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Development of Novel Technostress Instrument Among Education and Health Care Sectors

Kimmo Vänni[1], Antti Syvänen[2], and Jarmo Viteli[2]

[1]Häme University of Applied Sciences, Vankanlähde 9, 13100 Hämeenlinna, Finland
[2]Tampere University, Kalevantie 4, 33100 Tampere, Finland

ABSTRACT

Digitalization of society and digital transformation of organizations have been the emerging trend during the last decade and recently the Covid-19 pandemic even promoted the use of digital technology. There are numerous benefits reported due to digitalization but also some challenges have been addressed. One challenge has been the emerging amount of technostress due to rapid change in utilizing digital tools and applications. There are some validated technostress instruments available but those are universal instruments meant for assessing any kind of technostress. However, the number of technostress instruments targeted for assessing perceived stress due to online work is still limited. We aimed to develop and validate a novel instrument for assessing technostress due to online meetings. We compared the validity of the novel instrument in terms of other well-known instruments among education and health care sectors. A large survey was conducted, and a number of respondents was 499. Data were handled by SPSS-28. Statistical analyses were done by Pearson correlations. Study showed that the novel instrument was easy to use and valid for assessing technostress. However, more research is needed for establishing its status as an acknowledged technostress instrument.

Keywords: Digitalization, Technostress, Assessment, Online work

INTRODUCTION

Digitalization is still the emerging trend in working life even if the digitalization of organizations' processes and activities have started more than ten years ago. Companies and public organizations are looking forward that digital technology and artificial intelligence would help them to decrease or even to eliminate routine tasks that do not provide added value to organizations. For example, all kinds of manual manipulations of numbers and figures from registers are doomed to be waste of time because it can be handled by digital technology. Organizations are trying to advance productivity (William, W. & William, L. 2019) and work time which may increase value to organizations. However, sometimes organizations' digital processes are related to other organizations' digital process which means that organizations are in working in the ecosystem and at least a part of the advanced productivity depends on the performance of the ecosystem. There are two relevant levels

in the development of digitalization of organizations. First, the invisible level better known as robotic process automation (RPA) (Aguirre & Rodriguez 2017), which concerns data traffic, APIs and data processing between the servers and software. That is the level which can be fully automated, and it provides information and services to end users. Second, the visible level, which concerns human computer interaction (HCI), user interfaces, application software and the online interaction between the users. For example, the online meetings and the use of related application software such as Teams, Zoom and Google Meet represent the HCI level, even if all of them also have automated activities in servers. The invisible level requires functional hardware and the robust software, whereas the visible level requires functional user interfaces and users' know-how to use digital tools. A good example which connects both invisible and visible levels is digital platforms. The use of digital platforms and platform economy overall have increased during the last ten years, and during the last years the growth rate has been extensive (European Council 2023).

There are two different approaches to implement digitalization to organizations activities. First, an organization's directors and managers are looking forward to improving business processes and an organization's performance. In this approach, the top management discuss with consultants and service providers. Second, an organization's employees are looking forward to reducing routine work and improving wellbeing at work. In this approach, employees are the trigger for digital transformation. The approaches have the relationship between, but the employee-based approach may nurture psychosocial strain at work (Palumbo et al. 2022) less than the organization-based approach. Palumbo et al. (2022) reported that digitalization has side effects on psycho-social risks at work. Psycho-social risks are related to working conditions, such as work demands, ergonomics, work control and management practices. Ravalier (2018) reported that poor psycho-social working conditions had an impact on stress and related outcomes like job satisfaction and presenteeism (productivity loss). Therefore, it can be assumed that digitalization, psycho-social working conditions and perceived technostress have relationship between.

The term of technostress has been presented first time by Brod (1984) and since technostress has been studied from numerous perspectives including the use of technology in leisure time (Salo et al. 2019) and at work (Bondanini et al. 2020, Syvänen et al. 2022). The ongoing digital transformation and especially Covid-19 pandemic fostered organizations to adopt remote work (Leonardi 2021). The greatest part of remote work is done by digital technologies which may impact on perceived technostress (Singh et al. 2022).

The risks of digitalization to technostress have been discussed and the impacts of use of technology on perceived stress have been reported (Syvänen et al. 2022). The crucial issue concerning to technostress is to assess both the reasons for technostress (Tarafdar et al. 2007) and the impacts of technostress on an individual's psychological condition or experience (Salanova et al. 2014). There are many occupational stress instruments available (e.g., Cohen et al. 1994, Holmgren et al. 2009, Marcatto et al. 2022). Some of the stress instruments are targeted to specific conditions and to be used in

clinical settings (Lexis et al. 2014). In sum, earlier research has showed that occupational stress instruments are valid for assessing occupational stress, but it is still unclear if they are valid for assessing technostress. Study by Syvänen et al. (2022) compared Salanova et al. (2014), Tarafdar et al. (2007) and Cohen et al. (1994) instruments and reported that even if all the studied instruments were valid as such, and had correlations between, Cohen et al. (1994) instrument was not able to report technostress.

