ADAPTATION OF THE TECHNOSTRAIN SUBSCALE OF THE CUESTIONARIO DE TECNOESTRÉS [TECHNOSTRESS QUESTIONNAIRE] IN A GROUP OF ITALIAN TEACHERS

FRANCESCO SULLA
STEFANIA FANTINELLI
UNIVERSITY OF FOGGIA, ITALY

BENEDETTA RAGNI
LUMSA UNIVERSITY, ITALY

TERESA GALANTI
UNIVERSITY OF CHIETI "G. D'ANNUNZIO", ITALY

DOLORES ROLLO
UNIVERSITY OF PARMA, ITALY

The rapid integration of digital technologies in response to the COVID-19 pandemic has transformed various aspects of professional life. In particular, the literature found teachers to be among the professional categories most affected by technostress. Because assessing technostress is still a priority for scholars and mental health professionals, this study aimed to adapt the technostrain subscale of the Cuestionario de Tecnoestrés [Technostress Questionnaire] (extracted from the RED/TIC questionnaire) among Italian teachers. Confirmatory factor analysis confirmed the 4-factor structure observed in the original version. Results revealed that high levels of technostrain are associated with increased burnout and negative emotions. On the other hand, positive emotions were negatively correlated with technostrain and burnout, indicating their potential protective role against the latter. These findings suggest that human resource management providing technological support may serve as crucial protective factors against burnout, emphasizing the need for sustained efforts in promoting teacher well-being.

During the first months of 2020, the whole world progressively experienced a significant change in private and work life; the use of digital technologies became widespread and vital for every activity. The scientific literature investigated several contexts and reported both positive and negative evidence related to the technological issue. From a social and community point of view, the role of technology has been a crucial protective factor for social support and connectedness promotion (Esposito et al., 2021).

Other scholars observed that social isolation and family-work conflict when working from home are very demanding dimensions threatening work engagement and productivity (Galanti et al., 2021). The unpredictable working situation provided by the COVID-19 pandemic, deeply changed some mainstays in organizational dynamics: a good relationship with the leader could worsen the family-work conflict when working from home; this may be due to the workers' desire to meet the leader's expectations, neglecting

TPM Vol. 31, No. 3, September 2024
363-376
© 2024 Cises

Sulla, F., Fantinelli, S., Ragni, B.,
Galanti, T., & Rollo, D.
Italian validation of the RED/TIC scale

family care (Toscano et al., 2022). There is evidence about the impact of negative emotions produced by the use of Information and Communication Technology (ICT) for teachers during distance learning. The same applies to technostress, which amplified teachers' burnout (Sulla et al., 2022). An important aspect must be stressed: it was a global emergency, so teachers — just like other professional categories — were forced to restructure their jobs, without any skills building, nor previous training (Calderón-Garrido & Gustems-Carnicer, 2021; Toscano et al., 2024). This unexpected demand oftentimes represented a new source of stress for teachers, which was labeled technostress.

The first definition of technostress was provided by Brod (1984) who described it as an adaptive disease resulting from the inability to deal effectively and healthily with new computer technology. In more detail, technostress refers to "any negative effect on human attitudes, thoughts, behaviors, or body physiology that is caused directly or indirectly by technology" (Weil & Rosen, 1997, p. 5).

In numerous countries, Italy included, certain elements that schools, and the education sector in general, implemented as measures in response to the pandemic persist, leading to an increase in the use of information and communication technology (ICT) even in professions that until the digital revolution used mostly analog tools. Even before the pandemic period, the Italian Ministry of Education had already introduced the National Plan for Digital Schools (PNSD), the main planning tool for the digital transformation process of Italian schools introduced in 2015 (Italian Parliament, 2015). Currently, the PNSD is committed to a multilevel strategy for the adoption, in all schools, of digital curricula, European frameworks on digital competencies (DigComp and DigCompEdu), innovative teaching methodologies, innovative learning environments. Also, it opens to the new scenarios drawn by the National Recovery and Resilience Plan and the European Structural Funds (Ministry of Education and Merit, 2022).

However, the average age of a teacher in Italy is 50.2 — while, for example, in Germany, it is 46.3, in Spain 45.8, in France 44.3, and in the United Kingdom 39.9. Italian teachers receive tenure between the ages of 40 and 50 with the trend most pronounced in secondary education (OECD, 2023). This means that most teachers in Italy may be considered "digital immigrants," namely, people born before the widespread dissemination of digital technologies (Prensky, 2001). This might present some peculiar challenges for the Italian school system. Indeed, a recent investigation highlighted that senior workers encountering elevated levels of technostress may subsequently experience reduced job satisfaction and diminished job performance (Ali et al., 2020). The issue of advanced age in teachers goes hand in hand with the topic of diversity management, which encompasses how organizations are able and interested in involving each worker's identity, based on several categorizations, including age (Al Doghan et al., 2019). Working in an inclusive environment means that each employee receives respect and recognition for his/her distinctive contribution; an inclusive and supportive environment fosters open communication and is a facilitating element for cross-generational knowledge transfer (Lefter et al., 2011; Pershina et al., 2019). Moreover, teachers feeling supported and recognized are more likely to embrace technology as a tool for enhancing their teaching practices (Spiteri & Chang Rundgren, 2020; Winter et al., 2021; Wohlfart & Wagner, 2023). Given these premises, the ubiquitous availability of the Internet in contemporary society and the swift expansion of online education, education institutions must strive for the delivery of high-quality online learning experiences and, as a consequence, for scholars and mental health professionals to assess, and prevent, technostress.

