011). The dimensions of fatigue, anxiety, inefficiency, and addiction showed high factor loadings, with saturations greater than .60 for most items, supporting the internal consistency and structural validity of these factors in the teaching population that teleworks. The items corresponding to fatigue (F5–F8) and anxiety (A9–A12) showed robust clustering, confirming their relevance as central manifestations of technostress in the virtual educational environment. Furthermore, the items associated with the addiction item (ADC17–ADC22) registered consistent and high loadings, suggesting a tendency toward hyperconnectivity and technological dependence in teachers with prolonged exposure to digital tools. However, some items related to the skepticism dimension showed weaker loadings or cross-loadings, which could reflect cultural or interpretive particularities in the Ecuadorian context. This finding suggests the need for future cross-cultural studies to strengthen the adaptation of this dimension. Overall, the Exploratory Factor Analysis with Varimax rotation provides complementary evidence to the confirmatory model, confirming that the RED Scale maintains an adequate multidimensional structure in this sample and strengthening its psychometric validity for assessing technostress in Ecuadorian teachers working remotely.

To identify significant relationship within the psychological dimensions analyzed, a Chi – square test was conducted. The results indicate that there are statistically significant differences in fatigue and anxiety levels in relation to gender. These two categories are identified as relevant in the development of technostress. Fatigue emerges as a key factor, associated with work overload and the continuous and permanent use of technology without the implementation of self-regulation strategies. Anxiety is also considered a determining factor, given that the technological demands of teleworking generate high levels of emotional stress. As both categories are central to concept of technostress, the findings suggest that teleworking can lead to increased mental and emotional strain among teachers, establishing a direct and statistically significant relationship between technostress and telework (Table 11).

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
E4	.41			.53	
F5	.60				
F6	.71				
F7	.68				
F8	.66				
A9		.74			
A10		.78			
A11		.76			
A12		.72			
I13				.63	
I14				.67	
I15				.61	
I16				.59	
ADC17					.71
ADC18					.75
ADC19					.77
ADC20					.73
ADC21					.70
ADC22					.68

Note. Only factor loadings $\geq .40$ are displayed. Extraction method: principal component analysis. Rotation method: Varimax.

Table 10. Rotated component matrix (Varimax rotation)

	Skepticism	Fatigue	Anxiety	Inefficacy	Addiction
Chi-square	,123	6,241	5,575	2,330	,370
Df	1	1	1	1	1
Asymptotic Sig.	,726	,012	,127	,127	,543

Note. p values are asymptotic (two-tailed).

Table 11. Chi – Square Test

The relationship that exists or that occurs between the dimensions is known as covariance, which is the regression weight of each relationship, that is, the p-value, must be below 0.50 to be valid. In this case the relationship between each dimension of skepticism and addiction is 0.89, between skepticism and fatigue is 0.95, of skepticism and anxiety is 0.97, between skepticism and inefficacy is 0.80. The p-value between fatigue and anxiety is 1.50, between fatigue and ineffectiveness is 1.13. The p-value between anxiety and inefficacy is 1.13. That is, they are not valid since they are greater than 0.50 (Figure 1).

