seminar.net
MEDIA, TECHNOLOGY & LIFELONG LEARNING
www.seminar.net

ISSN: 1504-4831 Vol 20, No 1 (2024) https://doi.org/10.7577/seminar.5718

Job demands and resources of information and technology use among teachers in Germany: A group concept mapping study

Malte Cramer
Center for Educational Research, University of Kaiserslautern-Landau, Landau, Rhineland-Palatinate, Germany

m.cramer@rptu.de

Ingmar Hosenfeld
Center for Educational Research, University of Kaiserslautern-Landau, Landau, Rhineland-Palatinate, Germany

i.hosenfeld@rptu.de

Abstract

Some teachers associate Information and Communication Technology (ICT) use with additional stress, referred to as technostress, while others seem to be able to utilize the advantages and potentials of ICT. There is a lack of research on how ICT experience is perceived as a threat or a positive challenge to well-being and how ICT specifically impacts the well-being of teachers in a positive way. Thus, the study aims to compile influencing factors of ICT use on teachers' well-being and to gain knowledge on the role of the benefits of ICT. Furthermore, information about the interplay of factors is to be obtained. The group concept mapping (GCM) method was used with 14 in-service German teachers from different school types. They compiled, sorted and rated factors related to teachers' well-being in the context of ICT use. The sorted factors were structured using non-metric multidimensional scaling and cluster analysis. Seventy-eight unique factors were generated and divided into 9 clusters. The resulting concept map (CM) provides an overview of the various factors and gives information about their interplay. In addition, the teachers rated clusters related to the positive effects on teachers' well-being as more important than those related to negative effects. The results suggest that future studies should consider the positive effects of ICT on teachers' well-being more extensively. Furthermore, the structure of the CM and the individual factors are linked to previous research. Limitations concerning the chosen method and sampling are discussed.

Keywords: ICT, technostress, digitalization, school, teacher health, well-being

Introduction

The ongoing digitalization in German schools is transforming the teaching profession in many ways (Kultusministerkonferenz, 2016). For example, teachers have to develop new digital competences for handling educational applications and learn how to integrate them in a pedagogically meaningful way into their instruction. In addition, they require continuous professional development to keep up with the rapid technological changes (Redecker & Punie, 2017). Against this background, it is not surprising that some teachers associate the use of ICT in schools with increased workload and higher levels of stress (Effiyanti & Sagala, 2018; Fernández-Batanero et al., 2021). On the other hand, the advantages and potentials of ICT can promote well-being. For example, ICT can increase work efficiency (Mäkiniemi, 2022) and help improve parent-teacher relationships through enhanced communication (Kuusimäki et al., 2019).

Day et al. (2019) described this dual role of ICT with the “iParadox triad”, which illustrates how ICT can simultaneously promote and reduce perceived autonomy, social connectivity, and productivity, depending on individual and organizational factors. Hill et al. (2024) further address this dual role by providing an integrated framework that shows how various subdimensions of technology dependence and dispersion in virtual work impact employees’ well-being through perceived work characteristics. The authors highlight that the same subdimensions can have both positive and negative effects on well-being. Aside from the question of how ICT experience is perceived as a threat or a positive challenge to well-being, there is little evidence on how ICT specifically impacts teachers’ well-being, particularly in terms of positive outcomes (Passey, 2021).

Well-being in the occupational context

The job demands-resources (JD-R) model provides an explanation for how positive and negative states of well-being arise in the context of work (Bakker & Demerouti, 2007). The term “job demands” encompasses facets of occupational activities necessitating continuous effort. Job demands can therefore lead to physiological costs or stress and burnout over the long term (Schaufeli, 2017), when employees cannot fully recuperate from stressors. Job demands include, for example, conflicts in the workplace or shift work. On the other hand, factors that support the achievement of work-related objectives and therefore contribute positively to work engagement (e.g., a supportive work environment or opportunities for autonomy) are considered as “job resources” (Xanthopoulou et al., 2007). Xanthopoulou et al. (2009) found that there is a positive feedback loop between these resources and well-being. Job demands and resources interact, so that existing resources can help reduce the impact of stressful demands. Therefore, in this study, well-being is understood as the balance point between job demands and resources, following Bakker and Demerouti (2007). It encompasses physical, psychological, social, and organizational dimensions, reflecting an individual’s overall satisfaction and functioning in both work and personal domains.

