Adaptation of the Technostress Scale in Teleworking Teachers in Mexico

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Abstract

The psychometric properties were analyzed to adapt the technostress scale for teleworking teachers in the Mexican population. The sample consisted of 219 university teachers in telework mode. Exploratory and confirmatory factor analyses were conducted using SPSS Statistics and AMOS Graphics to assess the validity and reliability of the model. The results showed that three valid dimensions were retained (F1 α = 0.853, F2 α = 0.744, F3 α = 0.770), with a total of 9 items explaining 72.5% of the variance. Regarding reliability, the fit indices were satisfactory, with a CMIN of 3.514, CFI of 0.929, NFI of 0.905, TLI of 0.893, and RMSEA of 0.107. Finally, practical recommendations are provided for organizations implementing new Information and Communication Technologies (ICT) or telework systems that aim to measure, prevent, or identify cases of technostress.

Keywords: Technostress, scale adaptation, telework, teachers.

Introduction

Advancements in Information and Communication Technologies (ICT) have driven significant transformations in work modalities. According to the decree published on November 11, 2021, in the Official Gazette of the Federation (DOF), which amended Article 311 and added Chapter XII Bis to the Federal Labor Law (LFT) in Mexico, teleworking is defined as "a form of subordinated labor organization that consists of performing remunerated activities in locations other than the employer's establishments... primarily using information and communication technologies for contact and command between the worker and the employer" (DOF, 2022:79). This work model has expanded into various sectors, including education.

The use of educational platforms, the intensive integration of ICT, and the rapid evolution of technological tools necessitate continuous learning and an ongoing adaptation process. However, these changes trigger what is known as technostress among educators, understood as a form of adaptation illness (Salanova et al., 2007; Tarafdar et al., 2007). Technostress represents a negative psychological state that induces anxiety, fear, mental fatigue, skepticism, and perceptions of inefficacy when learning and utilizing ICT, whether directly or indirectly (Salanova et al., 2007). In other words, it refers to the stress caused by the present or anticipated use of information and communication technologies (Ayyagari et al., 2011; Elizalde, 2021; Lei & Ngai, 2014; Sahin & Coklar, 2009; Salanova et al., 2007; Tarafdar et al., 2007; Wang et al., 2008).

Implementation of Teleworking

Teleworking, a concept with over 50 years of history, has undergone extensive analysis from various perspectives over time (Gentilin, 2020; Baruch & Nicholson, 1997; Baruch, 2000; Bailey & Kurland, 2002; Araya-Guzmán et al., 2021). This work modality has emerged as a response to different crises, serving as a strategy to ensure operational continuity and maintain productivity within organizations. A significant example of this occurred during the 1973 oil crisis, when Nilles' studies and contributions played a crucial role in consolidating his position as a pioneer of teleworking (Gentilin, 2020), as well as during the Covid-19 pandemic in 2020.

According to Cifuentes-Leiton (2020), the government views teleworking as an opportunity to enhance employability indicators and provide access to the labor market for individuals with specific characteristics. For employers, it serves as a flexibilization tool that can help reduce costs, whereas for workers, it represents a means to achieve greater autonomy (Cifuentes-Leiton, 2020).

From an organizational perspective, companies that have adopted this model—particularly due to the need for social distancing—must implement adjustments in management and organizational structure, modify communication methods, and redefine process flows and job profiles (Belzunegui & Erro, 2020; Kawashima et al., 2020; Bojovic et al., 2020).

Baruch and Nicholson (1997) identify four key factors for the implementation of teleworking: Individual, encompassing the worker's capabilities, personality, and motivations; Organization, including the company's strategy, culture, and internal policies (Blount, 2015); Home and family, considering the economic and familial conditions that impact teleworking (Baruch, 2000); and Work, referring to the nature of tasks and the technology required to perform them. Additionally, in response to the pandemic, Antonio-Javier and Nava-Rogel (2024) introduce a fifth factor: external factors, which account for force majeure situations—such as health crises—that compelled organizations to adopt teleworking to sustain their operations. This factor also relates to customer satisfaction, both internal and external, as well as the availability and proper functioning of technology within a given region.

Within this context, a performance management system based on results plays a crucial role in fostering an organizational culture built on trust. Trust, in turn, closely correlates with the perception of strong performance and job satisfaction (Kowalski & Swanson, 2005).

Technostress

Technostress constitutes an emerging phenomenon in academic research, characterized by its interdisciplinary nature, establishing a theoretical link between the literature on information systems and psychological stress (Tarafdar et al., 2017). This concept examines how and why the use of information and communication systems imposes various demands on individuals (Agboola & Olasanmi, 2016; Tarafdar et al., 2017). Table 1 presents key definitions of technostress.

Table 1. Definitions of Technostress

Author and Year	Definition
Salanova et al. (2007)	A negative psychological state associated with the use or the perceived future threat of using ICT, linked to feelings of anxiety, mental fatigue, skepticism, and inefficacy.
Tarafdar et al. (2007)	A consequence of an individual's struggles and efforts to cope with continuously evolving ICT and the cognitive and social demands associated with its use.
Wang et al. (2008)	A reflection of discomfort, fear, tension, and anxiety when learning and using ICT, either directly or indirectly, ultimately leading to psychological and emotional aversion that prevents further learning or use.
Sahin & Coklar (2009)	A specific type of stress related to ICT use, resulting from the rapid pace of technological change.
Ayyagari et al. (2011)	A modern illness caused by the inability to cope with or maintain a stable relationship with ICT, leading to health and quality-of-life issues with potentially far-reaching consequences.
Lei & Ngai (2014)	A work accelerator, where employees work faster and with greater motivation while anticipating a reward or moral recognition from their superior.