To the best of our knowledge, two measures of technostress are validated and adapted to the Italian context. The Italian Technostress Scale for university students in technology-enhanced learning (IT-TSUS; Schettino et al., 2022), based on the scale developed in China by Wang and colleagues (2020), aims to assess a global measure of technostress. This 8-item scale was specifically designed to assess university students' technostress in technology-enhanced learning. Instead, the Technostress Creators Scale (Molino et al., 2020) is based on the scale developed in the United States by Ragu-Nathan and colleagues (2008) and aims to measure

workers' technostress. In particular, this 11-item instrument consists of three factors: techno-overload, techno-invasion, and techno-complexity.

Both instruments are based on the person-environment fit model (Edwards, 1996; Penado Abilleira et al., 2021) — a theoretical framework that considers the relationship between individuals and their environments. Workers seem to be most satisfied and motivated when there is a good fit between their personal characteristics and their environment characteristics. According to Holland and colleagues (1994), it is possible to define different professional personalities who best match those workplace contexts able to satisfy individuals' needs and expectations. With specific reference to the person-technology fit, there should be an alignment of individuals' skills and abilities with the technology they use in their working activities. A good fit can lead to positive outcomes, such as increased job satisfaction and performance; on the contrary, a misfit may result in technostress (Wang & Li, 2019).

This study aims to adapt the technostrain subscale of the Cuestionario de Tecnoestrés [Technostress Questionnaire], an excerpt of the RED/TIC (resources-experiences-demands/information and communication technologies) questionnaire (Salanova et al., 2007) in a sample of Italian teachers. According to the authors, technostress — specifically in the work context — is defined as a "negative psychological state associated with the use of ICT or the threat of its use in the future. This experience is related to feelings of anxiety, mental fatigue, skepticism, and inefficacy" (Salanova et al., 2007, p. 1). The Cuestionario de Tecnoestrés is based on the operationalization of technostress provided by Salanova et al. (2007, 2013), which is not based on its predictors or antecedents, as the ones that are already validated in Italian, but on the psychological experience of technostress itself. Specifically, the authors proposed that the term technostress acts as an umbrella encompassing two different but related psychological experiences: technostrain and technoaddiction (Salanova et al., 2013). Technostrain was defined as the most traditional dimension of technostress. Workers experiencing technostrain feel a combination of high levels of anxiety, fatigue, skepticism, and inefficacy related to the use of ICT. The first component is related to the most traditional kind of stress: it is represented by a person interacting with a computer and experiencing fear or anxiety because of the panic of entering wrong passwords or wrong inputs (Ragu-Nathan et al., 2008). The second affective component of technostrain is fatigue or exhaustion, typical in case of information overload or a lower level of psychological activation. Skepticism represents the third component, characterized by a feeling of cognitive distancing, indifference, or detachment with regard to technologies. The fourth and last cognitive component of technostrain is the sense of inefficacy when using ICT, strictly related to high demands and feeling overwhelmed. The reference data for the scoring are those for a sample of Spanish workers with varied occupations, including teachers (Salanova et al., 2007). The instrument, with specific regard to the technostrain subscale, consists of a total of 16 items, divided into four dimensions, each containing four items: (1) skepticism (Cronbach's α =.93; $M = 1.33$, $SD = \pm1.32$); (2) fatigue (Cronbach's α =.92; $M = 1.47$, $SD = \pm1.35$); (3) anxiety (Cronbach's α =.83; $M = 1.22$, $SD = \pm1.19$); (4) ineffectiveness (Cronbach's α =.84; $M = 1.05$, $SD = \pm1.13$).

The technoaddiction experience, instead, is most related to those individuals who use ICT intensively, they feel and express an uncontrollable compulsion to use ICT with no limits in terms of time and space. Because of the specific job profile of teachers, technoaddiction seems to be less applicable to their work experience where ICT [as a tool] is used to facilitate and improve teaching or administrative tasks. Moreover, the risk of compulsive use of ICT is reduced by the kind of tasks and activities carried out by teachers: active interactions with students prevail, teachers are meant to plan lessons and manage the classroom, so continuous use of digital is less likely. In Salanova et al. (2013), the scale of technoaddiction, not considered in the current study, is an adaption of the UWAS (Utrecht Workaholism Scale), where the items were reworded to fit ICT settings.

Thus, we decided to adapt and validate only the subscale related to technostrain, because it represented the most vivid experience for teachers during the COVID-19 pandemic, and it might also apply to

teachers in the future. As far as we are concerned, technostrain may be more relevant and useful to validate because of the growing need for adaptation due to new educational technologies and digital platforms; second, teachers are subjected to increased demands related to the shift to hybrid learning models, so that also the teaching preparation phase needs to be adapted.

Specifically, using a confirmatory factor analysis (CFA), the main aim of the current study was to test the factorial validity of the technostrain subscale, as well as its internal consistency reliability, criterion validity (supposing that each of its subscales will correlate with teachers' burnout and reported positive and negative emotions experienced during online teaching), and convergent validity. The proposed Italian adaptation may represent an opportunity for evaluating teachers' technostrain and subsequently propose tailored interventions to improve teachers' well-being and design specific training programs.