Technostress as a negative state of well-being

The negative effects of ICT use on well-being are referred to as technostress (e.g. Özgür, 2020) and digital stress (e.g. Fischer et al., 2021). Technostress was originally defined as “a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner" (Brod, 1984, p. 16). Current definitions specify specific types of stress that arise from the use of ICT (Dong et al., 2020; Syvänen et al., 2016). These include the demands that new technologies place on users and changes in work processes that are perceived as negative (Tarafdar et al., 2013). Technostress is commonly investigated by assessing techno-complexity, techno-uncertainty, techno-insecurity, techno-overload, and techno-invasion (Tarafdar et al., 2007). Techno-complexity refers to the degree of difficulty users experience in understanding and using technology, which can lead to a sense of inadequacy concerning their abilities. Techno-uncertainty describes the feelings of insecurity caused by the constant changes in ICT and the need for continuous training. Techno-insecurity is experienced when users fear losing their job because they could be replaced by new ICT, or when they are concerned that other employees with a better understanding of ICT will take over their jobs. Techno-overload describes the pressure to work longer and faster due to ICT use, while techno-invasion is related to the blurring of boundaries between work and personal life which can occur due to technology use (Tarafdar et al., 2007).

Technostress has become a significant research area in the course of advancing digitalization in various occupational contexts (Özgür, 2020). In multiple studies, technostress has been associated with burnout (Califf & Brooks, 2020; Cascio & Montealegre, 2016; Park et al., 2020), low quality of life (Nimrod, 2018), low job satisfaction (Hassan et al., 2019; Tarafdar et al., 2015), low job performance (Ayyagari et al., 2011; Tarafdar et al., 2015), and intentions to quit (Tarafdar et al., 2015).

Technostress among teachers

Teachers are also affected by the ongoing digitalization as they are expected to teach digital competences that are crucial for successful educational pathways and participation in society. The European Commission has provided a reference framework for the digital competences (DigCompEdu) that educators need in order to teach effectively in the 21st century (Redecker & Punie, 2017). Based on this framework, German educational policy makers have derived the concrete digital knowledge, skills, and competences that students should possess after their compulsory education and divided them into six areas (Kultusministerkonferenz, 2016). They include not only simple research of digital information, but also more complex skills such as the ability to create digital products in compliance with legal requirements. Mußmann et al. (2021) emphasize that teachers face a dual challenge in this regard. On the one hand, ICT should be used in a didactically meaningful way and students should be prepared for the digital (working) world. On the other hand, teachers are expected to acquire the necessary competences for using and integrating digital technologies and to continuously pursue further education in this area. In addition, the success in mastering these new requirements depends not only on the individual teacher, but also on external factors such as the educational policy guidelines and school conditions (Voogt & Knezek, 2018).

Various studies have found a medium level (Çoklar et al., 2016; Mußmann et al., 2021; Özgür, 2020; Syvänen et al., 2016) or high level (Del Rey-Merchán & López-Arquillos, 2022) of technostress among teachers. A comparison of studies with different occupational groups showed that teachers reported either higher or the same level of technostress compared to other occupational groups (Mußmann et al., 2021).

What factors can lead to technostress in teachers using ICT?

Previous studies have highlighted multiple factors that are associated with technostress among teachers. In several studies, teachers with lower digital competences – generally operationalized according to the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) – experienced higher levels of technostress (Dong et al., 2020; Joo et al., 2016; Özgür, 2020; Syvänen et al., 2016). Furthermore, insufficient support from schools was related to technostress, when teachers feel that they lack the necessary assistance to use ICT effectively in their instruction (Califf & Brooks, 2020; Chou & Chou, 2021; Del Rey-Merchán & López-Arquillos, 2022; Joo et al., 2016; Özgür, 2020). Similarly, lower levels of computer-related self-efficacy, which is the confidence in one's ability to use technologies, were associated with higher technostress (Chou & Chou, 2021; Dong et al., 2020; Efilti & Naci Çoklar, 2019).