Experiencing technostress is associated with psychosomatic issues, such as sleep disorders, headaches, musculoskeletal conditions, and gastrointestinal problems, as well as organizational difficulties, including absenteeism and decreased performance (Salanova et al., 2007; Agboola & Olasanmi, 2016; Tarafdar et al., 2017). These issues often stem from the misuse or overuse of ICT in task execution, which, in the long term, may lead to burnout syndrome (Salanova et al., 2007; Agboola & Olasanmi, 2016).

Technostress emerges when individuals perceive technological conditions in their environment as demands or "technostressors", which impose cognitive and emotional burdens, triggering coping responses that can lead to psychological, physical, and behavioral effects (Agboola & Olasanmi, 2016; Tarafdar et al., 2017). These technological conditions pertain to information system characteristics that exert pressure on users, such as ubiquity, reliability, ease of use, mobility, and presenteeism, as well as system failures and technology-induced interruptions (Tarafdar et al., 2017).

According to Tarafdar et al. (2017), technostress not only yields negative effects on individuals but can also generate positive outcomes for organizations, such as increased efficiency and workplace innovation. Enhancing these positive effects requires well-designed information systems that maximize the benefits of technostress while mitigating its adverse consequences. In this regard, Borle et al. (2021) highlight a positive relationship between technostressors and work engagement, though they acknowledge that socioeconomic factors may influence this effect.

Salanova et al. (2007) argue that high demands—whether physical, social, or organizational—combined with insufficient resources for learning, managing, and controlling ICT in the workplace, contribute to increased technostress. However, resources such as self-efficacy and ICT-related competencies can help mitigate its impact. One of the primary work demands associated with technostress is work overload, which arises when employees face pressure to complete assigned tasks within strict deadlines, thereby intensifying cognitive demands (Salanova et al., 2007).

Cognitive workload refers to the amount of information or requests that a worker must receive, process, and interpret during their professional activities (Patlán, 2013). Ayyagari et al. (2011) classify work overload as a stress factor that can induce maladaptation, reflecting the degree of fit between the individual and their job, and highlighting the impact of technological demands relative to the individual's ability to manage them.

Within this framework, Salanova et al. (2007) distinguish between two types of work overload: (i) Quantitative overload, which involves an excessive number of tasks that must be completed within a given timeframe. (ii) Qualitative overload, which refers to complex tasks that exceed the individual's competencies, making it difficult to estimate the required completion time.

Technostressors are stress-inducing factors that individuals perceive as harmful, classified into the following categories (Tarafdar et al., 2017):

a) Techno-overload: Results from the excessive use of information and communication systems, compelling users to handle additional tasks, comply with heightened security requirements, and meet external expectations regarding social media use, information overload, and system functionalities. This can lead to anxiety, fatigue, or addiction.

b) Techno-invasion: Users feel that work intrudes on personal time, as they face expectations of constant availability and immediate responsiveness. Additionally, they experience privacy invasions due to monitoring and surveillance.

c) Techno-uncertainty: Individuals perceive continuous changes in information systems, experience a lack of communication regarding significant technological decisions, and feel powerless over IT usage policies.

d) Techno-insecurity: Arises when individuals fear that others possess superior technological knowledge, leading to feelings of job insecurity.

e) Techno-complexity: Stems from the continuous need to learn how to operate new information and communication systems, comprehend IT policies, and handle technological interruptions and complications.

Among these, techno-overload and techno-invasion remain the most extensively studied stressors due to their strong negative impact on both health and work performance (Borle et al., 2021). Technostress is associated with symptoms such as anxiety, fatigue, and mental exhaustion, as well as psychosocial harm stemming from excessive and continuous ICT use (Salanova et al., 2007, p. 3).

Three primary manifestations of technostress are detailed below:

a) Techno-anxiety (TANS)

Individuals experience high physiological activation, tension, and discomfort when facing imminent technology use. This anxiety triggers negative thoughts that undermine self-confidence in handling technological tools (Salanova et al., 2007).

b) Techno-fatigue (TF)

Techno-fatigue manifests as mental and cognitive exhaustion due to prolonged ICT use. It is characterized by skepticism and perceived inefficacy regarding ICT management. Information fatigue syndrome constitutes a subset of techno-fatigue, where symptoms include difficulty in structuring and assimilating new digital information, ultimately leading to mental strain (Salanova et al., 2007).

Techno-fatigue correlates with anxiety, exhaustion, skepticism, and inefficacy associated with ICT use (Salanova et al., 2013). Workplace factors such as high workload, role ambiguity, emotional demands, workplace harassment, and obstacles, along with insufficient resources (e.g., job autonomy, transformational leadership, social support, and facilitators) and lack of personal resources (e.g., mental competencies), contribute to techno-fatigue (Salanova et al., 2013).

c) Techno-addiction (TAD)

Techno-addiction involves an uncontrollable compulsion to use ICT at all times and in all settings. This excessive behavior fosters technology dependence, generating a constant need to stay updated with the latest technological advancements (Salanova et al., 2007; 2013).

Technological addictions fall under non-chemical addictions related to human-machine interaction, categorized into: (i) Passive addictions, such as television or other fixed screens.(ii) Active addictions, involving devices like smartphones, tablets, gaming consoles, and the internet (Griffiths, 1997, cited in Salanova et al., 2007). (iii) Workplace demands—such as excessive workload, role ambiguity, workplace harassment, and a lack of personal resources (e.g., emotional competence)—are closely linked to techno-addiction (Salanova et al., 2013).

Technostress Among Educators

During the pandemic, educators faced situations that challenged their ability to adapt to the use of ICT. Various studies have documented the demands imposed by the COVID-19 pandemic on the education sector and the transition to remote work (Acevedo-Duque et al., 2021; Castellanos-Alvarenga et al., 2024; García et al., 2021; Pordelan et al., 2022; Rodríguez-Vásquez et al., 2021; Rozentale et al., 2020; Villela & Contreras, 2021).

