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Spanish validation of Technostress Creators Scale

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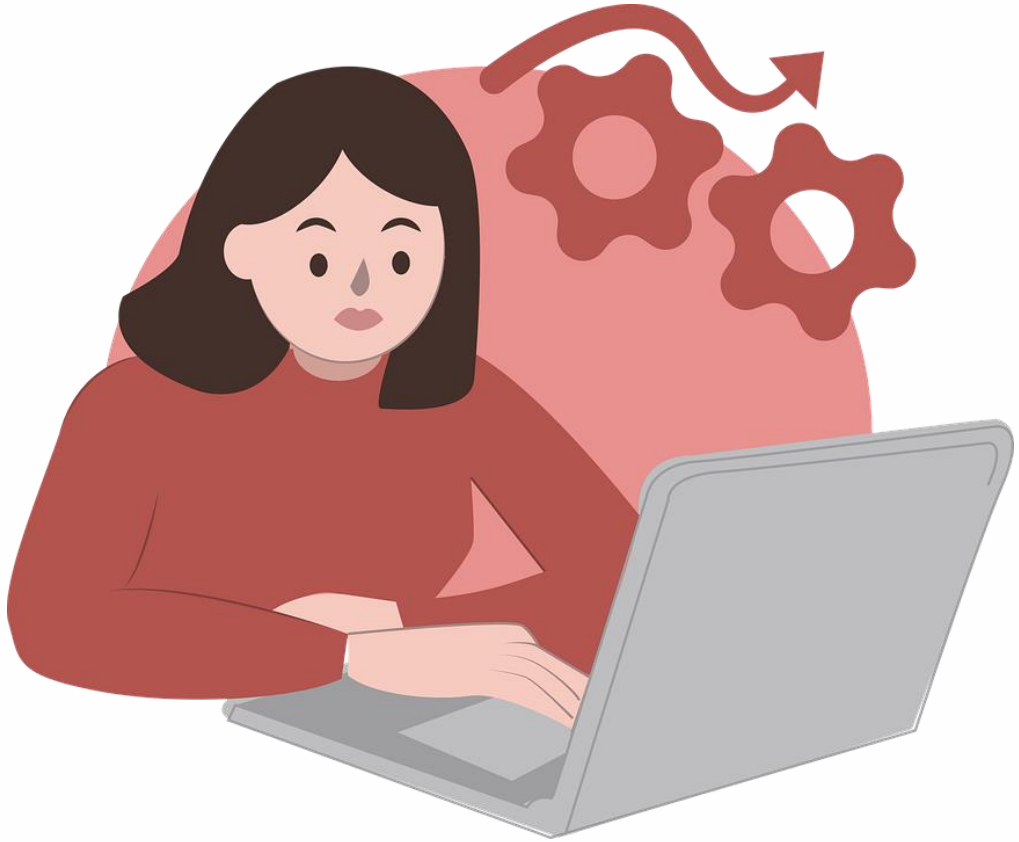
COVID-19 pandemic has changed the way organizations function, forcing many of them to opt for remote-working as an alternative to the face-to-face mode

Some studies suggest that **excessive use of information and communication technologies (ICTs) can have a significant impact on**:

- **Mental health** (anxiety, depression, and sleep disorders, Buomprisco et al., 2021)
- **Employees' nonworking hours** (Eurofound & ILO, 2017)
- **Gender roles** (women assuming the roles of care and home maintenance, increasing their workload, Hartig et al., 2007)



Psychosocial risk as a consequence of inadequate use of ICTs: **technostress**

Craig Brod (1984): modern disease caused by the **inability to cope with technology adequately**.

