Guest Editors' Introduction

WHEN TECHNOLOGY USE CAUSES STRESS: CHALLENGES FOR CONTEMPORARY RESEARCH

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INTRODUCTION

The current immense impact of ICT on individuals can be particularly strong in areas such as work and education. Both internet and computer systems have become an indispensable component of working or learning assignments. When ICT is missing, team cooperation and performance of certain tasks may be significantly limited. This has become especially clear recently, in the face of COVID-19 pandemic and all the challenges it has brought into our professional lives. Much of the workload had to be done virtually, forcing some employees and students to master new technologies enabling them to communicate through virtual platforms (e.g., Zoom or MS Teams) and to grasp the principles of digital and cyber safety at the same time.

Apart from the obvious benefits, the implementation of new technologies carries certain risks, which in the literature are described as 'iParadox' (Day, Barber, & Tonet, 2019). For example, on the one hand, ICT allows flexibility in exchange of the information between employees at any time of the day or night, but on the other hand, the employees feel obligated to check whether someone has sent message to them more often. Another example of iParadox is also the fact that technology helps co-workers or students and teachers keep in touch, especially in the case of distance working or learning, but at the same time it can be a source

of disruptive interferences and misunderstandings. Research shows that challenges related to the use of ICT constitute an independent source of stress together with other organizational stressors, such as lack of control, overload, boredom, and ambiguity (Day, Paquet, Scott, & Hambley, 2012) and contribute significantly to predictable negative consequences, e.g., professional burnout (Barber & Santuzzi, 2015). Moreover, virtual work during the pandemic and the high intensity and invasiveness of technology in our lives has resulted in heightened levels of techno-overload and conflicts between private and professional life (Molino et al., 2020).

Studies by work market analysts seem to indicate that organizations will not return to the former pre-crisis working solutions even after the pandemic subsides. The technological trend in ICT implementation which has recently emerged is here to stay (Savić, 2020). Virtual, computer-based technology enabled many institutions to revamp their processes and reduce costs (Thulin, Vilhelmson, & Johansson, 2019). The steep learning curve which employees had to rush along due to the pandemic will now have to be undertaken due to economic reasons. Therefore, increasing the awareness of how people react when learning new technologies becomes an imperative, as does the affect on performance of the consequences of such processes (technostress).

Although technostress is increasingly present in research, there is still a large gap to be filled. Moreover, analysis of the research findings on this subject reveals several crucial challenges. In the following sections, the selected research questions will address technostress and the challenges associated with it.

The Problem is Not Just about Employees

The available concepts and research results on technostress focus mainly on the organizational context. This phenomenon is well described from the perspective of employees and employers and quite well so in the group of professional teachers (Amarilla & Vargas, 2019; X. Wang & Li, 2019). However, there are very few theoretical studies and research results explaining how technostress affects the well-being and educational achievements of students. By definition, the use of new technology should support the effectiveness of learning and increase student achievements (Nami & Vaezi, 2018; Syvänen, Mäkiniemi, Syrjä, Heikkilä-Tammi, & Viteli, 2016). But is it really so? Moreover, it lacks reports on the relationship between attitude towards ICT and technostress among teachers and attitudes and technostress among students. Therefore, the question is how the way technology is percived by teachers affects attitudes and technostress among students, especially in a situation when a new educational technology is introduced in a given class. It is also important to determine whether individual attitudes of teachers and students has an influence on the effectiveness of learning a new technology. Perhaps this problem has not been sufficiently exposed so far because students often have extensive knowledge of new technologies far in excess of the knowledge and skills of teachers. However, this does not mean that students' use of technology is not stressful.

Technostress Measurement Challenges

ICT properties which its users can experience such as overload, invasiveness and a compound effect of threat and uncertainty justify using those categories as the basis for some of the most popular technostress diagnostic tools (Ayyagari et al., 2011; Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008; Wang, Shu, & Tu, 2008). It is worth noting however, that items assessing technostress in these measures seem to be quite generic and refer to all IT technologies, instead of specific devices or applications. Therefore, there is a need for modified versions of these tools to diagnose perceived technostress in a more targeted way, and in reference to more specific technological solutions (e.g., smartphones, Facebook). Moreover, most current methods measuring technostress are self-assessment based (e.g. Gaudioso, Turel, & Galimberti, 2017; Ragu-Nathan et al., 2008; Salanova, Llorens, & Cifre, 2013).