In Mexico, Rodríguez-Vásquez et al. (2021) conducted a quantitative study involving 127 Mexican university professors, revealing a high perception of technostress in the addiction dimension across both genders, with a notable difference in women regarding anxiety levels. Similarly, García et al. (2021), analyzing a sample of 164 participants, found that 57.4% of educators experienced a high degree of technostress, with fatigue manifesting more frequently among those over 50 years old.

According to Borle et al. (2021), not all technostress factors hold the same relevance across different work environments, making it essential to assess the pertinence of specific technostressors before attempting to replicate the technostress model. Studies on technostress must demonstrate the paradoxical effects of technologies to achieve a more comprehensive understanding of the implications of specific technostressors. Although the technostress model has undergone multiple validations, researchers should also consider the validity of constructs that may have received less empirical validation (Borle et al., 2021).

Method and Design

This study follows an instrumental approach with a non-experimental, cross-sectional design, aimed at adapting, validating, and conducting a psychometric analysis of a measurement instrument (Ato et al., 2013). The convenience sample consisted of 219 participants: 104 men (47.5%) and 115 women (52.5%). Regarding age distribution, 23 participants (10.5%) were under 30 years old; 66 (30.1%) fell within the 31–40 age range; 87 (39.7%) were between 41 and 50 years old, and 43 (19.6%) exceeded the age of 50. According to Hinkin (1998), a sample of 200 subjects provides an adequate basis for validating a measurement instrument.

Instrument

The study employed the technostress questionnaire validated by Villavicencio-Ayub et al. (2020), originally administered to a Mexican population comprising workers from various sectors, homemakers, and students. Given these characteristics, a pilot test was conducted to adapt the instrument to the target population. The original scale included 20 items measured on a Likert scale, where 1 = never, 2 = a couple of times per month, 3 = once per week, 4 = a couple of times per week, and 5 = every day. Scores above 4 indicate the need for intervention to reduce technostress levels.

Three subject-matter experts critically reviewed the items, assessing each construct dimension and its applicability to the context of Mexican teleworking educators (techno-anxiety, techno-fatigue, and techno-addiction). Additionally, a pilot study was conducted with 60 volunteer teachers, who provided feedback regarding the clarity and applicability of each item, response time, and any potentially complex questions.

Data Collection Procedure

An online self-administered survey was used, developed through Google Forms and based on a Likert scale. Data collection took place from April to May 2023. University professors engaged in remote work were contacted via social media platforms such as Facebook, WhatsApp, and Messenger. Due to a low initial response rate, university administrators at two institutions were approached, who then requested that faculty members complete the survey. At the first university, 25% of 343 faculty members participated, while at the second university, 30% of 427 faculty members responded. In total, 219 questionnaires were collected.

Data Analysis

A normality test was performed using the Kolmogorov-Smirnov test, followed by a psychometric analysis that included descriptive analysis, internal consistency assessment, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA) (Ferrando et al., 2022). The EFA was conducted using SPSS (Statistical Package for the Social Sciences) with varimax rotation and factor loadings above 0.50. EFA serves as a technique for exploring latent variable structures (Lloret-Segura et al., 2014). Additionally, Structural Equation Modeling (SEM) was employed via the AMOS (Analysis of Moment Structures) extension to perform the CFA, leveraging SEM to model measurement error (Escobedo Portillo et al., 2016).

Results

A pilot test was conducted with 60 teleworkers from the education sector to adjust the technostress scale to the target population. Participants provided feedback on item clarity and relevance within their specific context. As a result, the three dimensions of the original model by Villavicencio-Ayub et al. (2020) were retained: techno-anxiety (TANS), techno-fatigue (TF), and techno-addiction (TAD). However, after conducting a principal component analysis, three items were retained for the TAD dimension, five for TANS, and three for TF (see Table 2).

Since the obtained KMO value was 0.779, the recommendation by Ferrando et al. (2022) was followed, indicating that matrices with values above 0.75 warrant the application of an EFA. Items with low communalities, such as TANS2, TANS3, TANS6, TANS7, TAD2, TAD3, and TAD4, were removed. Bartlett's sphericity test yielded a value of 270.204, with 55 degrees of freedom and a significance of 0.000. These findings informed the final application of the instrument.

Table 2. Principal Component Analysis of the Technostress Variable (Pilot Test)

	Component		
	1	2	3
TAD1		0.794	
TAD5		0.738	
TAD6		0.786	
TANS1	0.642		
TANS4	0.843		
TANS5	0.735		
TANS8	0.679		
TANS9	0.766		
TF1			0.844
TF2			0.720
TF3			0.689

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.a
a. Rotation converged in 6 iterations.
Source: Own elaboration.

Based on these results, the questions selected for the final application of the instrument among university faculty are presented in Table 3. These correspond to the technostress variable and have been assigned new codes for subsequent analysis.

Table 3. Technostress Variable and Its Dimensions: New Coding Based on Pilot Test Results

Variable	Conceptual Definition	Dimensions	Code	Question
Technostress	A process involving the presence of technological environmental conditions, which are perceived as demands or techno-stressors imposed on the individual, triggering coping responses that lead to psychological, physical, and behavioral outcomes (Salanova et al., 2013; Tarafdar et al., 2017). Likert scale where: 1 = Never, 2 = A couple of times per month, 3 = Once per week, 4 = A couple of times per week, 5 = Every day. Scores above 4 indicate the need for intervention to reduce technostress levels.	TANS (Villavicencio-Ayub et al., 2020).	TANS1	
			TANS2	It is difficult to work with technology.
			TANS3	Things go wrong when I use technology.
			TANS4	I prefer not to use technology because it hinders my work.
			TANS5	I struggle to learn how to use new technologies.
		TF (Villavicencio-Ayub et al., 2020).	TF1	I find it difficult to relax after a day of working with technology.
			TF2	It is hard for me to concentrate after working with technology.
			TF3	After using technology, I struggle to focus on other activities.
		TAD (Villavicencio-Ayub et al., 2020).	TAD1	I feel bad if I do not have access to technology (internet, email, mobile phone, etc.).
			TAD2	I spend more time using technology than being with my friends and family.
			TAD3	I spend more time using technology than engaging in sports or outdoor activities.