METHOD

Participants

A convenience sample of 1210 Italian teachers was recruited between February and March 2021. The mean age was 41.7 years ($SD = \pm 8.68$ years), with a minimum of 20 years and a maximum of 66. Women were 84.79% of the participants, with a mean age of 41.93 years ($SD = \pm 8.40$), and 15.21% were men, with a mean age of 40.42 years ($SD = \pm 10.05$). Among the participants, 9.8% were from the North of Italy, 4.9% from the Center, 77.9% from the South, and 7.4% from the islands of Sicily and Sardinia. Curricular teachers represented 60.3% of the sample, while special needs teachers were 39.7%. Specifically, as regards curricular teachers, 8.1% worked in preschool, 9.5% in primary school, 32.6% in secondary school, and 10.1% were in-training teachers. Years of teaching experience varied from less than 1 (30%), to 1-5 years (33.1%), 5-10 years (16.3%), 10-20 years (11.2%), and more than 20 years (9.4%).

Procedure

Permission for translation and use of the scale was requested from the Spanish authors. The scale was preliminarily translated with multiple forward and back translation. This approach involved an initial translation from Spanish into Italian, carried out independently by two Italian psychologists with excellent Spanish language skills. Once agreement was obtained on the Italian version, it was translated back into Spanish by a native Spanish speaker with excellent Italian language skills and checked for concordance with the original version. The questionnaire was disseminated between February and March 2021 through personal contacts. After explaining the objectives of the research to the participants and having them sign the informed consent, the scale was administered, together with a form to collect sociodemographic data. In addition, other two self-report questionnaires were completed by participants to assess the criterion validity of the scale. The questionnaires were disseminated and completed digitally via the Google Forms platform; a filter denied access to the test battery to people who did not provide their consent to participate in the study. The study was conducted in accordance with the Declaration of Helsinki, following the general research principles and the ethical rules of the Italian Psychological Association (AIP). Data obtained by the same group of teachers were presented in a recent conference paper discussing the mental health and work conditions of teachers during the COVID-19 pandemic by investigating the relationship between teachers' technostress, burnout, and emotions comparing online and in-person teaching (Sulla et al., 2022).

Measures

Cuestionario de Tecnoestrés [Technostress Questionnaire] (Salanova et al., 2007). The instrument, with specific regard to the technostrain subscale, consists of a total of 16 items, divided into four dimensions, with four items each: (1) skepticism (e.g., *"I doubt the significance of working with these technologies"*); (2) fatigue (e.g., "I find it difficult to relax after a day of work using ICT"); (3) anxiety (e.g., "I hesitate to use ICTs for fear of making mistakes"); (4) ineffectiveness (e.g., "I am insecure about finishing my tasks well when I use ICTs"). Items are measured on a 7-point Likert scale where 0 = *very unlikely/never*, 1 = *unlikely/twice per year*, 2 = *rarely/once per month*, 3 = *sometimes/twice per month*, 4 = *enough/once per week*, 5 = *frequently/twice per week*, 6 = *always/every day*.

Copenhagen Burnout Inventory (CBI; Kristensen et al., 2005; Italian version by Fiorilli et al., 2015). This instrument investigates, through 19 items, three different domains of burnout: (1) personal (e.g., "How often do you think: 'I can't take it anymore?'"), (2) work-related (e.g., "Do you feel that every working hour is tiring for you?"), (3) student-related (e.g., *"Does it drain your energy to work with students?"*). The items are rated on a 5-point Likert-type scale (from 1 = *never* to 5 = *always*).

Emotions in Teaching Questionnaire (EMOZ), extracted from MESI (motivations, emotions, strategies, and teaching; Moè et al., 2010). The instrument consists of 30 items corresponding to an inventory of emotions: 13 positive (e.g., fulfillment, sense of achievement, happiness) and 17 negative (e.g., sense of inadequacy, anger, guilt). Individual items are scored using a 5-point Likert-type response scale (from 1 = *rarely* to 5 = *almost always*); participants were asked to rate how often they felt that particular emotion during their online teaching activity.

Data Analysis

To test the factorial structure of the scale as presented in the Spanish version (four factors; Salanova et al., 2013), a confirmatory factor analysis (CFA) was performed. Specifically, an item analysis was first conducted using SPSS 27 (IBM Corporation, 2020) to investigate the items' psychometric properties (mean, standard deviation, skewness, and kurtosis) to support the robustness of the analyses. Asymmetry and kurtosis values < | 1 | (e.g., Tabachnick & Fidell, 2013) were considered optimal. In addition to this, Mahalanobis distance ($p < .001$) was calculated for all scores to identify and skip any multivariate outliers. No missing data were present.

In line with recommendations for measures development (Brown, 2015), a CFA was performed using Mplus 8.3 (Mutheén & Mutheén, 2019) to test the factorial validity of the RED/TIC scale. The fit indices of the model were evaluated using systematic fit assessment procedures (Cheung & Rensvold, 2022; Hair et al., 2018; Hair & Sarstedt, 2019; McDonald & Ho, 2002). Such techniques include the chi-square test of exact fit (χ^2), comparative fit index (CFI ≥ .90; Bentler, 1990; Bentler & Bonett, 1980; Hair et al., 2018; Hair & Sarstedt, 2019; Tucker & Lewis, 1973), standardized root-mean-square residual (SRMR ≤ .10; Bentler, 1990; Bentler & Bonett, 1980; Hair et al., 2018, 2019; Tucker & Lewis, 1973), and the root-mean-square error of approximation (RMSEA ≤ .08 with its 90% confidence interval) (Hair et al., 2018; Hair & Sarstedt, 2019; Marsh et al., 2005). In addition, according to Salanova and colleagues (2013), we also tested an alternative model: together with the 4-factor model, we assessed a 1-factor model. Considering that they are nonnested models, we used three information criteria to choose the best fit: AIC, BIC, and sample-size adjusted BIC. Lower values of these indices indicate a better model (Wang & Wang, 2012).