DEVELOPING NOVEL TECHNOSTRESS INSTRUMENT

The starting point for developing a novel technostress instrument was based on the limited number of available technostress instruments and the limitations of them. The former instruments were developed for assessing technostress overall, but the digital transformation has changed working life and there was a need for detecting both the early symptoms of occupational stress (Frantz &. Holmgren 2019) as well as stress concerning the use of online tools and platforms (Syvänen et al. 2022). Another requirement was that the instrument should be self-administrated questionnaire, easy to use and short. Third, according to Singh et al. (2022) and Palumbo et al. (2022) there are need for measures, which are able to report the consequences of digitalization in terms of psycho-social risks and technostress.

The specific research questions were as follows:

1. What factors should the technostress instruments include?
2. How may a novel technostress instrument correlate with other technostress instruments?

METHODS

Being based on the requirements above and the literature review concerning the technostress instruments, we developed the technostress measure, which consisted of two factors and four items of each block. Also, the digital transformation and the trend towards online work were taken into account. The instrument and its items are as follows (Table 1). We assumed that there are both technical in content items, which may stress employees in online work. The items were presented to participants as claims with the response options in the 5-point Likert scale from 1 “strongly disagree” to 5 “strongly agree”. The sum variable was constructed including all eight items. Also, separate four items sum variables were constructed for technical and content issues.

Table 1. Items of online technostress instrument.

Online Technostress Instrument	
Technical items	**Content items**
User Interfaces	Timing of meeting
Audio Visual Settings	Participants in a meeting
Network Quality	Duration of meeting
information security	Topic of a meeting

An online survey was conducted, and the data were handled by SPSS-28 statistical package. The number of respondents was 499 and it consisted of 379 females and 120 males, who represented education or health care sectors. The mean age of respondents was 48.5 years (SD 10.3).

The construct validity of online instrument was assessed, and the statistical analyses were done by correlations in terms of Tarafdar's, Salanova's and Cohen's instruments. The construct of Tarafdar's, Salanova's and Cohen's instruments and their validity have been presented elsewhere (Cohen et al. 1994, Tarafdar et al. 2007, Salanova et al. 2014, Syvänen et al. 2022).

RESULTS

The Cronbach's Alpha of the instrument was 0.85, which indicates the very good validity. Also, the Cronbach's Alpha of four-item measures regarding content items was 0.82 and regarding technical items 0.83, which may imply that both technical and content items can be used separately as well.

Table 2 shows the correlations between Tarafdar's, Salanova's, Cohen's and the novel technostress instruments. All the instruments have statistically significant correlations between, and the highest correlations were between well-known Tarafdar's and Salanova's technostress instruments and between the novel technostress instruments. Table 2 shows that even the separate content and technical factors of the novel instrument correlate well with Tarafdar's and Salanova's instruments. The correlations between Cohen's and Tarafdar's instruments (R= 0.248) and between Cohen's and Salanova's instruments (R = 0.287) were low, but the correlation between Cohen's and novel instruments (R = 0.394) was moderate. The correlations between Cohen's and the separate factors of the novel instrument were significant but low.

Table 2. Correlations between various stress instruments.

	Tarafdar	**Salanova**	**Cohen**	**Novel instrument**	**Novel instrument (content)**	**Novel instrument (technical)**
Tarafdar	1	,631**	,248**	,824**	,447**	,429**
Salanova	,631**	1	,287**	,742**	,440**	,436**
Cohen	,248**	,287**	1	,394**	,203**	,141**
Novel instrument	,824**	,742**	,394**	1	,744**	,566**
Novel instrument (content)	,447**	,440**	,203**	,744**	1	,484**
Novel instrument (technical)	,429**	,436**	,141**	,566**	,484**	1

Pearson's Correlation.**Correlation is significant, p< 0.01 (2-tailed); N = 499

CONCLUSION

Digital transformation is multidimensional and affects both the business process of the organization and workers. There are two different approaches for developing digitalization at the company level. First, the organization oriented and second, human oriented. The natural development of society has forced organizations to adopt digital tools in relatively short time frame. In addition, the Covid 19 pandemic changed working methods from being at workplace to remote working. The third change driver has been the turmoil of platform economy and digital platforms, which have made possible to manage almost all the tasks online with digital tools.

From organizations' and workers' perspectives, the development of digitalization may include a common goal. Organizations are looking forward to better productivity and agile value chain, whereas workers are looking forward to freedom and new working method. The digital transformation requires process re-engineering and investment from the organization's side. From the workers' side the requirements concern resilience, digital literacy, and good digital skills.

According to reports, there are need for new measures for assessing the impacts of digitalization on workers' technostress (Singh et al. 2022) and psycho-social risks (Palumbo et al. 2022). The common opinion is that there is a need for technostress instrument which is able to predict the early symptoms of technostress.