Source: Own elaboration

Instrument Reliability

Reliability refers to the degree to which a measurement instrument controls random error (Mohajan, 2017) and produces consistent and coherent results. To assess internal consistency, Cronbach's Alpha was employed, as it estimates the reliability of an instrument based on a set of items expected to measure the same construct or theoretical dimension. Cronbach's Alpha is one of the most widely used measures of internal consistency in social sciences and the business field, interpreted as the average of all possible split-half coefficients (Rivas, 2020). Values above 0.7 are considered acceptable, those exceeding 0.8 are deemed good, and values surpassing 0.9 are regarded as exceptional (Mohajan, 2017; Rivas, 2020). The values obtained in this study are presented in Table 4, highlighting that the difference between Alpha and Omega values remains minimal. Both coefficients are considered acceptable, with all values exceeding 0.70, as recommended by Mohajan (2017).

Table 4. Reliability Analysis: Cronbach's Alpha and Omega Coefficients

Variable	Dimension	No. of Questions	Alpha (α)	Omega (Ω)
Technostress 2F	TANS and TF	6	0.880	0.884
	TAD	3	0.744	0.758
Technostress 3F	TANS	3	0.770	0.772
	TF	3	0.853	0.858
	TAD	3	0.744	0.758

Exploratory Factor Analysis

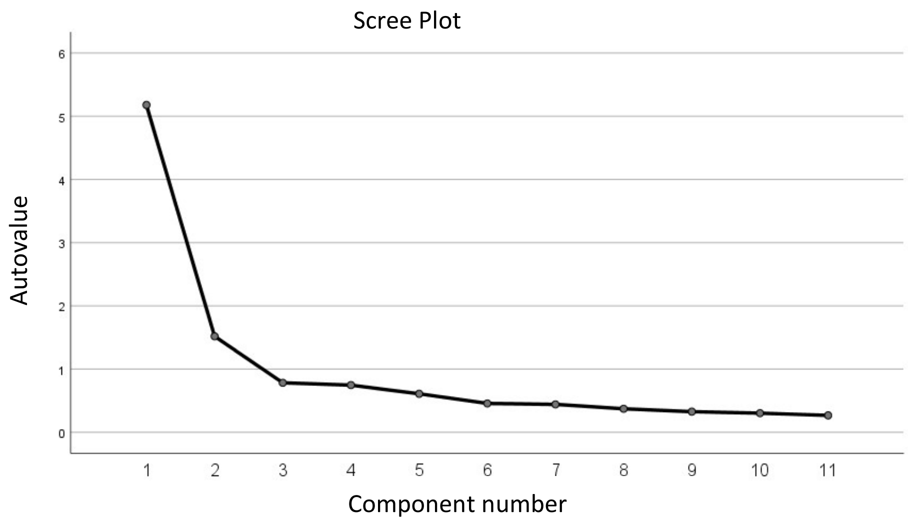
Exploratory Factor Analysis (EFA) is a statistical data reduction technique that proves useful in causal research, as it explains the correlations among observed variables through a smaller number of unobserved variables, known as factors (Lloret-Segura et al., 2014). The observed variables are modeled as linear combinations of these factors, combined with error expressions (Rivas, 2020). EFA is used to infer the internal structure of a relatively large set of variables, assuming that factors are associated with specific groups of these variables. The factor loadings for each factor help determine their relationship with the different variables (Rivas, 2020).

EFA consists of four phases: computing a matrix that reflects the variability of the analyzed variables, optimally extracting factors, rotating the solution using loadings greater than one, and estimating the subjects under study within the new dimensions (Rivas, 2020). In this study, an EFA was conducted to analyze the metric quality of the instrument and determine the factor loadings for each factor, using the principal components method with varimax rotation. This method generates a unique mathematical solution that extracts the maximum possible variance for each factor (Kerlinger, 1988), suppressing values below 0.50.

Statistical adequacy was assessed using Bartlett's test of sphericity, which tests the null hypothesis that the correlation matrix is an identity matrix (Juárez, 2013). Additionally, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was employed to compare the observed correlation coefficients with the partial correlation coefficients. KMO values close to zero indicate that principal component analysis is inappropriate, whereas values of 0.70 or higher are considered acceptable (Lloret-Segura et al., 2014).

The EFA was conducted with a sample of 219 participants, yielding two factors with eigenvalues greater than one, allowing for the identification of the TANS and TF dimensions as part of a single element, distinct from TAD. Given that the literature suggests three dimensions for the technostress variable, the analysis was performed using both two and three dimensions. The scree plot (see Figure 1) indicates that the third factor has eigenvalues below one. A subsequent analysis compared both models using Confirmatory Factor Analysis (CFA).

Figure 1. Scree Plot for Technostress (Two-Factor Model)



Source: Own elaboration based on data collected in SPSS.

In the Exploratory Factor Analysis (EFA), the principal components method was applied, using extraction based on eigenvalues greater than one and varimax rotation, suppressing loadings below 0.50. These specifications produced a two-factor solution, where TANS1 and TANS5 were removed due to low communalities (0.473 and 0.485, respectively). This solution accounted for 65.9% of the variance.

However, given that the literature suggests three dimensions for the technostress variable, an additional analysis was conducted, extracting three factors. In this three-factor solution, TANS1 was removed due to its low communality (0.582), while TANS3 loaded onto two factors (F1 and F2) and was thus excluded from the model. This resulted in a three-factor solution, explaining 72.6% of the variance (see Table 5).