Nowadays, it is also related to the work context, being conceived as an **inability to adapt to technological changes in an organization (Jena, 2015).**

Techno-overload	Techno-invasion	Techno-complexity	Techno-insecurity	Techno-uncertainty
Related to increased workload (e.g., I am forced by this technology to work much faster)	**Referring to work-home conflict** (e.g., I spend less time with my family due to this technology)	**Feeling of inadequacy due to the complexity of ICTs** (e.g., I need a long time to understand and use new technologies)	**Feeling threatened to lose a job** (e.g., I have to constantly update my skills to avoid being replaced)	**Due to constant changes associated to technologies** (e.g., There are constant changes in computer software in our organization)

Ragu-Nathan et al. (2008) developed the first instrument to measure technostress creators and inhibitors in organizations. Based on the transactional-based model of stress, the **Technostress Creators Scale (TCS)** **identifies five factors**

Technostress has shown to cause muscle cramps, headaches, and insomnia (Çoklar, & Şahin, 2011), inability to concentrate and increased irritability (Raja Zirwatul Aida et al., 2007), increased blood pressure (Johansson, & Aronsson, 1984), burnout (Khedhaouria, & Cucchi, 2019), etc.

To address these effects on ICT users' well-being, this research aims:

- To **adapt** and **provide validity evidence for the Spanish version of the TCS** by Ragu-Nathan et al. (2008)
- To **test the measurement invariance across gender**

An analysis of the TCS scores in relation to the General Health Questionnaire (GHQ-12) scores will be carried out, expecting to get:

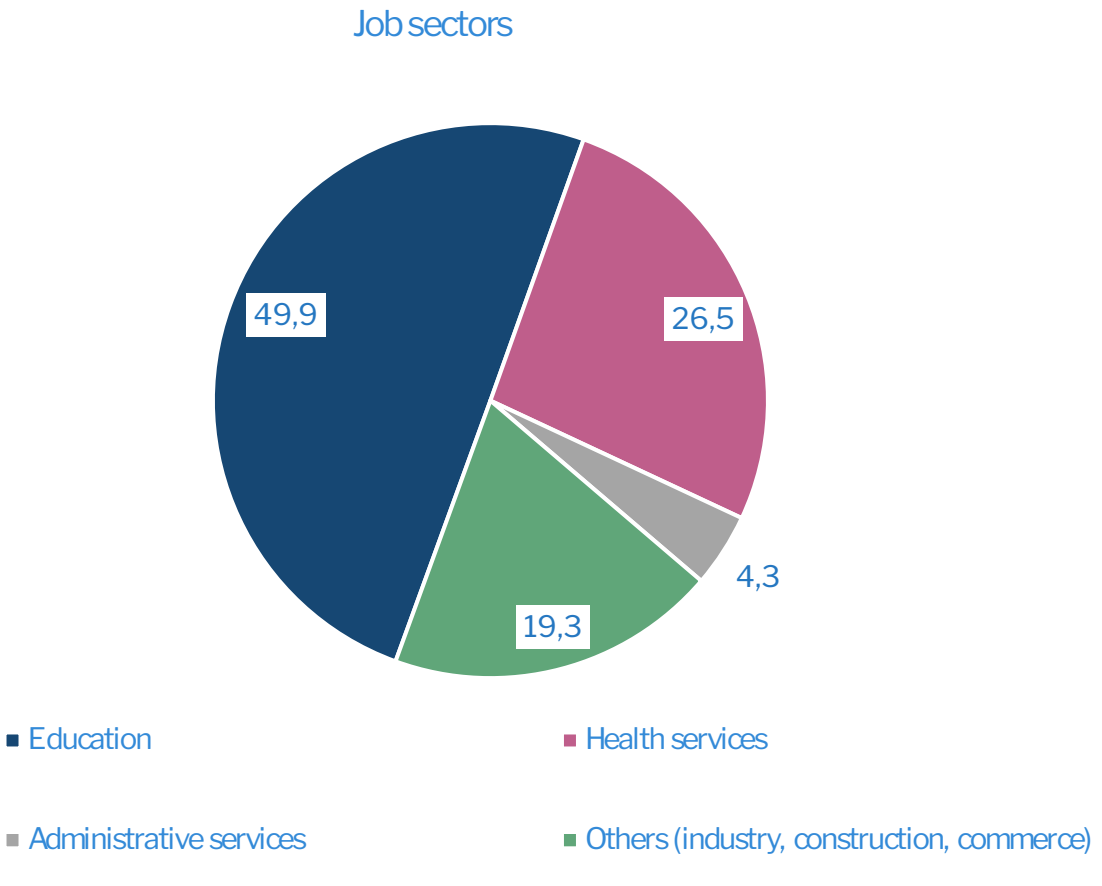
- **Negative correlations** with the Successful coping and Self-esteem factors of GHQ-12
- A **positive correlation** with the Stress factor of GHQ-12.

