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Testing the indirect effects of personality traits on the relationship between work overload and technostress

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Abstract: The widespread adoption of Information and Communication Technologies (ICT) resulted in a new form of work culture in which boundaries are not clearly established. Technostress – a phenomenon partially caused by excessive technology exposure and usage – is being associated with a myriad of negative effects. However, individual differences, such as personality traits, might influence one's experience of stress when using ICT. Thus, this study aimed to investigate the indirect effects of personality traits on the relationship between work overload and technostress. A sample of 213 ICT Brazilian workers (M_{age}=35.53±9.41; 64.8% males) provided information on demographic and labor-related data, as well as measurements of Technostress, Work Overload, and Personality Traits; moreover, based on a coefficient of determination (ρ^2=.12), the power achieved was 99%. Adjusted for multiple comparisons, results pointed to moderate, significant links between Fatigue and Neuroticism (ρ=.32), Fatigue and Work Overload (ρ=.37), Anxiety and Work Overload (ρ=.33). Moreover, Conscientiousness exerted an indirect effect on the relationship between Work Overload and the Technostress dimension of Fatigue (95%CI: .001, .06). The study highlights the role of individual differences that might prevent workers' experiences of technostress, particularly Fatigue.

Keywords: Technostress, Work overload, Personality.

Introduction

Currently, the use of technology in organizations seems inevitable. Notably, society recently witnessed an overwhelming reliance on information and communication technologies (ICT) when dealing with a myriad of necessities, ranging from social interactions, work and education, as well as a way of obtaining and maintaining health-related behaviors. In addition to the massive increase in ICT usage, studies about negative consequences, such as work overload, could be largely explained by an excessive amount of daily information (Vieira & Carlotto, 2024).

ICT made possible that an ubiquitous work culture emerged, in which boundaries are not clearly established and the imperative of 'anywhere, anytime' became ingrained in social structures (Rasool et al., 2022). While organizations have benefited from utilizing cutting-edge technologies, their incorporation into our daily lives has increased the reports of a specific type of stress directly linked to the widespread adoption of ICT (Ibrahim et al., 2023).

Technological stress – or, simply put, technostress – poses an important aspect that could not be ignored in today's workplace. Indeed, employees are dealing with increasing work demands, constants disruptions and distractions, and both implicit and explicit expectations of 24/7

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availability have been reported (Tarafdar et al., 2019). Portable devices, such as laptops and smartphones, enable workers to access work-related information and perform work tasks at times supposed to be spent for leisure and rest (Eichberger et al., 2021).

Considering that the first empirical study was published approximately 10 years ago, technostress is still an emerging phenomenon (Beltrame & Bobsin, 2021; Rohwer et al., 2022). Regardless, technostress has already demonstrated robust associations with mental health outcomes (Dragano & Lunau, 2020). Furthermore, albeit there is research also linking Technostress with work-related factors – such as Work Overload, Work Complexity, Insecurity, and Uncertainty (Rasool et al., 2022; Tarafdar et al., 2007) – there are still few studies carried out examining individual characteristics, such as personality traits (Ebrahimi et al., 2019; Lang & Schieder, 2021; Srivastava et al., 2015).

The five-factor model of personality proposes that human personality can be described in terms Openness, meaning a willingness to engage with ideas, experiences, values, and feelings; Conscientiousness, which includes traits of caution and responsibility, along with organized, rule-abiding profile; Extraversion, marked by a sociable, active, enthusiastic outlook; Agreeableness, which is the tendency to prioritize social harmony, marked by a cooperative and supportive manner when dealing with others; and Neuroticism, described by excessive worries and preoccupations that lead to unpleasant emotions (Hauck Filho et al., 2012; Mccrae & Costa, 1985).

According to Pflügner et al. (2021), personality traits seem to change little over time and strongly influence one's perceptions and behaviors. Therefore, personality traits are stable across contexts, which adds usefulness to understanding individual differences in thoughts, feelings, and behaviors. For example, Lang and Schieder (2021) demonstrated that higher levels of Extraversion were negatively associated with Technostress, adding that other traits, such as Openness and Conscientiousness, could diminish one's perception of Technostress. According to a systematic review, there is evidence for a positive correlation between Neuroticism and Technostress, while Openness and Extraversion appear mostly negatively association with Technostress (Li, 2023).