According to the study of Syvänen et al. (2016), teachers' attitudes and the consistency of pedagogical use of ICT with the teaching style also play a significant role for the development of technostress. Negative attitudes towards ICT and a lower concordance of ICT with the teaching style were statistically significantly correlated to higher levels of technostress.

In addition, a relationship between lower average time spent on the Internet and higher technostress was identified (Al-Fudail, 2008; Çoklar et al., 2016). However, Syvänen et al. (2016) were unable to replicate these results for the frequency of ICT use in the classroom among teachers and instead suggested that digital competences moderate the relationship between the frequency of ICT use and technostress.

Califf and Brooks (2020) examined the impact of increasing ICT use by teachers on work-life balance. According to their results, the blurring between home and work life can be intensified by ICT (in the form of techno-invasion) and have a negative impact on well-being.

Further studies showed that an increased workload due to ICT use (Effiyanti & Sagala, 2018) as well as privacy concerns are related higher levels of technostress (Chou & Chou, 2021).

Regarding demographical variables, a few studies found a positive relationship between age and technostress, with older teachers exhibiting higher levels of technostress (Özgür, 2020; Syvänen et al., 2016). Female teachers reported more technostress in the study by Syvänen et al. (2016), while other studies did not find any gender-specific differences (Çoklar et al., 2016; Özgür, 2020).

How can ICT use relieve the burden on teachers?

Other studies that are not specific to teachers point out a more complex relationship between ICT and well-being (Bordi et al., 2018; Day et al., 2019; Hill et al., 2024; ter Hoeven & van Zoonen, 2015). Day et al. (2019) described the “iParadox Triad”, which encompasses issues related to autonomy, social connectivity, and productivity. Regarding autonomy, for example, the authors state that ICT allow an employee to work from home or other locations, providing the ability to adjust work hours to personal needs. At the same time, it can also lead to the expectation to be available at all times, which can blur the boundaries between work and private life and lead to stress. According to the authors, individual stress appraisals in the sense of the transactional stress theory (Lazarus & Folkman, 1984) play a role in how ICT experience is perceived as a threat or a positive challenge to well-being. In case that primary appraisals classify external ICT-related events as a threat, secondary appraisals, considering personal characteristics and coping resources, can modify their impact on well-being. On the other hand, the authors argue that individual differences in managing work-home boundaries can be essential for addressing ICT-related paradoxes. Boundary theory suggests that people have multiple roles and use boundaries to organize their environment, with preferences for either integration (high permeability and flexibility) or segmentation (low permeability and flexibility) of different roles (Ashforth et al., 2000; Day et al., 2019). Thus, ICT can support both permeability and flexibility regarding work and private life, aiding integration but potentially undermining segmentation. Day et al. (2019) conclude that aligning individual and employer preferences for boundary management may reduce work-home interference and improve worker well-being.

Hill et al. (2024) have further addressed this dual role of ICT by developing an integrative framework that highlights how ICT can enhance and harm employee well-being. By synthesizing findings from 115 empirical studies, they identified subdimensions of technology dependence (communication leanness, asynchronicity, technical complexity, and flexible connectivity) and dispersion (spatial distance, temporal distance, and out-of-office location) as important in this context. These subdimensions affect employee well-being through their influence on perceived work characteristics, which can be divided into the four categories of task, knowledge, social, and work context. Furthermore, the authors point out that the impact of these subdimensions on well-being is not uniform but is moderated by individual, team, organizational, and external factors. In this way, spatial distance, for example, can either enhance autonomy or lead to isolation.