Confirmatory Factor Analysis Validity

Confirmatory Factor Analysis (CFA) aims to determine whether the number of factors obtained in the Exploratory Factor Analysis (EFA) and their factor loadings align with theoretical expectations based on prior knowledge of the data. The underlying hypothesis suggests the existence of pre-established factors or a factorial structure corresponding to the research problem (Cuadras, 2014), where these factors associate with a specific subset of variables. Thus, CFA provides a confidence level that allows for either accepting or rejecting the proposed hypothesis.

Structural Equation Modeling (SEM) can be applied in three scenarios: (1) to model Confirmatory Factor Analysis, (2) in competing models, and (3) for developing a new model (Cupani, 2012). In this study, SEM was employed for CFA, represented through path diagrams. In these diagrams, rectangles correspond to observed variables (questions), ellipses represent latent variables (common factors), unidirectional arrows between common factors and questions indicate factor loadings, while bidirectional arrows reflect correlations among latent variables (Cupani, 2012; Escobedo et al., 2016).

Table 5. Exploratory Factor Analysis of the Technostress Variable

Variable	Dimension	Matriz adequacy		Item	Factor 1	Factor 2	Factor 3	Factor variance	Total variance
		KMO	Bartlett						
Technostress (Two-Factor Model)	TANS y TF	0.858	932, 36 gl Sig. 0.000	TANS2	0.756			39.4%	65.9%
				TANS3	0.826				
				TANS4	0.815				
				TF1	0.691				
				TF2	0.66	0.514			
				TF3	0.799				
	TAD			TAD1		0.754		26.6%	
				TAD2		0.755			
				TAD3		0.843			
Technostress (Three-Factor Model)	TANS	0.845	869.604, 36 gl, Sig. 0.000	TANS2			0.767	23.8%	72.6%
				TANS4			0.709		
				TANS5			0.834		
	TF			TF1	0.805			24.9%	
				TF2	0.828				
				TF3	0.707				
	TAD			TAD1		0.73		23.8%	
				TAD2		0.747			
				TAD3		0.849			

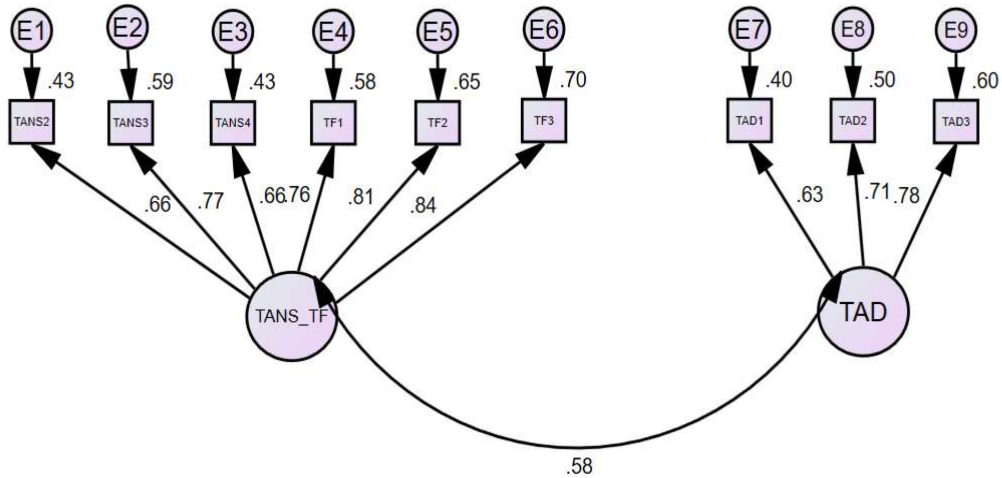
Source: Own elaboration based on collected data.

According to Lévy and Varela (2006), a researcher measuring a construct must identify its underlying dimensions and define observable variables as indicators of these latent dimensions. CFA then compares the data against the theoretical model and calculates fit indices, which indicate whether the model constitutes a plausible representation of reality.

CFA evaluates factor loadings, which represent the correlation between variables and factors. The closer a loading is to 1, the stronger the correlation (Escobedo et al., 2016). An empirical rule in CFA suggests that factor loadings should be ≥ 0.70; therefore, some factors and variables may be excluded from the model. This decision must rely on the researcher's judgment (Escobedo et al., 2016).

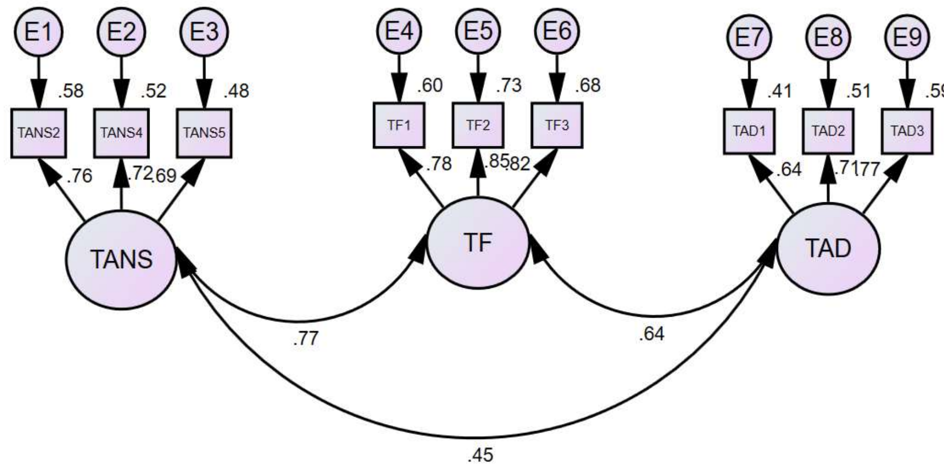
In this study, CFA was conducted using AMOS 23, adhering to the two- and three-dimensional structures obtained in the EFA (see Figures 2 and 3).