The current study

It seems that the use of technologies as a key element driving stress has been somewhat neglected, although digital technologies in most contexts and positions of work are blatant (Dragano & Lunau, 2020). Furthermore, existing studies examining variables connecting technostress to work-related factors, although scarce, have been conducted in different countries (Beltrame, 2023) or examined distinct mediators (i.e., self-efficacy; Putri et al., 2024). Another important limitation in the literature regards the conception of Technostress as a dimensional phenomenon. Therefore, this research aimed to evaluate the indirect effects of personality traits on the relationship between Work Overload and Technostress dimensions, namely: Anxiety, Fatigue, Disbelief, and Ineffectiveness. Additionally, the investigation also discusses how Work Overload could be differentially associated with dimensions of Technostress experienced by individuals and their personality characteristics.

Particularly, we anticipated that Extraversion would be negatively linked with Technostress while also acting as a negative mediator in the relationship between Work Overload and Technostress (Li, 2023). This hypothesis was based on the fact that Extraversion characterizes a group of communicative, socially active individuals who appreciate social harmony (Anglim & Horwood, 2021). Therefore, they tend to make technical innovations using creativity and the ability to adapt to work characteristics while also advocating for organizational changes (Wilmot et al., 2019). Another hypothesis set for the study predicted that higher levels of Neuroticism would be associated with greater self-reported experiences of Technostress (Hauck Filho et al., 2012; Li, 2003).

Method

Participants and design

A non-probability sample of 213 people who use ICT in their work activities participated in this cross-sectional study. Participants declared themselves as Analysts (30.2%), Managers (21.8%), and Technicians (16.9%). Most were male (64.8%), in a relationship (51.2%), and without children (54.9%). The mean age was 35.53 years (*SD*=9.41), with 6.66 years (*SD*=6.49) of experience in the current organization. Moreover, the number of hours spent using ICT was 7.61 per workday (*SD*=2.23). Higher education prevailed (43.2%), followed by post-bachelor training (28.6%) and master's or doctorate degrees (20.7%). Moreover, 71.4% of the sample reported working full-time, and a vast majority (79.3%) used smartphones during work hours.

Measures

Sociodemographic and work questionnaire. The first section of the survey gathered information about gender, marital status, age, education, and income. In addition, participants responded about their work position, length of professional, experience and length of experience at the current institution, equipment used during working hours, and daily working hours with ICT.

Scale of Technostress (RED/TIC). The RED/TIC was developed by a team of researchers from Work, Organization and New Technologies [WONT] and had been adapted for use in Brazil (Carlotto & Câmara, 2010). The RED/TIC consists of 16 questions, divided into four dimensions with four items each: Disbelief (α=.74, e.g., "over time, I have lost interest in technologies"); Fatigue (α=.89, e.g., "when I finish working with ICT, I feel exhausted"); Anxiety (α=.77, e.g., "I feel tense and anxious when working with technologies"); and Ineffectiveness (α=.80, e.g., "I feel insecure about completing my tasks effectively when I use ICT").

Work Overload. This was measured by the subscale "Work overload" from the ICT Demands/Resources Scale (Day et al., 2012). The factorial solution of the ICT scale varies, as items can load into two or more factors. However, in the current study, we adopted the three items for measuring work overload as suggested by the authors (α=.73; e.g., "technology creates more work for me").

The Reduced Markers for Personality Assessment (MR-25; Hauck Filho et al., 2012). The MR-25 is a Likert type scale that ranges from 1 (strongly disagree) to 5 (strongly agree). Participants are asked to rate their agreement with 25 adjectives that tap into five dimensions: Extraversion (α=.70; e.g., "communicative"); Agreeableness (α=.85; e.g., "kind"); Conscientiousness (α=.83; e.g., "responsible"); Neuroticism (α=.79; e.g., "pessimistic"); and Openness (α=.58; e.g., "bold"). The original study reported Cronbach's alpha coefficients between .63 and .82 for the MR-25 subscales.

Data analyses and ethical aspects

Data were modeled and analyzed using the Statistical Package for the Social Sciences (SPSS, v. 23; Armonk, USA), along with Jasp (v. 0.18.2; Amsterdam, The Netherlands) and Jamovi (v 2.3.17; Sydney, Australia). Descriptives statistics included mean and standard-deviations, as well medians, kurtosis, and asymmetry. Moreover, apart from the calculation of internal consistency,

Minimum Rank Factor Analyses (MRFA) were conducted to assess the dimensionality of the scales (Timmerman & Lorenzo-Seva, 2011). MRFA is suitable given the polytomous scoring system of the measures adopted, and rotation methods were replicated from previous studies using the instruments, considering whether factors were deemed orthogonal (i.e., Day et al., 2012) or oblique (i.e., Carlotto & Câmara, 2010; Hauck-Filho et al., 2012).