Considering stressor-strain approach, it is possible to conclude that most studies of technostress are focused on stressors – stress inducing technology evaluation. There are very few studies addressing properties of technology which lead to objective stress reaction in its users. Riedl (2013) reviewed studies relating to autonomic and somatic nervous system response as well as endocrinological system response to individual's interactions with computer. He concludes that negative technology user's experiences result in heightened skin conductivity, raised blood pressure, heightened heart rate, and raised stress hormones levels (especially adrenaline and cortisol). Another significant effect he noticed was lowered melatonin levels, which can disadvantageously impact immunological system. The above mentioned reactions can result from one-off short-term problems, like shut down of a computer system (Riedl, Kindermann, Auinger, & Javor, 2012) or continuous overload connected with being involved in electronic mail system (Mark, Voida, & Cardello, 2012).

The approach rooted in diverse diagnostical methods can benefit the methodology of technostress research in multiple ways, e.g., considering both the psychological (self-assessment) and physiological (stress hormone secretion) technostress measures at the same time, helps to predict the task performance better than when each domain was studied separately. However, as it was evidenced by Fischer and Riedl (2017), despite their undeniable benefits, studies which use multiple measurements are extremely rare in technostress research.

A Multi-level Approach to the Analysis of Attitudes Towards ICT and Technostress

The majority of studies on the determinants of technostress conducted so far focused on individual factors, such as demographic variables, the sense of effectiveness in the field of ICT or personality traits (Shu, Tu, & Wang, 2011; Srivastava, Chandra, & Shirish, 2015; Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2011). On the other hand, little research has been conducted to explain the role of organizational climate in explaining the phenomenon of technostress and the effectiveness of learning new technologies. A negative organizational climate has been shown to reduce psychological security among team members and ultimately to increase stressful situations (Finne, Christensen, & Knardahl, 2016). It should be expected that a similar mechanism occurs in the case of high incidence of techno-stressors in the learning environment. Research by Turel and Gaudioso (2018) shows that a positive leadership climate in the organization protects employees from perceiving technology as stressful, and a competitive climate intensifies the negative effects

of technostress. Ma and Turel (2019) proved that the level of technostress is related to organizational culture perceived by employees as power distance. However, so far, the issue of the climate of openness to ICT in the workplace or classroom and school has not been presented in a comprehensive manner. Furthermore, thus far the phenomenon of technostress has not been analyzed in a multi-level approach, i.e., the one in which technostress perceived by an individual results not only from individual differences, but also from being part of a given entity (team, organization, class, school).

According to the assumptions of concept of positive technology (Riva, Baños, Botella, Wiederhold, & Gaggioli, 2012), technology can perform three positive functions in human life: 1) hedonistic (technology is used to generate pleasant experiences); 2) eudaimonic (technology is supposed to support a person in achieving individual goals and self-realization); and 3) social (technology helps improve relationships with other people or groups). Promoting these three functions in an organization or school could help build a positive ICT climate, and thus support technology efficiency among its users.

Technostress Coping Strategies

The strength of the relationship between the perceived techno-stressors and stress response, as well as negative consequences, is determined to a large extent by more or less adaptive ways of dealing with technostress (Gaudioso et al., 2017). Beaudry and Pinsonneault (2005) investigated IT users coping strategies in reference to challenges arising from learning new computer technologies. Pirkkalainen and his team (Pirkkalainen, Salo, Makkonen, & Tarafdar, 2017) explored the efficacy of two main emotionally based coping strategies adopted in the IT environment. Their research points out that emotionally based coping strategies may to some extent mitigate tensions, but are not helpful in reducing technostress in the long run. Additionally, Gaudioso, Turel, & Galimberti (2017) demonstrated that the stronger the technological distress stemming from perception of ICT as overloading and invasive, the higher the propensity to employ maladaptive coping strategies. Some knowledge of technostress coping strategies does not go hand in hand with knowledge of the effectiveness of training and interventions to reduce technostress. Longitudinal studies are particularly lacking.