However, there are only a few studies on how ICT specifically impacts teachers’ well-being in terms of positive outcomes (Passey, 2021). Pablos-Pons et al. (2013) found digital competences, teachers’ internal beliefs, and values that guide their use of ICT to be important for the emergence of personal satisfaction and positive emotions (e.g., satisfaction, pleasure, and happiness), which in turn contribute to teachers’ well-being. Similar to these findings, Mäkiniemi et al. (2020)

reported moderate correlations between value congruence related to educational technology use, autonomous use of educational technology, social support in the course of educational technology use, technology-related self-efficacy, and techno-work engagement. They defined the latter as “a positive and fulfilling well-being state or experience that is characterized by vigor, dedication, and absorption into work with respect to the use of technology at work” (Mäkiniemi et al., 2020, p. 2). In another qualitative study by Mäkiniemi (2022), teachers reported techno-work engagement when digital technologies increased work efficiency, created novelty value (e.g., by enabling new learning experiences), were used for collaboration, and when positive feelings occurred during use (e.g., feelings of enthusiasm and success, positive turns). Furthermore, Kuusimäki et al. (2019) investigated the impact of digital communication on the parent-teacher relationship. According to their results, digital communication can improve this relationship, especially in rural areas, which in turn can have a positive impact on teachers’ well-being. In another study, a regression analysis was conducted to examine the relationship between personality traits (extraversion, conscientiousness, and neuroticism), digital competences, and teacher well-being (Stan, 2022). The findings revealed that, in addition to personality traits, digital competences significantly predicted well-being, albeit with a small proportion of explained additional variance. The author assumed that teachers with high digital competences were more confident and less stressed when using digital technologies, which may contribute to better job-related well-being and reduce the burnout risk. Finally, Moreira-Fontán et al. (2019) found that teachers with higher digital self-efficacy and better school support experienced more positive ICT-related emotions (e.g., well-being, happiness, pride, or satisfaction) and higher work engagement.

Aims and research questions

In light of the presented research, this study aims to broaden the empirical foundation for the effects of ICT use on the well-being of teachers in Germany. To this end, in-service teachers were recruited as experts for their occupational group, hereafter referred to as expert teachers. They identified the job demands and resources associated with ICT use and teachers’ well-being. These factors were structured in a data-driven manner to obtain an overview and to gain insight into the interplay of factors. Lastly, it was of interest to assess the importance of these factors in order to provide a criterion for distinguishing between relevant and less relevant factors. Based on the stated aims, the following research questions were formulated: (1) Which job demands and resources are relevant for teachers in Germany in the context of ICT use in schools? (2) How can these factors be structured? (3) Which factors are perceived as particularly important or unimportant for teachers’ well-being?

Method

Sample characteristics

The total sample consisted of 14 teachers from different types of schools. Twelve participants (86%) were female. Six of them (43%) reported that they had a specific role in their school related to digitalization (e.g., ICT coordinator). The distribution of age, professional experience, and the types of school represented are presented in Table 1.

Table 1

Sociodemographic Characteristics of Participants

Sample Characteristics	*n*	%
Age		
31-40 years	6	43
41-50 years	2	14
51-60 years	5	36
> 60 years	1	7
Work experience		
6-10 years	4	29
11-20 years	4	29
21-30 years	4	29
> 30 years	2	14
School type		
Primary school	3	21
Secondary school	10	71
Special school	1	7

Procedure of the study

The group concept mapping (GCM) method developed by Trochim (1989) was employed to address the research questions. This method will be briefly outlined in this chapter (for further information see Kane & Trochim, 2007).

Fourteen teachers from different schools in Germany were recruited as experts in the field of ICT use in schools. Expert teachers who held a digitalization-related position at their school were explicitly approached. It was assumed that they, as contact persons for digitalization-related topics in their school, would be particularly valuable for the study. All participants were informed about the study's purpose, procedures, and confidentiality before the start of the study. Informed consent was obtained. All procedures were approved by the Human Research Ethics Committee of the University [NEUTRAL PLACEHOLDER]. After recruitment, the expert teachers were prompted to develop statements and ideas on the factors related to teachers' well-being in the context of ICT use in schools. The central terms of the task were explained beforehand. The generation of statements took place on the virtual platform Online Cooperation (https://www.oncoo.de) where the teachers collected a total of 148 statements. After removal of duplicates and merging of similar statements, a final set of 72 statements was obtained. Six additional statements, which we perceived as relevant and were not previously represented, were added.