Normality was assessed prior to conducting correlational analyses. Both the Shapiro-Wilk and Kolmogorov-Smirnov tests were significant, which resulted in the decision of examining Spearman's correlations with Holm correction for multiple comparisons. In addition, we based the results from these analyses to compute the study's power. By inserting a coefficient of determination of ρ^2=.12, along with the sample size and two-tailed tests, the achieved power was 99% (Faul et al., 2007).

With the purpose of investigating the indirect effects of personality traits on the relationship between technostress dimensions and work overload, we used Hayes (2013) Process extension in JASP, which tests indirect effects through a series of regression procedures. Precisely, indirect effects were explored when the following conditions were met: the predictor of the study (Work Overload) should be significantly linked to the outcome (in this case, Technostress dimensions). Moreover, personality traits, our proposed cross-sectional mediators, should be likewise associated with the outcome. Finally, to establish a cross-sectional mediation effect, the associations between the predictor and outcomes must remain significant when accounting for the indirect effects (Baron & Kenny, 1986; O'Laughlin et al., 2018). Results were based on 95% confidence intervals (95%CI) obtained with bootstrapping (10,000 samples).

The investigation has been approved by the [Omitted during peer Review] Research Ethics Committee. Moreover, the study followed both national and international guidelines to assure high ethical standards when collecting data from human subjects.

Results

Prior to conducting the main analyses, we assessed the factorability and dimensionality of the self-reported instruments used in the study. For the MR-25, results showed a 5-factor structure accounting for 61.46% of the variance. Both the Kaiser-Meyer-Olkin (KMO; .66) and Bartlett's test (3349.57, p<.001) confirmed data factorability. Likewise, results for the RED/TIC indicated that a 4-factor solution accounted for 67% of the variance (KMO=.88, Bartlett's test=2139.06, p<.001), while the ICT Demands/Resources Scale seemed to be best represented by a 7-factor structure (KMO=.78, Bartlett's test=2476.06, p<.001).

Table 1 presents the descriptive statistics of the variables. The dimension of technostress with higher mean was Fatigue (2.29; *SD*=.89), whereas Conscientiousness had higher mean out of the personality traits (*M*=4.11; *SD*=.70). The correlations between technostress dimensions, personality traits, and work overload were examined next (Table 2). Among the significant correlations, stronger links were found between the Technostress dimension Fatigue with Neuroticism (ρ=.32, p<.001) and with Work Overload (ρ=.37, p<.001). On the other hand, Fatigue and Agreeableness were negatively associated (ρ=-.22, p=.039). The Technostress dimension Ineffectiveness was correlated with Conscientiousness (ρ=-.25, p=.008) and Work Overload (ρ=.21, p=.049). For the Anxiety dimension, there were links with Neuroticism (ρ=.25, p=.006), Agreeableness (ρ=-.22, p=.043) and Work Overload (ρ=.33, p<.001). Table 2 displays the complete correlation matrix.

Table 1

Descriptive statistics for the measures of Technostress, Work overload and Personality Traits

	Mean	*SD*	Median	Skewness	Kurtosis	Min.	Max.
Technostress: Disbelief	1.30	1.20	1.00	.97	.52	.00	5.50
Technostress: Fatigue	2.49	1.67	2.50	.17	-1.10	.00	6.00
Technostress: Ineffectiveness	.70	.89	.25	1.64	2.87	.00	5.00
Technostress: Anxiety	1.64	1.36	1.25	.72	-.50	.00	5.50
Neuroticism	2.48	.91	2.40	.53	-.43	1.00	4.80
Extraversion	3.46	.77	3.40	-.09	-.42	1.60	5.00
Agreeableness	3.79	.74	4.00	-.75	.69	1.00	5.00
Conscientiousness	4.11	.70	4.20	-1.16	1.72	1.00	5.00
Openness	2.94	.71	3.00	-.40	-.07	1.20	4.60
Work overload	2.17	1.19	2.00	-.16	-1.01	.00	4.00

Note. Max: maximum values; Min: minimum values; *SD*: standard-deviation.