Figure 2. First Model of the Technostress Variable: Two-Factor Solution with Standardized Estimates



Source: Own elaboration based on collected data.

Figure 3. Second Model of the Technostress Variable: Three-Factor Solution with Standardized Estimates



Source: Own elaboration based on collected data.

The maximum likelihood method was employed to estimate the goodness-of-fit parameters. For the first two-factor model, the Chi-square value reached 109.4 with 26 degrees of freedom and a significance level of 0.000. In the case of the second three-factor model, as suggested in the literature, the Chi-square value was 84.332 with 24 degrees of freedom and a significance level of 0.000.

Table 6 presents the values obtained for both models, indicating a better fit in the three-factor model. The Chi-square test should yield a value greater than 0.05; the discrepancy between χ^2 and degrees of freedom (CMIN/DF) should remain below five; the Root Mean Square Error of

Approximation (RMSEA) should be below 0.05 or 0.08, depending on the author. Additionally, the Comparative Fit Index (CFI) should fall between 0.90 and 1, as should the Normed Fit Index (NFI) and the Non-Normed Fit Index (NNFI or TLI).

Table 6. Fit Indices for the Technostress Variable

Fit Index	Expected	Obtained (Two-Factor Model)	Obtained (Three-Factor Model)
Chi-Square (χ^2)	> 0.05	.000	.000
Discrepancy between χ^2 and Degrees of Freedom (CMIN/DF)	< 5	4.207	3.514
Root Mean Square Error of Approximation (RMSEA)	< 0.05 / 0.08	0.121	0.107
Comparative Fit Index (CFI)	0.90 - 1	0.909	0.929
Normed Fit Index (NFI)	0.90 - 1	0.885	0.905
Non-Normed Fit Index (NNFI or TLI)	0.90 - 1	0.874	0.893

Source: Own elaboration based on collected data.

Table 7 summarizes the configuration matrix corresponding to the final scale used to measure technostress in teleworking educators. It includes values such as means, standard deviations, Cronbach's alpha, and omega coefficients, as well as factor loadings and explained variances.

Table 7. Factor Structure Matrix for the Final Technostress Scale in Teleworking Educators

Factors and Items	M	SD	α	Ω	Item Loadings	Explained Variance
Factor 1: Techno-Fatigue (TF)	1.71	.89	0.853	0.858		24.9%
I find it difficult to relax after a day of working with technology.					0.805	
It is hard for me to concentrate after working with technology.					0.828	
After using technology, I struggle to focus on other activities					0.707	
Factor 2: Techno-Addiction (TAD)	2.53	1.08	0.744	0.758		23.8%
I feel bad if I do not have access to technology (Internet, email, mobile phone, etc.).					0.730	
I spend more time using technology than being with my friends and family.					0.747	
I spend more time using technology than engaging in sports or outdoor activities.					0.849	
Factor 3: Techno-Anxiety (TANS)	1.61	.79	0.770	0.772		23.8%
It is difficult to work with technology.					0.767	

I prefer not to use technology because it hinders my work.	0.709
I struggle to learn how to use new technologies..	0.834

Source: Own elaboration based on collected data.

Discussion

Regarding the technostress variable, Salanova et al. (2013) analyzed the structure and predictors of two psychological experiences associated with ICT use: techno-fatigue (TF) and techno-addiction (TAD). Their findings revealed that, although TF and TAD represent independent negative psychological experiences, they remain interconnected, as they are not predicted by different job demands and personal or workplace resources. In this context, the present study aimed to validate the technostress scale through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

Recently, the omega coefficient has gained popularity as an alternative for estimating instrument reliability, as it relies on factor loadings, which serve as weighted sums of standardized variables. This approach stabilizes calculations, yielding a more accurate reflection of actual reliability levels, unlike Cronbach's alpha, which depends on the number of items in the instrument (Ventura-León & Caycho-Rodríguez, 2017). Therefore, this study employed both Cronbach's alpha and the omega coefficient to determine the reliability of the measurement instrument. The TAD dimension exhibited the lowest reliability (0.744), yet it remained within acceptable limits. The TANS dimension achieved a reliability of 0.770, while TF reached 0.853, indicating good reliability.

Regarding the EFA, the three-factor solution was retained, as recommended in the literature, comprising nine items that explained 72.6% of the variance. This result contrasts with Villavicencio-Ayub et al. (2020), who obtained an explained variance of 46.04% with three factors and 20 items. In both studies, the KMO values exceeded 0.70, specifically 0.858 in the present study and 0.845 in the previous one, making them statistically adequate.

Among the obtained results, the three-factor model demonstrated the best fit, aligning with previous literature, as it presented superior indicators across all measures, particularly in the discrepancy between χ^2 and degrees of freedom (CMIN/DF), where the value of 3.514 was lower than that of the two-factor model (4.207).

These findings support the three-dimensional factorial structure for the technostress variable, which, according to Villavicencio-Ayub et al. (2020), also applies to the Mexican population in measuring technostress. It is important to note that, based on the conducted analyses and pilot testing, the number of items was adjusted for this study. Future research should continue investigating the composition of this scale to measure technostress among teleworkers across different sectors.

In this regard, Domínguez (2018) conducted an exploratory analysis of the technostress scale among ICT workers in SMEs in Coahuila, Mexico, using a sample of 200 participants. This analysis produced a 21-item scale with four dimensions—anxiety, fatigue, inefficacy, and addiction—explaining 76.7% of the variance. Additionally, Diéguez Reyes & Valdés Santiago (2024) validated the technostress scale using Cronbach's alpha with a sample of 37 workers who frequently used ICTs, reporting acceptable values for five dimensions: skepticism (α = 0.789), fatigue (α = 0.794), anxiety (α = 0.718), inefficacy (α = 0.754), and addiction (α = 0.701). However, these studies remain limited to exploratory analyses.