This research presented the novel technostress instrument which was targeted on online work and especially online meetings. The results showed that the construct validity of the instrument was good, and the instrument correlated well with other technostress instruments. The limitation of the study was that it was based on survey data and the survey results were not linked to respondents' health register data. However, the instruments aimed to assess techno-stressors and it is not clear if techno-stressors had the connection to health register data in this case. Another limitation was that the mean age of respondents was rather high. Though, this study focused on the validity of a novel technostress instrument but not reporting technostress figures of the respondents. In sum, the novel technostress instrument was adequate for assessing technostress in the studied population, but more research is needed for validating it.

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REFERENCES

Aguirre, S., Rodriguez, A. (2017). Automation of a Business Process Using Robotic Process Automation (RPA): A Case Study. In: Figueroa-García, J., López-Santana, E., Villa-Ramírez, J., Ferro-Escobar, R. (eds) Applied Computer Sciences in Engineering. WEA 2017. Communications in Computer and Information Science, vol. 742. Springer, Cham. https://doi.org/10.1007/978-3-319-66963-2_7

Bondanini G, Giorgi G, Ariza-Montes A, Vega-Muñoz A, Andreucci-Annunziata P. (2020) Technostress Dark Side of Technology in the Workplace: A

Scientometric Analysis. Int J Environ Res Public Health. 30;17(21):8013. doi: 10.3390/ijerph17218013. PMID: 33143270; PMCID: PMC7662498.

Brod, C. (1984) Technostress: The Human Cost of the Computer Revolution. Addison-Wesley Publishing Company, Reading, USA.

Cohen, S. Kamarck, T. Mermelstein, R. (1994) Perceived stress scale. Measuring stress: A guide for health and social scientists, 10, 1–2.

European Council. (2023) The EU's platform economy. Website https://www.consilium.europa.eu/en/infographics/platform-economy/

Frantz, A. Holmgren, K. (2019) The Work Stress Questionnaire (WSQ) – reliability and face validity among male workers. BMC Public Health 19, 1580. https://doi.org/10.1186/s12889-019-7940-5

Holmgren, K, Hensing, G, Dahlin-Ivanoff, S. (2009) Development of a questionnaire assessing work-related stress in women - identifying individuals who risk being put on sick leave. Disabil Rehabil. 31(4):284–92.

Leonardi, P. M. (2021) COVID-19 and the New Technologies of Organizing: Digital Exhaust, Digital Footprints, and Artificial Intelligence in the Wake of Remote Work. Journal of Management Studies. 58(1):249–53. doi: 10.1111/joms.12648. Epub 2020 Oct 17. PMCID: PMC7675341.

Lexis, M. Jansen, N. Amelsvoort, L. Huibers, M. Berkouwer, A. Tjin, A. Ton G. et al. (2012) Prediction of long-term sickness absence among employees with depressive complaints. J Occup Rehabil. 22(2):262–9.

Marcatto, F. Di Blas, L. Luis, O. Festa, S. Ferrante, D. (2022) The Perceived Occupational Stress Scale: A brief tool for measuring workers' perceptions of stress at work. European Journal of Psychological Assessment, 38(4), 293–306.

Palumbo, R. Casprini, E. Montera, R. (2022) Making digitalization work: unveiling digitalization's implications on psycho-social risks at work, Total Quality Management & Business Excellence, DOI: 10.1080/14783363.2022.2055458.

Ravalier, J. M. (2019) Psycho-Social Working Conditions and Stress in UK Social Workers, The British Journal of Social Work, 49(2): 371–390, https://doi.org/10.1093/bjsw/bcy023

Salo, M. Pirkkalainen, H. Koskelainen, T. (2019) Technostress and social networking services: Explaining users' concentration, sleep, identity, and social relation problems. Info Systems J. 29: 408–435.

Singh, P. Bala, H. Dey, B. L. Filieri, R. (2022) Enforced remote working: the impact of digital platform-induced stress and remote working experience on technology exhaustion and subjective wellbeing. J Bus Res. 151: 269–286. doi: 10.1016/j.jbusres.2022.07.002.

Syvänen, A. Vänni, K. Viteli, J. (2022) Comparison Between Technostress Instruments Among Education and Health Care Sectors. In: Vesa Salminen (eds) Human Factors, Business Management and Society. AHFE (2022) International Conference. AHFE Open Access, vol. 56. AHFE International, USA.

Tarafdar, M. Tu, Q. Ragu-Nathan, B. S. Ragu-Nathan, T. S. (2007). The impact of technostress on role stress and productivity. Journal of Management Information Systems, 24(1), 301–328.

Tarafdar, M. Bolman Pullins, E. Ragu-Nathan, T. S. (2014) Examining impacts of technostress on the professional salesperson's behavioural performance. Journal of Personal Selling & Sales Management, 34:1, 51–69.

William, W. William, L (2019). Improving Corporate Secretary Productivity using Robotic Process Automation. International Conference on Technologies and Applications of Artificial Intelligence (TAAI), Kaohsiung, Taiwan, pp. 1–5, doi: 10.1109/TAAI48200.2019.8959872.