Complexity of Situational Factors

Both context and the course of new technology learning may significantly impact the perceived levels of technostress as well as the consequences of technology skills acquisition. One of the key characteristics of the job is computer-related technology dependence (Karr-Wisniewski & Lu, 2010), which is the extent to which employees have to depend on computer technology to carry out their tasks successfully. Shu, Tu and Wang's studies (2011) evidenced that employees whose dependence on computer-related technology was higher experienced higher levels of technostress. On the other hand, Weinert's and his team demonstrated that receiving instrumental support from help desks while experiencing difficulties in new technology learning process (computer freeze) effectively improves the level of task performance, lowers the user's physiological arousal and reduces burn-out resulting from technology use (Weinert, Maier, Laumer, & Weitzel, 2020). Moreover, the same study indicated that emotional support (compassion and comofort) in this stressful situation lowers only the physiological arousal, and does not affect the task performance

level, or long-term technostress consequences. Nevertheless, the above-mentioned studies are still rare. There are no complex research plans to illustrate the interaction of situational factors in shaping attitudes towards ICT and technostress.

Long-term Consequences of Technostress

Technostress researchers present strong evidence to corroborate the claim that stressors stemming from technology utilization (techno-stressors) impact employees in a meaningful way by evoking stress reaction, reducing their sense of well-being and self-efficacy (Ayyagari et al., 2011; Srivastava et al., 2015). Salanova and her team (Salanova et al., 2013) evidenced that a person's cognitive-emotional reaction to technology based negative experience entails anxiety, fatigue, skepticism, and a general self-efficacy drop in reference to utilizing ICT. Technostress is believed to reduce the ability to focus, the capability to form opinions, and to make the right decisions; it may also increase sense of ambiguity (Aghwotu & Owajeme, 2010). These symptoms are likely to affect one's capabilities to analyze situations or find solutions. In other words, technostress can significantly decrease levels of one's cognitive functioning, which in turn would reduce the technology-based task performance levels. However, explanation of the relationship between perceiving technology as stressful and the effectiveness of acquiring the skills to use it is a gap in scientific research that is yet to be filled. It remains unclear how perception of technologies impacts learning of new technologies. On the one hand, tension stemming from perceiving them as overloading, complex, invasive, uncertain, and threatening may lower the level of technological task performance. On the other hand, however, occurrence of stressors may motivate a person to find novel and creative ways to find new solutions for various efforts.

REFERENCES

Aghwotu, P., & Owajeme, J. (2010). Technostress: Causes, symptoms and coping strategies among librarians in university libraries. *Educational Research, 1*(12), 713–720.

Amarilla, S. B. G., & Vargas, S. F. P. (2019). Tecnoestrés docente: el lado opuesto de la utilización de las nuevas tecnologías por los Docentes del Nivel Medio. *Revista Científica Estudios e Investigaciones, 8*(1), 21–35. doi: 10.26885/rcei.8.1.21

Ayyagari, R., Grover, V., & Purvis, R. (2011). Technostress: Technological antecedents and implications. *MIS Quarterly: Management Information Systems, 35*(4), 831–858. doi: 10.2307/41409963

Barber, L. K., & Santuzzi, A. M. (2015). Please respond ASAP: Workplace telepressure and employee recovery. *Journal of Occupational Health Psychology, 20*(2), 172–189. doi: 10.1037/a0038278

Beaudry, A., & Pinsonneault, A. (2005). Understanding user responses to information technology: A coping model of user adaptation. *MIS Quarterly: Management Information Systems, 29*(3), 493–524. doi:10.2307/25148693

Day, A., Barber, L. K., & Tonet, J. (2019). Information Communication Technology and Employee Well-Being. In *The Cambridge Handbook of Technology and Employee Behavior* (pp. 580–607). doi:10.1017/9781108649636.022

Day, A., Paquet, S., Scott, N., & Hambley, L. (2012). Perceived information and communication technology (ICT) demands on employee outcomes: The moderating effect of organizational ICT support. *Journal of Occupational Health Psychology, 17*, 473–491. doi: 10.1037/a0029837

Finne, L. B., Christensen, J. O., & Knardahl, S. (2016). Psychological and social work factors as predictors of mental distress and positive affect: A prospective, Multilevel study. *PLoS ONE, 11*(3), 1–22. doi:10.1371/journal.pone.0152220

Fischer, T., & Riedl, R. (2017). Technostress research: A nurturing ground for measurement pluralism? *Communications of the Association for Information Systems, 40*. doi: 10.17705/1cais.04017

Gaudioso, F., Turel, O., & Galimberti, C. (2017). The mediating roles of strain facets and coping strategies in translating techno-stressors into adverse job outcomes. *Computers in Human Behavior, 69*, 189–196. doi:10.1016/j.chb.2016.12.041