Method:
Participants and procedure

931 employees from Spain (75.6% were female) aged between 21 and 67 years old (M = 47.89; SD = 8.34)

A **convenience sampling system:** invited organizations which agreed to participate in the study (30% of response rate)

Online questionnaire, the participation was completely voluntary and anonymous



Method: Instruments

1. **Technostress Creators Scale**

Spanish translated version of the Ragu-Nathan et al.'s (2008) TCS (back translation). The English version scale is composed by **23 items** (from 1 'strongly disagree' to 5 'strongly agree').

The original version shows a five-factor structure:

- Techno-overload (TC1, α= .82),
- Techno-invasion (TC2, α= .80),
- Techno-complexity (TC3, α= .77)
- Techno-insecurity (TC4, α= .78)
- Techno-uncertainty (TC5, α= .83)

2. **General Health Questionnaire** (GHQ-12)

The 12-item version validated in Spanish (Sánchez-López, & Dresch, 2008) was used to assess psychological health with a three-factor structure (α = .76):

- Successful coping (e.g., Capable of making decisions)
- Self-esteem (e.g., Losing confidence)
- Stress (e.g., Loss of sleep over worry)

The items scored on a four-point Likert-type scale from 0 (never) to 3 (always).

Method: Analyses

1	2	3	4
Exploratory factor analysis (EFA) to determine factorial loadings on each item	Confirmatory factor analysis (CFA) to determine factor loading on the final Spanish version	Gender invariance analysis to probe the invariant structure of the final Spanish scale	Test of concurrent validity with the GHQ-12

Validation of the scale was conducted in four steps

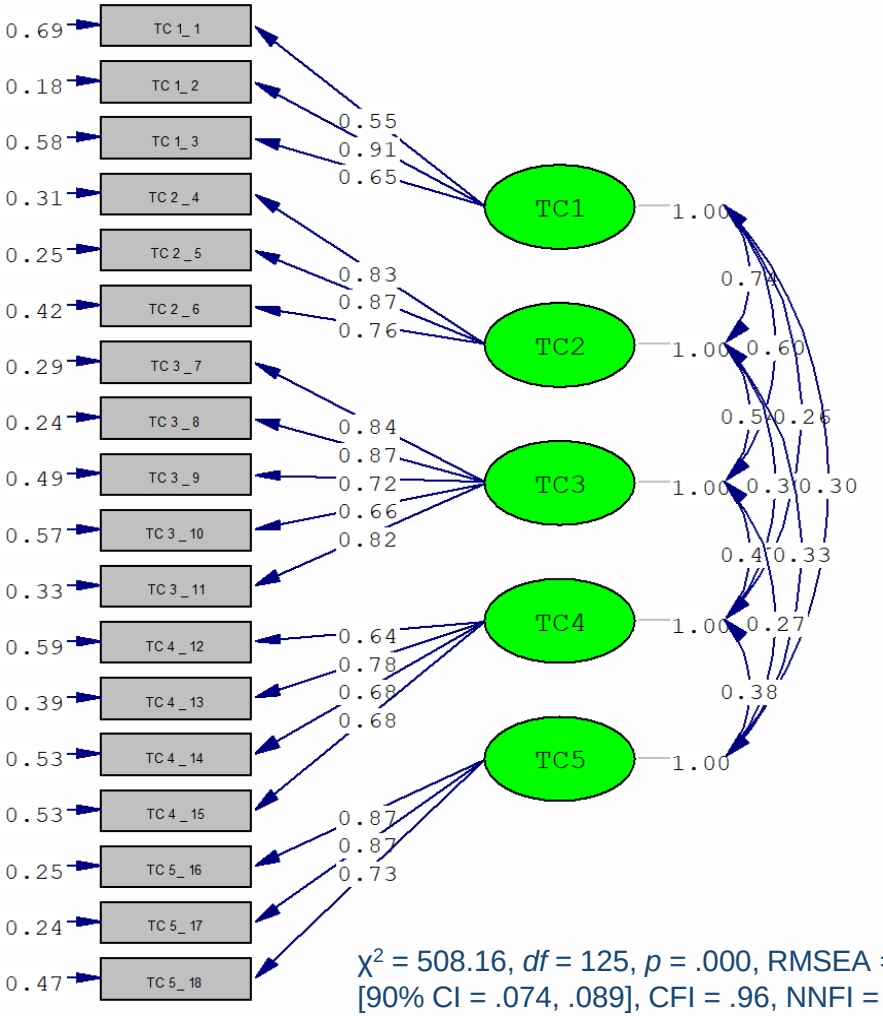
Results: Step 1, Exploratory factor analysis (n = 466): 18 items