Table 2

Correlations (Spearman) between Technostress Dimensions, Work Overload and Personality Traits

	1	2	3	4	5	6	7	8	9	10
1. Technostress: Disbelief	-									
2. Technostress: Fatigue	.36*	-								
3. Technostress: Ineffectiveness	.50*	.33*	-							
4. Technostress: Anxiety	.46*	.67*	.57*	-						
5. Neuroticism	.10	.32*	.10	.25*	-					
6. Extraversion	-.11	-.01	-.09	-.15	-.36*	-				
7. Agreeableness	-.06	-.22*	-.18	-.22*	-.16	.13	-			
8. Conscientiousness	-.05	-.23*	-.25*	-.21	-.14	.11	.48*	-		
9. Openness	.02	.04	-.05	-.02	-.05	.16	.37*	.25*	-	
10. Work overload	.15	.37*	.21*	.33*	.03	.14	-.12	-.15	-.01	-

Note. * Denotes significant associations after adjusting for multiple comparisons (α=.05).

Further analyses sought to test the indirect effects (also called cross-sectional mediators) of personality traits between Work Overload and Technostress dimensions. After inspecting the associations presented in Table 2, it was found that Work Overload was related to three dimensions of Technostress, namely: Fatigue, Ineffectiveness, and Anxiety. Next, the examination of the links between cross-sectional mediators and outcomes revealed that the dimension Fatigue was associated with Conscientiousness, Agreeableness, and Neuroticism. The Technostress dimension of Ineffectiveness was solely linked to Conscientiousness. Anxiety – the fourth dimension of technostress – showed significant associations with Neuroticism and Agreeableness.

Finally, each mediator was inspected in terms of its associations with the independent variable. For the model predicting Anxiety, none of the tentative mediators were significantly linked to work overload (p>.05). For the model predicting Fatigue, Conscientiousness was associated with the independent variable (p=.02) as was ineffectiveness (p=.004). Consequently, these dimensions were eligible for analyses of indirect effects.

Mediation analysis was conducted to explore the indirect effect of personality traits on work overload and technostress. The effect obtained through standardized bootstrapping with 10,000 samples was non-significant for the model Fatigue (b=.02, 95%CI: -.001, .008). However, the total effect of the model for Ineffectiveness was significant (b=0.02, z=1.82, 95%CI: 0.001, .06); also, there were statistically significant direct (b=0.17, z=3.41, 95%CI: .09, .26) and indirect effects (b=.02, z=1.82, 95%CI: .001, .06), suggesting that Conscientiousness had indirect effects on the relationship between work overload and the technostress dimension of Ineffectiveness.

Discussion

Research on Technostress has gained increasing popularity across disciplines, such as information systems, psychology, marketing, and public health. Technostress can lead to ineffectiveness in the workplace, physical problems (Pflügner, 2022; Scott & Timmerman, 2005), depression (Thomée et al., 2007), poor performance (Lang & Schieder, 2021; Pflügner, 2022), and turnover (Ebrahimi et al., 2019). This body of evidence emphasizes the adverse effects of massive utilization of digital technologies in the workplace (Borle et al., 2021; Carlotto & Wendt, 2016; Salazar-Concha et al., 2021). Thus, the present study aimed to evaluate the indirect effects of personality traits on the relationship between Work Overload and Technostress in a sample of individuals who use ICT for work purposes. Importantly, the investigation explored specific dimensions that comprise the phenomenon of Technostress (i.e., Fatigue, Anxiety, Ineffectiveness, and Disbelief).

The Technostress dimensions of Fatigue and Anxiety were more strongly associated with personality traits and Work Overload. After adjusting for multiple comparisons, moderate, significant, and positive links were detected for the relationships between Fatigue and Neuroticism, Anxiety and Work Overload, and Fatigue and Work Overload. These results partially confirmed our hypotheses. While Neuroticism was indeed associated with the Fatigue dimension, the links between Extraversion and Technostress dimensions did not reach statistical significance at 0.05.

The role of Neuroticism in one's experience of Technostress has been demonstrated in various studies being one of the stronger personality traits in the pooled analyses reported by Li (2003). Moreover, given the negative association between Neuroticism and Extraversion, one might expect that higher levels of Neuroticism could be explained by an unpleasant interpretation of work demands in comparison to extrovert's challenging approach (Pflügner et al., 2021). Another possible explanation for the lack of significant association between Technostress and Extraversion found in our study could be related to the sample size, the adjustment for multiple comparisons, or sample characteristics that differ significantly from other reports.