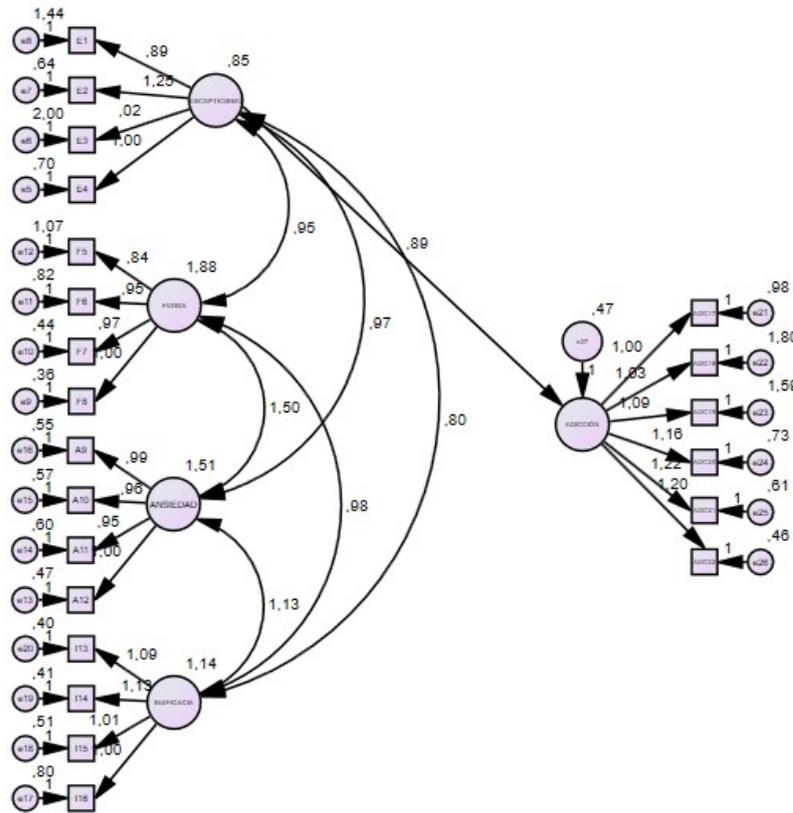


Figure 1. Structural Equation Diagram

The items being represented by the rectangles and the common factors by the ellipses, the arrows that join them are the saturations. If they are close to 1 there is a higher correlation, in this case those variables that are less than 0.07 are left out of the model, in this case the common factor of skepticism with items E1 with a value of 0.89, E3 with 1.20, E3 with 0.2 and E4 with 1.00. E3 does not have a high correlation. In the case of fatigue F5 with 0.84, F6 0.95, F7 0.97 and F8 1.00, with anxiety with A9 with a value of 0.99, A10 with 0.96, A11 0.95, A12 1.00. With ineffectiveness I13 with 1.09, I14 with 1.13, I15 with 1.01 and I16 with 1.00. Finally, addiction in ADC17 with 1.00, ADC18 with 1.03, ADC19 with 1.09, ADC20 with 1.16, ADC21 with 1.22 and ADC22 with 1.20. Those items with a lower value are eliminated from the model to determine whether they are accepted or not (Figure 2).

In the newly adjusted model, the relationships between each dimension of skepticism and addiction are 1.90, between skepticism and fatigue are 1.67, between skepticism and anxiety are 1.14, and between skepticism and inefficacy is 1.04. As for the p-value, a value of 1.50 was recorded for fatigue and anxiety, and 1.04 for fatigue and inefficacy. The relationship between anxiety and inefficacy is 1.22.

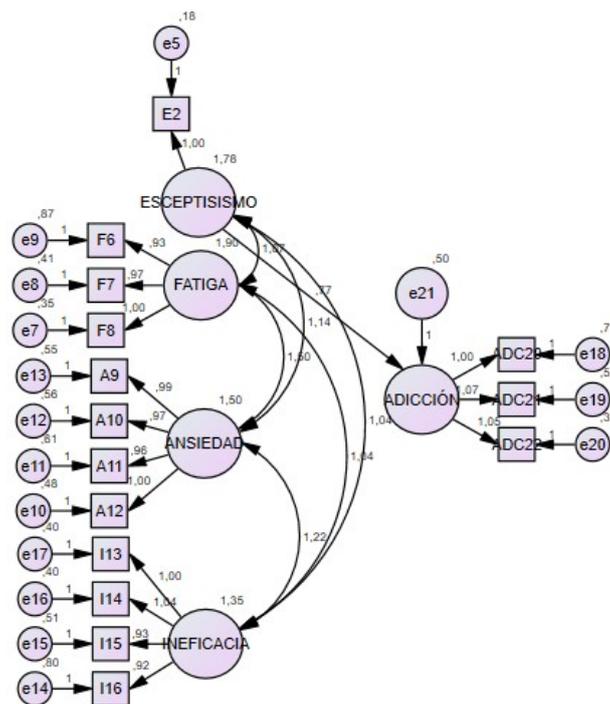


Figure 2. Modified Structural Equation Diagram

Representing the items by rectangles and the common factors by ellipses, the arrows connecting them represent the saturations. Once the items that are not significant have been removed, the following values are obtained: for skepticism, E2 has a value of 1.00. For fatigue, F6 has a saturation of 0.87, while F7 and F8 have saturations of 0.41 and 0.35 respectively. In anxiety, A9 has a saturation of 0.55, A10 of 0.56, A11 of 0.61 and A12 of 0.48. Regarding inefficacy, I13 and I14 have saturations of 0.40 each, I15 has a saturation of 0.51, and I16 has a saturation of 0.80. Finally, in addition, ADC20 has a saturation of 1.00, while ADC21 and ADC22 have saturations of 1.07 and 1.05 respectively.

6. Discussion

Telework was a modality that had not been widely implemented in Latin America prior to the COVID-19 pandemic. With the onset of the health crisis, telework emerged as a necessary solution to cope with lockdown measures and maintain economic and educational activity. This shift led to a transformation in work practices and acted as a catalyst for the adoption of technology in the labor market (Arenas et al., 2023). The use of telework occurred in a context lacking clear policies to regulate this form of work, along with limited knowledge and familiarity among teachers, students, and workers in general regarding the digital tools required to carry out their duties.