Subscale	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	M	SD	Skewness	Kurtosis	
TC1 Techno-overload	1					.603	3.34	1.11	-.40	-.46	α= .85, Ω= .89
	2		-.623			.839	3.46	1.12	-.24	-.73	
	3					.619	3.13	1.16	-.01	-.87	
	4	**.530**	**-.663**			**.713**	**3.54**	**1.20**	**-.48**	**-.75**	
	5	**.547**	**-.740**			**.780**	**3.57**	**1.21**	**-.42**	**-.87**	
TC2 Techno-invasion	**6**		**-.775**			**.643**	**3.35**	**1.24**	**-.25**	**-1.01**	α= .88, Ω= .91
	7		-.831				3.27	1.36	-.24	-1.20	
	8		-.856				3.02	1.32	-.01	-1.18	
	9		-.742				3.45	1.19	-.42	-.78	
TC3 Techno-complexity	10	.849					2.93	1.18	.11	-.92	α= .91, Ω= .93
	11	.895					3.02	1.18	.01	-.95	
	12	.752					3.32	1.14	-.28	-.77	
	13	.724					3.00	1.12	.03	-.70	
	14	.887					2.91	1.16	.11	-.93	
TC4 Techno-insecurity	**15**	**.649**			**.517**		**2.76**	**1.17**	**.28**	**-.79**	α= .82, Ω= .87
	16				.669		2.70	1.13	.33	-.55	
	17				.764		2.32	1.01	.48	-.31	
	18				.682		1.76	.81	1.01	.93	
	19				.740		2.13	1.06	.81	.04	
TC5 Techno-uncertainty	**20**			**.486**			**3.39**	**.98**	**-.54**	**-.01**	α= .82, Ω= .88
	21			.859			2.94	1.03	-.03	-.47	
	22			.840			2.71	1.01	.08	-.38	
	23			.760			3.06	1.02	-.22	-.37	