Ultimately, technostress continues to affect ICT users, making it crucial for the government to pay close attention to technostress manifestations in the Mexican population. In this context, Mexico implemented NOM-035-STPS-2018 (Psychosocial Risk Factors at Work—Identification, Analysis, and Prevention), which establishes guidelines for identifying, analyzing, and preventing psychosocial risk factors while promoting a favorable organizational environment in workplaces (STPS, 2018).

Although technostress is recognized as a psychosocial risk, it remains excluded from current regulations. Furthermore, both public and private institutions lack an easy-to-use instrument for identifying this type of risk in workplaces. The proposed instrument in this study may serve as a valuable tool for assessing stress levels in individuals intensively using ICTs. Similarly, the individual work performance scale for virtual environments proposed by Antonio-Javier et al. (2023) could provide a benchmark for institutions or organizations lacking a performance evaluation tool for telework positions. By leveraging these scales and implementing new ICTs or telework modalities, the proposed flowchart (see Figure 4) could serve as a guide.

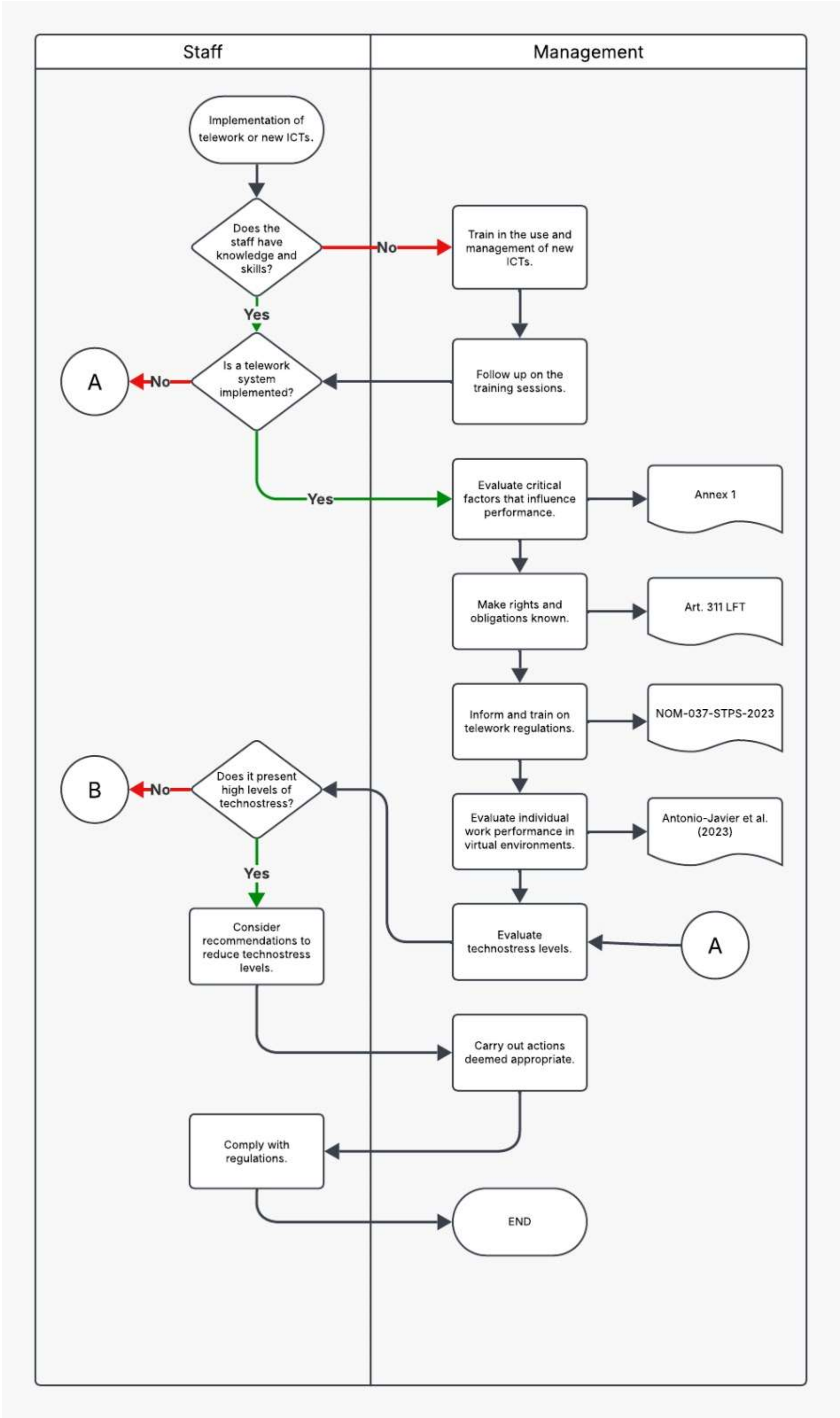
The process begins with the decision to implement a telework system or new ICTs within the organization. Then, an assessment determines whether the staff possesses the necessary knowledge and skills to adopt the new work system or technologies. If needed, training is provided.

For telework scenarios, it is advisable to review the critical factors influencing teleworker performance (see Appendix 1). It is essential for both organizations and employees to be familiar with and comply with Article 311 of the LFT and NOM-037-STPS-2023. Additionally, executives can evaluate individual job performance (Antonio-Javier et al., 2023) before and after the adoption of new ICTs or telework systems, as well as measure technostress levels. If high levels of technostress are detected, an action plan may be developed to mitigate its effects, based on general recommendations.