To assess the internal consistency reliability, Cronbach's α (excellent, α ≥ .90; good, α ≥ .80; acceptable, α ≥ .70; questionable, α ≥ .60; poor, α ≥ .50; unacceptable, α ≤ .50; Cronbach, 1951) was used and reliability indices of the latent factors identified in the final model were verified including

composite reliability (CR; cut-off values ≥ .60), maximal reliability (MR; excellent, α ≥ .90; good, α ≥ .80; acceptable, α ≥ .70; questionable, α ≥ .60; poor, α ≥ .50; unacceptable, α ≤ .50; Fornell & Larcker, 1981).

Finally, the criterion validity of the scale was evaluated (Pearson's r index correlations), as well as convergent validity using the average variance extracted (AVE) according to Fornell and Larcker (1981) criterion for assessing convergent validity (the AVE should not be lower than .50 to demonstrate an acceptable level of convergent validity, meaning that the latent construct explains no less than 50% of the indicator variance; Cheung et al., 2023; Fornell & Larcker, 1981).

RESULTS

Results from the item analysis showed that values for asymmetry and kurtosis were all < | 1 | (Tabachnick & Fidell, 2013) except for Item S_4 (kurtosis = 2.627) and Item I_3 (kurtosis = 3.372). According to the literature (Kim, 2013; Kline, 2010) | 7 | could be considered the maximum kurtosis cut-off in a sample size greater than 300 subjects. For this reason, we maintained these items in the subsequent analyses, using a robust estimator (MLR in Mplus) for the CFA. Multivariate outlier cases were not identified.

Table 1 reports the fit indices of the two tested models. The 4-factor model showed the lowest AIC, BIC, and sample-size adjust BIC, and, therefore, the best fit (Wang & Wang, 2012). Specifically, the confirmatory factor analysis showed an acceptable fit of the 4-factor model: $\chi^2(90) = 758.552$, $p < .001$; CFI = .92; TLI = .90; RMSEA = .08; SRMR = .05 (Table 1). Analyzing the factor loadings of this model, we found that all values were > of |0.3| (Table 2). All the four factors showed significant correlations ($p = .000$). fatigue with skepticism ($r = .59$), and anxiety ($r = .87$), and ineffectiveness ($r = .63$); anxiety with skepticism ($r = .62$) and ineffectiveness ($r = .87$); ineffectiveness and skepticism ($r = .58$).

Table 2 also shows the internal consistency of each factor. Reliability, assessed by Cronbach's α, showed good and acceptable values of internal consistency for the four dimensions: skepticism (α = .82), fatigue (α = .93), anxiety (α = .90), ineffectiveness (α = .88). With regard to CR and MR, all the subscales presented values between acceptable and good. Furthermore, AVE values were all higher than .50 (skepticism AVE was = .50), demonstrating an acceptable level of convergent validity.

The reliability of the other measures utilized was also assessed. Cronbach's α values were in line with previous studies (Fiorilli et al., 2015; Moè et al., 2010): personal burnout, α = .91; work-related burnout, α = .86; student-related burnout, α = .83; total burnout, α = .92; positive emotions, α = .94; negative emotions, α = .94.

With regard to the criterion validity (Table 3), positive moderate to large correlations were found between scores in negative emotions and all dimensions of technostrain as well as between scores in all dimensions of burnout and all dimensions of technostrain. Finally, small negative significant correlations were found between positive emotions and all dimensions of technostrain. Table 3 also shows the means and standard deviations of the studied variables.

DISCUSSION

The main aim of the current study was to evaluate the factorial structure, validity, and reliability of the Cuestionario de Tecnoestrés technostrain subscale (Salanova et al., 2007) in a sample of Italian teachers. Results from the CFA showed that a 4-factor model, as validated in the development and validation study (Salanova et al., 2013) provided a good fit to the data. The internal consistency of the four dimensions was high and comparable to those obtained in the original study (Salanova et al., 2007, 2013).

TABLE 1
Goodness-of-fit indices for the two tested models

Model	χ^2	p	df	CFI	TLI	SRMR	RMSEA	RMSEA 90% CI		AIC	BIC	Sample-size adjusted BIC
								Lower	Upper			
One factor	2327.477	.000	103	.73	.68	.10	.13	.13	.14	60353.536	60603.357	60447.713
Four factors	758.552	.000	97	.92	.90	.05	.08	.07	.08	57320.231	57600.641	57425.939

Note. *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation; CI = confidence interval; AIC = Akaike information criterion; BIC = Bayesian information criterion.