In the second part of the study, each participant sorted the 78 statements into multiple stacks without being instructed to follow a specific sorting logic. For this step, the online card sorting platform Proven by Users (see https://provenbyusers.com) was utilized. Additionally, each statement was rated in terms of its perceived importance for the well-being of teachers in the context of ICT use with a 4-point scale (ranging from 1 = unimportant to 4 = important). Thirteen expert teachers completed the sorting task, and 12 of them submitted ratings of the statements.

Using non-metric multidimensional scaling, a two-dimensional map-like representation called a “concept map” (CM) was created from the individually sorted stacks of statements. On this map, statements were represented as dots, and statements that were sorted together more frequently were located closer together. Subsequently, a hierarchical cluster analysis was applied to the group statements, allowing a more straightforward interpretation of the CM. The CM was generated and the cluster analysis conducted using R-CMap software, which was implemented in R (Bar & Mentch, 2017; R Core Team, 2022). Finally, the average rated importance was calculated for the individual statements and clusters using R (R Core Team, 2022).

In the final part of the study, the clusters were discussed and labeled with names by a subgroup of expert teachers (n = 6) in a video conference. The names of clusters 2, 4, 8, and 9 were subsequently adjusted by the authors to provide a more precise description of the cluster contents and to ensure better differentiation from other clusters. Furthermore, a single statement that had not been initially assigned to a cluster in the cluster analysis was added to Cluster 4 by the expert teachers. To allow a further analysis of the map, the dimensions of the CM were interpreted by the group of experts. (Borg, 2010; Kane & Trochim, 2007).

GCM was used for several reasons. As outlined above, the available data on the job demands and resources of ICT use for teachers’ well-being is still sparse. It is therefore necessary to draw on expert knowledge to structure the field of action so that subsequent research can benefit. Furthermore, GCM has the following advantages over other structuring methods: In comparison to content analysis, GCM includes communicative validation phases. For example, the CM is checked in a group session, and, if necessary, the positioning and assignment of individual statements to clusters can be modified by the experts. In addition, the clusters are named following a consensus among the participants. Compared to a factor-analytical approach, it is advantageous that the participants themselves generate a structure through the sorting of generated statements and that differences between people are not simply modeled and interpreted by the principal investigator. Overall, GCM is characterized by the advantageous feature that it attempts to minimize the influence of the researcher on the results.