61,71 % total variance

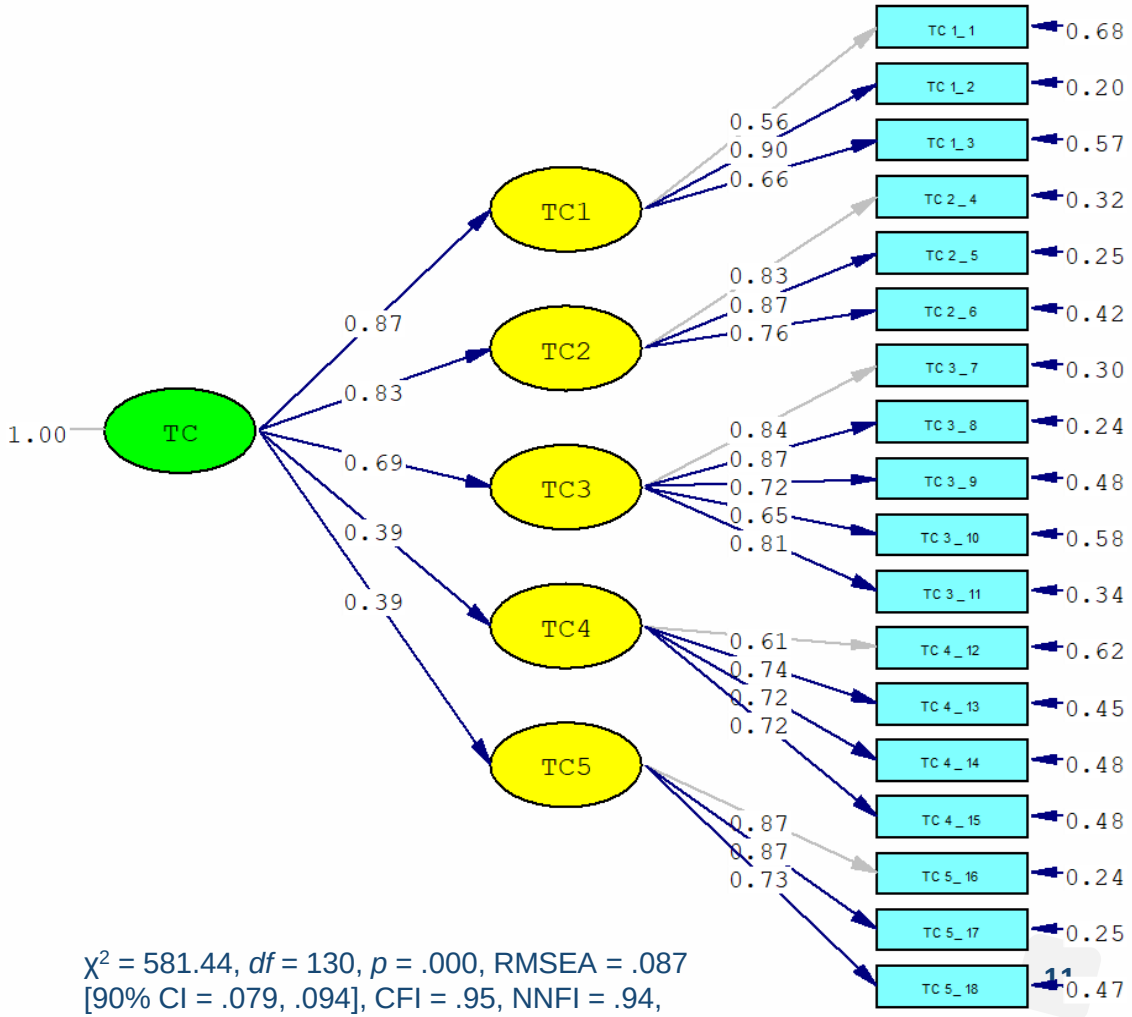
Step 2: Confirmatory factor analysis (n = 465)

First order CFA of the final Spanish version of the TCS



χ^2 = 508.16, *df* = 125, *p* = .000, RMSEA = .081 [90% CI = .074, .089], CFI = .96, NNFI = .95, SRMR = .064

Second order CFA of the final Spanish version of the TCS



χ^2 = 581.44, *df* = 130, *p* = .000, RMSEA = .087 [90% CI = .079, .094], CFI = .95, NNFI = .94, SRMR = .083

Step 3: Test of gender invariance

Results of the multi-group analyses revealed non-significant differences between genders in the **configurational (M1) and metric (M2) invariance tests.**

However, there are significant differences between genders in the scalar (M3) and residual (M4) invariance tests.