Sulla, F., Fantinelli, S., Ragni, B.,
Galanti, T., & Rollo, D.
Italian validation of the RED/TIC scale

TABLE 2
Factor loadings, reliability, and convergent validity

	Estimate	SE	Cronbach's α	CR	MR	AVE
Factor 1: RED/TIC skepticism			.82	.79	.81	.50
1. Con il passare del tempo mi sento sempre meno interessatə alle TIC [As time goes by, ICTs interest me less and less]	.64	.03				
2. Ogni volta mi sento meno coinvoltə nell'utilizzo delle TIC [I feel less and less involved in the use of ICTs]	.55	.03				
3. Sono scetticə riguardo il contributo che le TIC possono dare al mio lavoro [I am skeptical about the contribution of ICTs in my work]	.88	.02				
4. Dubito del valore significativo che la tecnologia può offrire al lavoro [I doubt the significance of working with these technologies]	.87	.02				
Factor 2: RED/TIC fatigue			.93	.84	.85	.57
5. Trovo difficoltoso rilassarmi dopo una giornata di lavoro con le TIC [I find it difficult to relax after a day of work using ICT]	.80	.02				
6. Quando termino di lavorare con le TIC mi sento esaustə [When I finish working with ICTs, I feel exhausted]	.84	.01				
7. Quando lavoro con le TIC sono così stancə da non riuscire a fare nient'altro [I am so tired when I finish working with ICTs that I can't do anything else]	.93	.01				
8. Per me è complicato concentrarsi dopo avere lavorato con le TIC [It is difficult to concentrate after working with ICTs]	.94	.01				
Factor 3: RED/TIC anxiety			.90	.82	.83	.54
9. Mi sento tesə e ansiosə dopo aver lavorato con le TIC [I feel tense and anxious after working with ICTs]	.88	.01				

Table 2 (continued)

	Estimate	SE	Cronbach's α	CR	MR	AVE
(*Factor 3: RED/TIC anxiety*)						
10. Mi spaventa pensare di poter danneggiare molte informazioni a causa di un uso improprio delle TIC [It scares me to think that I can destroy a lot of information by misusing ICTs]	.78	.02				
11. Indugio nell'utilizzo delle TIC per paura di commettere degli errori [I hesitate to use ICTs for fear of making mistakes]	.74	.02				
12. Lavorare con le TIC mi rende inquietə, irritatə ed impaziente [Working with ICTs makes me uncomfortable, irritable, and impatient]	.87	.01				
Factor 4: RED/TIC ineffectiveness			.88	.82	.82	.53
13. A mio parere, sono inefficiente nell'uso delle TIC [In my opinion, I am ineffective in using ICTs]	.88	.01				
14. È difficile lavorare con le tecnologie della comunicazione e dell'informazione [It is difficult to work with ICTs]	.84	.01				
15. La gente dice che sono inefficiente nell'utilizzo delle TIC [People say that I am ineffective in using ICTs]	.70	.03				
16. Non sono sicurə di portare a termine i miei lavori quando utilizzo le TIC [I am insecure about finishing my tasks well when I use ICTs]	.80	.02				

Note. SE = standard error; CR = composite reliability; MR = maximal reliability; AVE = average variance extracted. RED/TIC = resources-experiences-demands/information and communication technologies In the Italian items the use of the schwa "ə" was preferred in place of the masculine ending to define a mixed group of people, to make the language as inclusive as possible. (English translation is provided by the authors for non-Italian-speaking readers and does not refer to the validated English version of the scale).

TABLE 3
Means (*SD*s) and correlations of the main variables

	M(SD)	1	2	3	4	5	6	7	8	9	10
1. Techno skepticism	0.73(1.21)										
2. Techno fatigue	1.55(1.67)	.72**									

(table 3 continues)

Table 3 (continued)

	M(*SD*)	1	2	3	4	5	6	7	8	9	10
3. Techno anxiety	1.10(1.45)	.78**	.88**								
4. Techno ineffectiveness	0.79(1.18)	.69**	.69**	.91**							
5. Burnout (total)	2.21(0.68)	.39**	.59**	.58**	.46**						
6. Personal burnout	2.61(0.83)	.29**	.52**	.48**	.40**	.88**					
7. Work-related burnout	2.19(0.77)	.32**	.48**	.48**	.39**	.93**	.74**				
8. Student-related burnout	1.84(0.72)	.27**	.33**	.37**	.36**	.78**	.51**	.63**			
9. Negative emotions	1.71(0.90)	.48**	.67**	.54**	.43**	.57**	.45**	.47**	.39**		
10. Positive emotions	3.35(1.00)	–.18**	–.20**	–.17**	–.12**	–.27**	–.18**	–.28**	–.20**	–.39**	

Note. Min-max values: 1 = .00-6.00; 2 = .00-6.00; 3 = .00-6.00; 4 = .00-6.00; 5 = 1.00-4.79; 6 = 1.00-5.00; 7 = 1.00-5.00; 8 = 1.00-5.00; 9 = 1.00-5.00; 10 = 1.00-5.62.
**$p < .01$.

All the correlations among the four subscales were in the expected direction. The subscales also demonstrated good construct validity. The correlations among the four factors and the other measured variables were in the hypothesized direction. Specifically, burnout scores and perceived negative emotions were positively correlated with all the factors of the RED/TIC scale (skepticism, anxiety, fatigue, ineffectiveness). This means that high levels of skepticism, anxiety, fatigue, and a sense of ineffectiveness toward TIC, in this sample of teachers, were found to be related to high levels of burnout and negative emotions. These results should be taken into great consideration because it is well established in the literature that burnout has negative consequences on teachers' mental (Conte et al., 2024; Santiago et al., 2023) and physical health (Madigan et al., 2023), as well as on their ability to teach (Sulla & Rollo, 2023). Positive emotions were negatively correlated with both technostrain and burnout. As expected, higher levels of burnout correlate with lower levels of positive emotions (e.g., Andreychik, 2019). All dimensions of the RED/TIC were negatively correlated with positive emotions. While positive emotions represent a protective factor within work settings and organizations, because they were seen to have a positive influence on variables vital for workplace success such as creativity, positive beliefs, work engagement, positive coping, health, teamwork and collaboration, customer satisfaction, and performance (Diener et al., 2020); technostrain may represent a risk factor against positive emotions. Technostrain, therefore, may also represent a risk factor for the onset of burnout.