Results

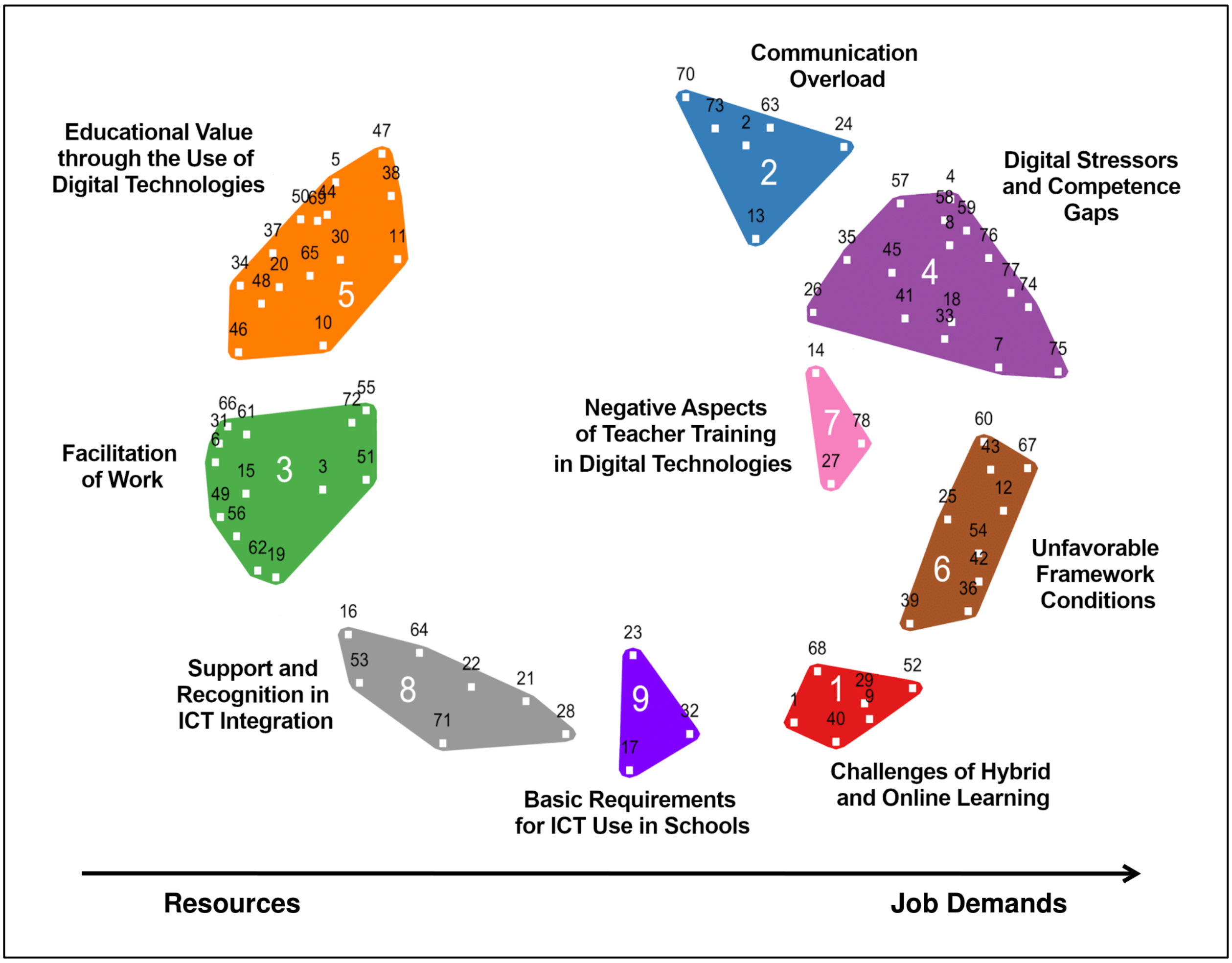
The cluster analysis yielded a cluster solution consisting of nine clusters which was the most interpretable. The calculated error proportion, which indicates how well the distances on the generated map represent the sorted statements, was 0.269 (Borg & Groenen, 2005). A low value reflects a good fit between the sorted statements and the generated map. On the other hand, high values may suggest that the aggregated sorted statements encompass a level of complexity that cannot be effectively depicted by a two-dimensional representation. The error proportion in the present study fell within the range of average values reported in other GCM projects (Donnelly, 2017; Rosas & Kane, 2012; Trochim, 1993).

The x-axis of the CM was interpreted by the expert teachers to represent whether the statements reflected resources (left pole) or job demands (right pole) associated with the use of ICT. The content of the clusters and individual marker items that represent the clusters well are presented below[1]. Furthermore, the average rated importance of each cluster is reported, indicating whether the expert teachers considered the statements in the clusters to be unimportant (values from 1 to 1.74), moderately unimportant (1.75 to 2.24), neither important nor unimportant (2.25 to 2.75), moderately important (2.76 to 3.25), or important (3.26 to 4). Figure 1 displays the final CM.

[1] The complete list of generated statements is available in Electronic Supplementary Material 1.

Figure 1

Final concept map



Clusters related to job demands

Cluster 1 was assigned the label “Challenges of Hybrid and Online Learning” by the expert teachers. It addresses various challenges associated with hybrid and online learning environments. These challenges stem from differences in digital skills among parents (S1[2]) and among students (S29), diverse conditions that students encounter at home (S9), and the issues of student engagement and control during online classes (S52). The average rated importance of all statements within the cluster is 2.75 (*SD* = 0.75). Thus, the cluster is considered neither important nor unimportant by the expert teachers.

Cluster 2, labeled “Communication Overload,” encompasses the challenges related to excessive digital communication faced by teachers. It addresses the issues of constant availability (S63) and excessive communication demands through various channels (S73), which can impact teachers’ work-life balance (S24). Furthermore, the statements reflect the burden of managing numerous

[2] Statements are abbreviated using the letter S (representing “Statement”) followed by a unique identification number.

emails (S2) and high expectations from parents (S13). With a mean value of 3.05 (*SD* = 0.52), the cluster is considered moderately important by the expert teachers.