Model	χ^2 (df)	CFI	NNFI	RMSEA (90%CI)	SRMR	Model Comp.	$\Delta\chi^2$ (df)	ΔCFI	ΔNNFI	ΔRMSEA	ΔSRMR	Decision
M1 Configural Invariance	612.96 (250)**	.96	.95	.080 (.072 .088)	.069	-	-	-	-	-	-	**Accepted**
M2 Metric Invariance	622.21 (263)**	.96	.95	.078 (.070 .086)	.072	M1	9.25 (13)	0	0	.002	.003	**Accepted (S&B)**
M3 Scalar Invariance	969.04 (281)**	.86	.85	.105 (.100 .110)	.015	M2	346,83 (18)**	.10	.10	.023	.058	Rejected (S&B)
M4 Residual Invariance	1057.61 (299)**	.86	.85	.106 (.100 .110)	.016	M3	88.57 (18)**	0	0	.001	.001	Rejected (S&B)

Note. N = 450; group 1 males n = 225; group 2 females n = 225. S&B = Satorra & Bentler, (2001). * $p \leq .05$. ** $p \leq .01$.

Step 4: Test of concurrent validity with GHQ-12

TC total score and the five factors showed **negative correlations** with global psychological health, successful coping and self-esteem, and **positive correlations** with stress.

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1 Sex (0 male-1 female)	--	--	--											
2 Age (years)	47.89	8.34	-.05	--										
3 TC Total	2.90	.65	.02	.18**	--									
4 TC1 (Techno-overload)	3.33	.92	.01	.10*	.72**	--								
5 TC2 (Techno-invasion)	3.28	1.16	-.03	.16**	.75**	.58**	--							
6 TC3 (Techno-complexity)	2.97	.91	.11*	.24**	.80**	.49**	.47**	--						
7 TC4 (Techno-insecurity)	2.19	.78	-.02	-.03	.62**	.22**	.24**	.39**	--					
8 TC5 (Techno-uncertainty)	2.92	.91	-.03	.10*	.55**	.26**	.27**	.24**	.32**	--				
9 Psychological health (GHQ-12)	30.64	7.44	.01	-.13**	**-.48****	**-.36****	**-.54****	**-.36****	**-.19****	**-.19****	--			
10 Successful coping (GHQ-12 F1)	14.81	3.37	.04	-.13**	**-.40****	**-.32****	**-.47****	**-.29****	**-.13**	**-.15****	.92**	--		
11 Self-esteem (GHQ-12 F2)	8.88	2.45	-.01	-.08	**-.47****	**-.33****	**-.46****	**-.35****	**-.27**	**-.19****	.89**	.73**	--	
12 Stress (GHQ-12 F3)	8.03	2.40	.00	.14**	**.45****	**.34****	**.54****	**.33****	**.12**	**.19****	-.88**	-.70**	-.73**	--

Discussion: The resulting instrument

- Adequate functioning of the psychometric properties in our sample. The EFA led to a model that explained 61.71% of the total variance, maintaining the five factors of the original English version.
- High reliability for each dimension, similar to or greater than the original version, as evidence of good internal consistency.
- Five items out of the 23 from the original scale were eliminated after showing inadequacy.

Psychometric properties

- Comparisons across genders should be avoided with this version of the scale since neither the scalar nor the residual invariance models demonstrated a good fit to the data.

Gender invariance analysis

- Our sample scores showed a negative correlation between all TCS factors and GHQ-12 factors Successful coping and Self-esteem.
- Positive correlation with the Stress factor of GHQ-12.

Concurrent validity

Discussion:
Limitations, strengths & conclusion

- Self-report surveys are linked to **method biases** related to respondents.
- Convenience sampling method: it is possible that some of the respondents were more interested in participating due to **experiencing higher levels of technostress.**
- **Type of company** as an extraneous variable in our study and including non-technical occupations in our samples could have altered the results.

- **Large sample** that contributes to guarantee more reliable and generalizable results.
- Wide **variety of work activities** of the respondents helps to validate the scale in different work settings.

This study contributes to the development of a valid, reliable, and easy-to-administer instrument for measuring technostress creators in Spain.

This scale can be used in future empirical research and/or organizations to explore this risk and develop **resources to prevent and decrease its effects** on employees' well-being.

Thanks for your attention!

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