In line with the results obtained and the person-environment fit model, it can be concluded that an educational institution must take care of the well-being of teachers, also through monitoring job demands of a technological nature. Indeed, this may have a direct impact on teachers' emotional state and, consequently, on their job performance. Moreover, with specific reference to the analyzed context and considering the Italian teachers' condition of "digital immigrants," it might be appropriate to establish an organizational support climate that promotes protective factors against burnout and an aging climate respectful of diversity, as it is also confirmed in the literature (Converso et al., 2018).

Limitations

These findings must be read in light of some limitations. Firstly, the generalizability of the results to broader populations may be constrained because it was conducted exclusively with a specific group of

TPM Vol. 31, No. 3, September 2024
363-376
© 2024 Cises

Sulla, F., Fantinelli, S., Ragni, B.,
Galanti, T., & Rollo, D.
Italian validation of the RED/TIC scale

teachers, predominantly women from Southern Italy. The sample, comprising 1210 teachers, although sufficient for the analysis undertaken, might not fully mirror the diverse range of educators in various environments. To improve the external validity of the results, future research should consider larger and more varied samples.

Secondly, the study adopted a cross-sectional design, limiting the ability to establish causation or temporal connections among variables. To address this constraint, forthcoming studies could opt for longitudinal designs or experimental methodologies, providing a more robust foundation for drawing causal inferences and understanding the evolution of relationships between variables over time.

Thirdly, the study reliance on self-report measures introduces the possibility of common method bias and social desirability biases. Participants may have offered responses perceived as socially desirable, potentially not accurately reflecting their real experiences and behaviors. To alleviate this limitation, future research could incorporate diverse data sources, such as observations or objective measures, to yield a more comprehensive and valid evaluation of the investigated constructs. Moreover, an objective measure of participants' familiarity with technology usage would have provided information on whether technostrain can also be influenced by this variable. Finally, future studies should measure the validity of this scale more in-depth, including other measures for convergent or divergent validity.

Implications for Research and Practice

The findings of this study hold significant implications for educational practices and future research. Understanding the challenges and stressors that teachers experience in relation to technology use can inform teacher training programs and targeted interventions. In particular, we see possible implications for practice at both an organizational and an individual level. From an organizational perspective, educational institutions need to assess and recognize the specific sources of technostrain. This can be achieved through regular job analyses that identify teachers' technological challenges and training needs. By doing so, institutions can create tailored professional development programs to enhance teachers' technological proficiency and confidence. Additionally, this approach ensures that the support provided aligns with the teachers' values, demands, and resources.

From the individual point of view, the study highlights the importance of considering teachers' well-being when adopting technology, emphasizing the need for specific supportive policies and resources. Moreover, teachers should feel free to seek help or support for excessive work-related demands and pressure from using digital technologies. By addressing technostrain, educators are better positioned to harness the benefits of technology for improved teaching and learning outcomes, ultimately contributing to a more successful and sustainable integration of technology in educational settings.

While the primary focus of this paper is the adaptation of the technostrain subscale of the Cuestionario de Tecnoestrés (Salanova et al., 2007) in a sample of Italian teachers, it also opens avenues for further research. Future studies could explore the effectiveness of specific interventions based on the identified sources of technostrain. Additionally, longitudinal research could examine how technostrain evolves and its long-term impact on teachers' professional development and well-being.

TPM

REFERENCES

Al Doghan, M. A., Bhatti, M. A., & Juhari, A. S. (2019). Do psychological diversity climate, HRM practices, and personality traits (Big Five) influence multicultural workforce job satisfaction and performance? Current scenario, literature gap, and future research directions. *Sage Open*, 9(2), Article 2158244019851578. https://doi.org/10.1177/2158244019851578

Ali, M. O., Tawfeq, A. O., & Dler, S. M. (2020). Relationship between diversity management and human resource management: Their effects on employee innovation in the organizations. *Black Sea Journal of Management and Marketing*, 1(2), 36-44.

Andreychik, M. R. (2019). Feeling your joy helps me to bear feeling your pain: Examining associations between empathy for others' positive versus negative emotions and burnout. *Personality and Individual Differences*, 137, 147-156. https://doi.org/10.1016/j.paid.2018.08.028

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107, 238-246. https://doi.org/10.1037/0033-2909.107.2.238

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88, 588-606. https://doi.org/10.1037/0033-2909.88.3.588

Brod, C. (1984). *Technostress: The human cost of the computer revolution*. Addison-Wesley.

Brown, M. W. (2015). *Confirmatory factor analysis for applied research*. Guildford Press.