General Recommendations for Preventing Technostress in ICT Users

According to Moscoso et al. (2019), several recommendations can help prevent technostress, including: Organizing the workday, prioritizing the most important activities. Saying NO when resources such as time and availability are limited. Avoiding work outside of official working hours. Enjoying quality free time. Separating work life from personal life. Training staff who lack the necessary knowledge or skills. Using self-regulation techniques, such as relaxation or yoga. Avoiding screen use during meals. Eliminating unnecessary messaging groups. Resting the mind after every hour of work in front of a computer or mobile device. Stimulating the brain by reading books in traditional formats. Maintaining a healthy and balanced diet. Engaging in regular physical activity to reduce stress and promote well-being. Respecting sleep schedules. Seeking professional help if technostress persists.

Figure 4. Flowchart for the Implementation of Telework or New ICTs.



Source: Own elaboration based on collected data

Limitations and Future Research

The lack of information or databases to verify the total number of educational institutions continuing online work constrained the use of probabilistic sampling, which limits the generalizability of the results. Future studies should consider conducting probabilistic sampling, including teachers from all educational levels, to achieve a more representative depiction of Mexico's teaching population. This study focused exclusively on analyzing the technostress scale among teleworking faculty members from two public higher education institutions that continued remote work post-pandemic. However, the intensive use of ICTs has increased since the pandemic, opening up opportunities to assess technostress levels in schools that do not operate under telework modalities.

Expanding qualitative studies could provide deeper insights into teachers' experiences regarding changes in teaching methodologies and their adaptation to technology, as well as the impact on their performance. Following the pandemic, numerous qualitative studies have begun to explore this issue. Additionally, conducting a quantitative study to examine the relationship between technostress and job performance could broaden understanding of this phenomenon. Furthermore, a longitudinal or intervention study could provide evidence on the evolution of technostress and identify the most effective strategies to mitigate its effects.

Conclusions

With the evolving landscape of work and teaching methods increasingly integrating ICTs, users face rising levels of technostress. Adapting the technostress scale for university faculty enables a precise measurement of technostress in modern educational environments. Moreover, this refined scale, composed of only nine items and three dimensions, explains 72.6% of the variance, compared to Villavicencio et al. (2020), whose scale accounted for only 46.04% of the variance. This study provides evidence supporting the instrument's validity and reliability.

These results should be interpreted cautiously, as the study relied on convenience sampling due to limited access to the target population. A more robust approach would involve probabilistic or cluster sampling, leveraging databases from the Mexican Secretariat of Public Education (SEP) to enhance generalizability, which could yield different statistical values. Finally, further research should explore whether this instrument is applicable to professionals in other sectors who intensively use ICTs.

Annex 1

Checklist and Action Plan for Critical Factors Influencing Teleworkers' Performance.

CHECKLIST						ACTION PLAN			
ELEMENTS	No.	DESCRIPTION	STATUS			ACTIVITY	RESPONSIBLE	DATE	PROGRESS
Organization: Strategy and Culture	1	The company wants to implement telework as an organizational strategy.	N/A	YES	NO				
	2	The company's culture facilitates the implementation of telework.	N/A	YES	NO				
	3	The organization has the financial conditions for implementing telework.	N/A	YES	NO				
	4	The organization provides the necessary computer equipment and furniture for telework.	N/A	YES	NO				
	5	The unions agree with the implementation of telework.	N/A	YES	NO				
	6	Managers agree with and support the implementation of telework.	N/A	YES	NO				
	7	The organization is aware of the applicable laws and regulations.	N/A	YES	NO				
	8	The company has established internal rules and policies based on applicable regulations.	N/A	YES	NO				
Work: Technology and Nature	9	The job design allows for telework.	N/A	YES	NO				
	10	The job does not require face-to-face contact.	N/A	YES	NO				
	11	The job is designed to meet measurable, achievable, and deliverable objectives.	N/A	YES	NO				
	12	The job requires minimal supervision.	N/A	YES	NO				
	13	The job demands technical, analytical, and interpersonal skills.	N/A	YES	NO				
	14	The job is assigned a portable device and the necessary resources for telework.	N/A	YES	NO				
Individual: Capacity, Personality, and Motivation	15	The employee agrees with telework.	N/A	YES	NO				
	16	The employee is motivated by telework.	N/A	YES	NO				
	17	The employee has the necessary skills: technical, analytical, interpersonal, communication, and problem-solving.	N/A	YES	NO				
	18	The employee has no physical limitations preventing telework.	N/A	YES	NO				
Home and Family: Economic and Family Conditions	19	The employee shares the home with other family members (if applicable).	N/A	YES	NO				
	20	The family agrees with telework.	N/A	YES	NO				
	21	The employee has a designated workspace.	N/A	YES	NO				
	22	The space meets the minimum requirements to perform tasks.	N/A	YES	NO				
	23	The space is free from visual and auditory distractions or contaminants.	N/A	YES	NO				
	24	The space meets the minimum safety requirements.	N/A	YES	NO				
Trust, Support, Communication, and Autonomy	25	There is a culture of trust among organization members.	N/A	YES	NO				
	26	There is a culture of support among organization members.	N/A	YES	NO				
	27	Communication channels are well-defined and applicable throughout the organization.	N/A	YES	NO				
	28	The employee has autonomy to make decisions about their activities and how to perform their work.	N/A	YES	NO				
External Factors	29	Telework is implemented due to force majeure.	N/A	YES	NO				
	30	The implementation of telework meets the needs of internal and external clients.	N/A	YES	NO				
	31	The region where telework will be implemented has the necessary technological infrastructure.	N/A	YES	NO				
		TOTAL: 31							

Record:

DATE C. = Commitment Date
P= Plan
H=Do
V= Verify
A=Act

Objective: Analyze whether the minimum requirements for implementing telework in the organization are met, considering the critical factors that affect performance. Ideally, all descriptions should be answered with "YES," except for the following questions: "The employee shares the house with other family

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