The aim of this study was to explore workers' perception of telework and its psychological effects. The findings confirmed that the scale used in this study is effective for measuring the level of technostress in the population, as well as the degree of technological dependency. Furthermore, the scale demonstrated strong psychometric properties. The semantic validation process confirmed a high level of understanding and relevance of the instrument's items for the target population, as well as the clarity of the statements. The results support that the RED – TIC instrument is valid and reliable for assessing technostress in teachers, finance personnel, and administrative staff within the analyzed context. A strong female presence was identified across the analyzed sectors, with women representing the majority at all educational levels, including higher education. This highlights the central role women play in the education system. Moreover, fatigue was found to be more prevalent among women, possibly due to factors such as dual responsibilities (professional and domestic) and work reorganization (Heredia-Gálvez et al., 2018). In contrast, addiction tendencies were more pronounced among male participants. A notable relationship was also observed between fatigue and anxiety, which may be explained by limited opportunities for

disconnection among workers and the lack of proper regulatory frameworks during the early implementation of telework. This study also conducted a confirmatory analysis using structural equations to explore the observed relationships. These results revealed a regulatory relationship between addiction and other categories, as well as a strong and direct connection between fatigue and anxiety.

Furthermore, this study helped identify the challenges workers faced in adapting to telework, which resulted in high levels of fatigue, anxiety, and feelings of inefficacy in completing assigned tasks. For this reason, it is crucial that organizations manage employees' workloads more effectively and establish reasonable expectations regarding digital device usage (Mazmanian, 2013; Perlow, 2012). This includes setting clear working hours within the framework of organizational structure, defining disconnection policies, establishing communication strategies, and implementing controls over the number of hours worked, so that connection and work time do not exceed healthy limits. One of the most important measures to mitigate technostress, as noted by several authors, lies in digital literacy training specifically related to the tools necessary for professional performance. However, this process can be further strengthened by implementing mentoring programs that provide temporary guidance for workers as they adapt to technological demands. Additionally, organizations must give special attention to the technical support they provide to their employees.

6.1. Limitations of the study

The main limitations of this research were its cross-sectional design and the unequal distribution of the sample by gender (67% women and 33% men). While the results reveal relevant trends, it is recommended that future research include equitable and balanced samples, as well as cross-cultural comparisons, to better assess technostress by gender associated with teleworking for teachers.

7. Conclusions

This research demonstrated that telework became a priority and emerging modality in Ecuador and globally during the COVID-19 pandemic. However, its adoption occurred without sufficient legislative, organizational, and social regulation, resulting in psychosocial repercussions among educators, as evidenced by the presence of technostress. The findings establish that technostress is an emerging risk and a determining factor under conditions of sudden technological adoption without proper contextual planning. Factors such as chronic fatigue, anxiety, and addiction were found to be elevated across all teaching levels. These factors not only impacted job performance but also directly contributed to inefficacy and skepticism regarding the intensive use of information and communication technologies. These dimensions are closely related and significantly affect teachers' quality of work.

The factor analysis revealed gender differences in the presence of technostress. The results show higher levels of fatigue and anxiety among female teachers. These differences should be interpreted with caution, considering that the explanatory factors associated with family or domestic roles could vary significantly according to cultural and social context. Therefore, the findings cannot be generalized to other countries or populations without considering additional data to investigate the influencing factors. These findings call on educational institutions to design organizational strategies for mitigating technostress that account for the specific circumstances faced by women. In contrast, male teachers showed slightly higher scores in the addiction dimension, suggesting a greater dependency on digital tools, possibly associated with a more instrumental approach to remote work.

Differences in these categories, linked to the social and organizational roles played by each gender, suggest the need for a complementary analysis that could further contextualize the findings of this study and help identify the different ways men and women interact with technology. Additionally, results revealed disparities in the impact of technostress based on academic level. Teachers with lower academic qualifications (technical and tertiary levels) exhibited higher levels of technostress. This highlights the need for progressive digital literacy policies, with tiered training programs combined with technical and emotional support.

Moreover, the research confirms a direct interrelation between technostress dimensions identifying anxiety as a central component due to its strong correlation with fatigue and inefficacy. These findings demonstrate the emotional and cognitive toll of teleworking, particularly in environments lacking disconnection policies, proper training, or technological guidance. Therefore, it becomes urgent and essential to develop legislation and internal policies that promote mental health in remote work environments, with a gender – sensitive approach and the implementation of preventive, inclusive, and technology – supported measures.

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Authors' contributions

Sonia Alexandra Heredia-Gálvez: conceptualization and planning, analysis and direction of the research process.

William Tigse-Bravo: data processing and generation of statistical processes.

Federico Aníbal Martínez Vélez: formal analysis and generation of structural equations and interpretation of results.

Yolanda Moreno-Guamán: analysis and generation of discussion section.

Data availability

Data available upon request.

Use of Artificial Intelligence

The authors declare that the content of the article has not been developed using Artificial Intelligence.

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