Calderón-Garrido, D., & Gustems-Carnicer, J. (2021). Adaptations of music education in primary and secondary school due to COVID-19: The experience in Spain. *Music Education Research*, 23(2), 139-150. https://doi.org/10.1080/14613808.2021.1902488

Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2023). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*, 1-39. https://doi.org/10.1007/s10490-023-09871-y

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, 9, 233-255. https://doi.org/10.1207/S15328007SEM0902_5

Conte, E., Cavioni, V., & Ornaghi, V. (2024). Exploring stress factors and coping strategies in Italian teachers after COVID-19: Evidence from qualitative data. *Education Sciences*, 14(2), Article 152. https://doi.org/10.3390/educsci14020152

Converso, D., Sottimano, I., Guidetti, G., Loera, B., Cortini, M., & Viotti, S. (2018). Aging and work ability: The moderating role of job and personal resources. *Frontiers in Psychology*, 8, Article 2262. https://doi.org/10.3389/fpsyg.2017.02262

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334. https://doi.org/10.1007/BF02310555

Diener, E., Thapa, S., & Tay, L. (2020). Positive emotions at work. *Annual Review of Organizational Psychology and Organizational Behavior*, 7, 451-477. https://doi.org/10.1146/annurev-orgpsych-012119-044908

Edwards, J. R. (1996). An examination of competing versions of the person-environment fit approach to stress. *Academy of Management Journal*, 39(2), 292-339. https://doi.org/10.5465/256782

Esposito, C., Di Napoli, I., Agueli, B., Marino, L., Procentese, F., & Arcidiacono, C. (2021). Well-being and the COVID-19 pandemic: A community psychology systematic review. *European Psychologist*, 26(4), 285-297. https://doi.org/10.1027/1016-9040/a000468

Fiorilli, C., De Stasio, S., Benevene, P., Iezzi, D., & Albanese, O. (2015). Copenhagen Burnout Inventory (CBI): A validation study in an Italian teacher group. *TPM — Testing, Psychometrics, Methodology In Applied Psychology*, 22(4), 537-551. https://doi.org/10.4473/TPM22.4.7

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18, 39-50.

Galanti, T., Guidetti, G., Mazzei, E., Zappalà, S., & Toscano, F. (2021). Work from home during the COVID-19 outbreak: The impact on employees' remote work productivity, engagement, and stress. *Journal of Occupational and Environmental Medicine*, 63(7), e426-e432. https://doi.org/10.1097/JOM.0000000000002236

Hair, J. F., Black, W. C., Babin, B., & Anderson, R. (2018). *Multivariate data analysis* (8th ed.). Cengage.

Hair Jr, J. F., & Sarstedt, M. (2019). Factors versus composites: Guidelines for choosing the right structural equation modeling method. *Project Management Journal*, 50(6), 619-624. https:// doi.org/10.1177/8756972819882132

Holland, J. L., Johnston, J. A., & Asama, F. N. (1994). More evidence for the relationship between Holland's personality types and personality variables. *Journal of Career Assessment*, 2(4), 331-340.

IBM Corporation. (2020). IBM SPSS Statistics for Macintosh (Version 27.0) [Computer software]. IBM Corporation.

Italian Parliament. (2015). Legge 13 luglio 2015, n. 107. Riforma del sistema nazionale di istruzione e formazione e delega per il riordino delle disposizioni legislative vigenti. GU Serie Generale n. 162 del 15-07-2015 [Reform of the national education and training system and delegation for the reorganization of current legislative provisions]. Retrieved from https://www.gazzettaufficiale.it/eli/id/2015/07/15/15G00122/sg

TPM Vol. 31, No. 3, September 2024
363-376
© 2024 Cises

Sulla, F., Fantinelli, S., Ragni, B.,
Galanti, T., & Rollo, D.
Italian validation of the RED/TIC scale

Kim, H.-Y. (2013). Statistical notes for clinical researchers: Assessing normal distribution (2) using skewness and kurtosis. *Restorative Dentistry & Endodontics*, *38*, 52-54. https://doi.org/10.5395/rde.2013.38.1.52

Kline, R. B. (2010). *Principles and practice for structural equation modelling* (3rd ed.). Guildford Press.

Kristensen, T. S., Borritz, M., Villadsen, E., & Christensen, K. B. (2005). The Copenhagen Burnout Inventory: A new tool for the assessment of burnout. *Work & Stress*, *19*(3), 192-207. https://doi.org/10.1080/02678370500297720

Lefter, V., Brătianu, C., Agapie, A., Agoston, S., & Orzea, I. (2011). Intergenerational knowledge transfer in the academic environment of knowledge-based economy. *Amfiteatru Economic Journal*, *13*(30), 392-403.

Madigan, D. J., Kim, L. E., Glandorf, H. L., & Kavanagh, O. (2023). Teacher burnout and physical health: A systematic review. *International Journal of Educational Research*, *119*, Article 102173. https://doi.org/10.1016/j.ijer.2023.102173

Marsh, H. W., Hau, K. T., & Grayson, D. (2005). Goodness of fit in structural equation models. In A. Maydeu-Olivares & J. J. McArdle (Eds.), *Contemporary psychometrics* (pp. 275-340). Lawrence Erlbaum Associates Publishers.

McDonald, R. P., & Ho, M. H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, *7*, 64-82. https://doi.org/10.1037/1082-989X.7.1.64

Ministry of Education and Merit. (2022). Piano nazionale scuola digitale [National digital school plan]. Retrieved from https://scuoladigitale.istruzione.it/pnsd/

Moè, A., Pazzaglia, F., & Friso, G. (2010). *MESI. Motivazioni, emozioni, strategie e insegnamento. Questionari metacognitivi per insegnanti* [*Motivations, emotions, strategies and teaching. Metacognitive questionnaires for teachers*]. Edizioni Erickson.