Although not predicted, we found that Conscientiousness mediated the relationship between Work Overload and the Technostress dimension of Ineffectiveness, with 13.34 percent of mediation explained. Conscientiousness involves a great degree of awareness, caution, precision, and skills. Therefore, results indicated that, as Conscientiousness increased, the effect of Work Overload on Ineffectiveness strengthened.

This is not only theoretically but empirically sound. Workers' Conscientiousness about the excessive amount of work could drive a sense of hopelessness as the demands do not match their individual tendencies. Indeed, higher levels of Conscientiousness have been recently linked to self-reported measurements of Technostress (Korzynski et al., 2020). From a developmental perspective on Technostress, chronic, gradual unpleasant experiences with technology - such as Work Overload – might result in homeostasis' disruptions, thus triggering responses of lack of control and general inefficacy (Stephan et al., 2016).

Implications, limitations and further directions

As activities become increasingly complex and time-consuming, workers have to spend more time learning how to navigate and incorporate ICT (Rasool et al., 2022). This adds extra demands and greater cognitive overload (Carlotto & Câmara, 2010). In summary, our study added extra evidence to a growing number of investigations that claim that changes caused by the introduction of technologies in the work context have undeniable consequences for workers, with immediate impacts on psychological well-being (Dragano & Lunau, 2020; Nastjuk et al., 2023).

The results also suggest the need for further investigations. For instance, longitudinal studies could assess the stability and changes over time of key variables that link Technostress to individual and contextual factors. This also means that exploring other putative hypotheses might shed greater understanding about the risks and benefits associated with an ever-increasing reliance on ICT in the workplace. The role of coping strategies, work demands – such as 24/7 availability, constant need for updating – and organizational policies are equally important to account for in upcoming studies.

Alternative interventions involve actions that aim to clearly describe the demands of each position, including the assignment of functions and resources available to reduce work overload. A balanced stance must become imperative for attenuating the impacts of Technostress. Such approach implies that productivity should not come at the cost of the employees' well-being. Finally, albeit there were many interesting results that could be particularly relevant for health promotion and prevention strategies in the workplace, some limitations must be considered when interpreting this report. These involve the study's design, the non-probabilistic sampling method, and the reliance on only self-reported measures.

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Authors contribution

Conceptualization: MSC, GWW; Data curation: LSV; Formal analysis: GWW; Methodology: MSC, GWW; Project administration: MSC; Writing – Original draft: MSC, LSV, GWW; Writing – Review and editing: MSC, LSV, GWW.

All the authors read and approved the final manuscript.

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Testando efeitos indiretos de fatores de personalidade na relação entre tecnoestresse e sobrecarga no trabalho

Resumo: A adoção generalizada das Tecnologias de Informação e Comunicação (TIC) resultou numa nova forma de cultura de trabalho em que limites não estão claramente estabelecidos. O estresse tecnológico ou tecnoestresse – fenômeno parcialmente causado pela exposição e utilização excessiva da tecnologia – está associado a diversos efeitos negativos. No entanto, diferenças individuais, como os traços de personalidade, podem influenciar a experiência de estresse de uma pessoa quando utiliza as TIC. Assim, este estudo teve como objetivo investigar os efeitos indiretos dos traços de personalidade na relação entre sobrecarga de trabalho e tecnoestresse. Uma amostra de 213 trabalhadores brasileiros que utilizam TIC (*M*=35,53±9,41; 64,8% homens) participou do estudo, que coletou dados sociodemográficos e ocupacionais, além de utilizar escalas de Tecnoestresse, Sobrecarga de Trabalho e Traços de Personalidade. Com base num coeficiente de determinação (ρ^2=0,12), o poder do estudo foi de 99%. Após ajustamentos para comparações múltiplas, os resultados apontaram para associações moderadas e significativas entre Fadiga e Neuroticismo (ρ=0,32), Fadiga e Sobrecarga de Trabalho (ρ=0,37) e Ansiedade e Sobrecarga de Trabalho (ρ=0,33). Verificou-se que a Conscienciosidade exerceu um efeito indireto na relação entre a Sobrecarga de Trabalho e Fadiga (IC95%: 0,001, 0,06). O estudo destaca o papel das diferenças individuais, que podem amenizar as experiências de tecnoestresse dos trabalhadores, particularmente Fadiga.

Palavras-chave: Tecnoestresse, Sobrecarga de trabalho, Personalidade.

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