Karr-Wisniewski, P., & Lu, Y. (2010). When more is too much: Operationalizing technology overload and exploring its impact on knowledge worker productivity. *Computers in Human Behavior, 26*(5), 1061–1072. doi: 10.1016/j.chb.2010.03.008

Ma, Y., & Turel, O. (2019). Information technology use for work and technostress: effects of power distance and masculinity culture dimensions. *Cognition, Technology & Work, 21*(1), 145–157. doi: 10.1007/s10111-018-0503-1

Mark, G. J., Voida, S., & Cardello, A. V. (2012). "A pace not dictated by electrons": An empirical study of work without email. *The SIGCHI Conference on Human Factors in Computing Systems*, 555–564. doi:10.1145/2207676.2207754

Molino, M., Ingusci, E., Signore, F., Manuti, A., Giancaspro, M. L., Russo, V., … 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*(5911), 1–20. doi: 10.3390/SU12155911

Nami, F., & Vaezi, S. (2018). How ready are our students for technology-enhanced learning? Students at a university of technology respond. Journal of Computing in Higher Education, 30(3), 510–529. https://doi.org/10.1007/s12528-018-9181-5

Pirkkalainen, H., Salo, M., Makkonen, M., & Tarafdar, M. (2017). Coping with Technostress: When Emotional Responses Fail. *Thirty-eight International Conference on Information Systems*, 1–18. Seoul.

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 validation. *Information Systems Research, 19*, 417–433. doi: 10.1287/isre.1070.0165

Riedl, R. (2013). On the biology of technostress: Literature review and research agenda. *Data Base for Advances in Information Systems, 44*(1), 18–55. doi: 10.1145/2436239.2436242

Riedl, R., Kindermann, H., Auinger, A., & Javor, A. (2012). Technostress from a neurobiological perspective: System breakdown increases the stress hormone cortisol in computer users. *Business and Information Systems Engineering, 4*, 61–69. doi: 10.1007/s12599-012-0207-7

Riva, G., Baños, R. M., Botella, C., Wiederhold, B. K., & Gaggioli, A. (2012). Positive Technology: Using interactive technologies to promote positive functioning. *Cyberpsychology, Behavior, and Social Networking, 15*(2), 69–77. doi: 10.1089/cyber.2011.0139

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. doi:10.1080/00207594.2012.680460

Savić, D. (2020). COVID-19 and work from home: Digital transformation of the workforce. *Grey Journal, 16*, 101–104.

Shu, Q., Tu, Q., & Wang, K. (2011). The impact of computer self-efficacy and technology dependence on computer-related technostress: A social cognitive theory perspective. *International Journal of Human-Computer Interaction, 27*, 923–939. doi: 10.1080/10447318.2011.555313

Srivastava, S. C., Chandra, S., & Shirish, A. (2015). Technostress creators and job outcomes: Theorising the moderating influence of personality traits. *Information Systems Journal, 25*(4), 355–401. doi:10.1111/isj.12067

Syvänen, A., Mäkiniemi, J.-P., Syrjä, S., Heikkilä-Tammi, K., & Viteli, J. (2016). When does the educational use of ICT become a source of technostress for Finnish teachers? *Seminar.Net, 12*(2), 95–109.

Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., & Ragu-Nathan, T. S. (2011). Crossing to the dark side: Examining creators, outcomes, and inhibitors of technostress. *Communications of the ACM, 54*, 113–120.

Thulin, E., Vilhelmson, B., & Johansson, M. (2019). New telework, time pressure, and time use control in everyday life. *Sustainability, 11*(11), 1–17. doi: 10.3390/su11113067

Turel, O., & Gaudioso, F. (2018). Techno-stressors, distress and strain: the roles of leadership and competitive climates. *Cognition, Technology & Work, 20*, 309–324. doi: 10.1007/s10111-018-0461-7

Wang, K., Shu, Q., & Tu, Q. (2008). Technostress under different organizational environments: An empirical investigation. *Computers in Human Behavior, 24*(6), 3002–3013. doi: 10.1016/j.chb.2008.05.007

Wang, X., & Li, B. (2019). Technostress among teachers in higher education: An investigation from multidimensional person-environment misfit. *Frontiers in Psychology*. doi: 10.3389/fpsyg.2019.01791

Weinert, C., Maier, C., Laumer, S., & Weitzel, T. (2020). Technostress mitigation: an experimental study of social support during a computer freeze. *Journal of Business Economics, 90*, 1199–1249. doi: 10.1007/s11573-020-00986-y

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