Molino, M., Ingusci, E., Signore, F., Manuti, A., Giancaspro, M. L., Russo, V., Zito, M., & Cortese, C. G. (2020). Wellbeing costs of technology use during COVID-19 remote working: An investigation using the Italian translation of the Technostress Creators Scale. *Sustainability*, *12*(15), Article 5911. https://doi.org/10.3390/su12155911

Mutheén, L. K., & Mutheén, B. O. (2019). Mplus 8.3 [Computer software]. Muthén & Muthén.

OECD. (2023). *Education at a Glance 2023: OECD Indicators*. OECD Publishing. https://doi.org/10.1787/e13bef63-en.

Penado Abilleira, M., Rodicio-García, M. L., Ríos-de Deus, M. P., & Mosquera-González, M. J. (2021). Technostress in Spanish university teachers during the COVID-19 pandemic. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.617650

Pershina, R., Soppe, B., & Thune, T. M. (2019). Bridging analog and digital expertise: Cross-domain collaboration and boundary-spanning tools in the creation of digital innovation. *Research Policy*, *48*(9), Article 103819. https://doi.org/10.1016/j.respol.2019.103819

Prensky, M. (2001). Digital natives, digital immigrants (Part 1). *On the Horizon*, *9*(5), 1-6. https://doi.org/10.1108/10748120110424816

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. *Information Systems Research*, *19,* 417-433. https://doi.org/10.1287/isre.1070.0165

Salanova, M., Llorens, S., Cifre, E., & Nogareda, C. (2007). *El tecnoestrés: Concepto, medida y prevención.* [*Technostress: Concept, measurement and prevention*]. Nota Técnica de Prevención, 730 [Prevention Technical Note, 730]. INSHT. https://www.insst.es/documents/94886/327446/ntp_730.pdf/55c1d085-13e9-4a24-9fae-349d98deeb8a

Salanova, M., Llorens, S., & Cifre, E. (2013). The dark side of technologies: Technostress among users of information and communication technologies. *International Journal of Psychology*, *48*(3), 422-436. https://doi.org/10.1080/00207594.2012.680460

Santiago, I. S. D., Dos Santos, E. P., da Silva, J. A., de Sousa Cavalcante, Y., Gonçalves Júnior, J., de Souza Costa, A. R., & Cândido, E. L. (2023). The impact of the COVID-19 pandemic on the mental health of teachers and its possible risk factors: A systematic review. *International Journal of Environmental Research and Public Health*, *20*(3), Article 1747. https://doi.org/10.3390/ijerph20031747

Schettino, G., Marino, L., & Capone, V. (2022). Technology-enhanced learning and well-being: A contribution to the validation of a measure to assess university students' technostress in the Italian context. *International Journal of Mental Health and Addiction*, 1-15. https://doi.org/10.1007/s11469-022-00940-9

Spiteri, M., & Chang Rundgren, S. N. (2020). Literature review on the factors affecting primary teachers' use of digital technology. *Technology Knowledge & Learning*, *25*(1), 115-128. https://doi.org/10.1007/s10758-018-9376-x

Sulla, F., Ragni, B., D'Angelo, M., & Rollo, D. (2022, June 10-11). *Teachers' emotions, technostress, and burnout in distance learning during the COVID-19 pandemic* [Conference session]. Third Workshop of Technology Enhanced Learning Environments for Blended Education, Foggia, Italy.

Sulla, F., & Rollo, D. (2023). The effect of a short course on a group of Italian primary school teachers' rates of praise and their pupils' on-task behaviour. *Education Sciences*, *13*(1), Article 78. https://doi.org/10.3390/educsci13010078

Tabachnick, C., & Fidell, L. S.. (2013). *Using multivariate statistics* (6th ed.). Prentice Hall.

Toscano, F., Zappalà, S., & Galanti, T. (2022). Is a good boss always a plus? LMX, family-work conflict, and remote working satisfaction during the COVID-19 pandemic. *Social Sciences*, *11*(6), Article 248. https://doi.org/10.3390/socsci11060248

Toscano, F., Galanti, T., Giffi, V., Di Fiore, T., Cortini, M., & Fantinelli, S. (2024). The mediating role of technostress in the relationship between social outcome expectations and teacher satisfaction: Evidence from the COVID-19 pandemic in music education. *Research in Learning Technology*, *32*. https://doi.org/10.25304/rlt.v32.3086

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*, 1-10. https://doi.org/10.1007/BF02291170

Wang, J., & Wang, X. (2012). Structural equation modeling: Applications using Mplus. John Wiley & Sons.

Wang, X., & Li, B. (2019). Technostress among university teachers in higher education: A study using multidimensional person-environment misfit theory. *Frontiers in Psychology*, *10*, Article 1791. https://doi.org/10.3389/fpsyg.2019.01791

Wang, X., Tan, S. C., & Li, L. (2020). Measuring university students' technostress in technology-enhanced learning: Scale development and validation. *Australasian Journal of Educational Technology*, *36*(4), 96-112. https://doi.org/10.14742/ajet.5329

Weil, M. M., & Rosen, L. D. (1997). *Technostress: Coping with technology @Work, @Home, @Play.* John Wiley & Sons.

Winter, E., Costello, A., O'Brien, M., & Hickey, G. (2021). Teachers' use of technology and the impact of COVID-19. *Irish Educational Studies*, *40*(2), 235-246. https://doi.org/10.1080/03323315.2021.1916559

Wohlfart, O., & Wagner, I. (2023). Teachers' role in digitalizing education: An umbrella review. *Educational Technology Research and Development*, *71*(2), 339-365. https://doi.org/10.1007/s11423-022-10166-0