The content of Cluster 4 can be summarized under the name "Digital Stressors and Competence Gaps," addressing a broad range of stressors that partly arise due to the lack of digital competences (S7). This is the case, for example, when teachers feel overwhelmed by students possessing better knowledge of digital technologies (S8), or when teachers with high digital competences drive the digital transformation in schools, leaving others feeling left behind (S26). Other statements address stress and anxiety from technical problems (S77), exhaustion from continuous learning (S75), and the feeling of self-exploitation due to new job demands (S4). Moreover, statements regarding the increased time invested in applying and integrating new digital technologies (S57), and the high number of different apps and digital tools available (S33) are located in this cluster. Finally, the physical health impacts of prolonged use of digital technologies are highlighted (S58). With an average value of 2.66 (*SD* = 0.46), the cluster is considered neither important nor unimportant by the expert teachers.

Cluster 6 was named "Unfavorable Framework Conditions." It includes statements on infrastructural and practical challenges that teachers face in the context of ICT integration. Specifically, persistent technical issues (S36), uncertainty regarding data protection regulations (S43), the high effort required for setting up and dismantling digital technology (S25), outdated operating systems (S54), and high costs of acquiring fee-based apps (S67) contribute to an unfavorable digital working environment. With an average importance rating of 2.97 (*SD* = 0.39), the cluster is considered moderately important by the expert teachers.

Cluster 7 was assigned the label "Negative Aspects of Teacher Training in Digital Technologies," highlighting problems and shortcomings associated with the training programs designed to enhance teachers' digital competences. It consists of just three statements that address the lack of practical relevance in training content (S27), the neglect of other important competences (S14), and insufficient number of training courses (S78). The average importance rating of the cluster is 2.61 (*SD* = 0.38). Thus, the cluster is considered neither important nor unimportant by the expert teachers.

Clusters related to job resources

Cluster 3 was named "Facilitation of Work." This group includes statements that describe the facilitation of administrative and organizational tasks (S49), and collaborative aspects of teaching. Specifically, digital technologies make it easier to access and store teaching materials (S6), which also leads to time savings for exchanging materials and lesson preparation (S61). Furthermore, virtual conferences from home adds convenience and flexibility (S15). Regarding the facilitation of collaboration, it is easier to get in contact with parents (S55), for example, to discuss problematic students (S72). Moreover, it also enhances the cooperation between teachers (S19). The average importance of the statements within this cluster is 3.14 (*SD* = 0.35), indicating that this cluster is considered moderately important by the expert teachers

Cluster 5 was labeled “Educational Value through the Use of Digital Technologies.” It highlights motivational, instructional, and supportive benefits of integrating ICT into teaching practices. Students’ motivation can be increased by more engaging and interactive learning experiences (S50). The benefits for the instruction relate to a greater variety (S34) and efficiency in teaching methods (S69). Furthermore, increased control over learning outcomes and processes through digital technologies (S48) offer improved opportunities for individual support for students (S65). Moreover, students can be provided with materials at home (e.g., in case of illness) (38) and the contact with students is facilitated (S10). With an average importance rating of 3.16 (*SD* = 0.41), the cluster is considered moderately important by the expert teachers.

Cluster 8 has received the title “Support and Recognition in ICT Integration.” It describes how the support and recognition teachers receive for integrating digital technologies into their teaching practices impact their well-being. Teachers’ well-being benefits from a good introduction to the use of new digital technologies (S21), the participation in training courses on digital technologies (S22), and support offered by colleagues in the event of technical problems (S64). Furthermore, appreciation from parents (S16) and the school administration (S53) for using digital technologies are highlighted. Finally, teachers who implement digital technologies in the classroom may experience greater popularity among students (S71). The average importance rating of the cluster is 2.92 (*SD* = 0.56); hence, it is considered moderately important by the expert teachers.

Statements in Cluster 9 can be summarized under the title “Basic Requirements for ICT Use in Schools.” It consists of just three statements addressing fundamental prerequisites for the use of ICT. These include a good digital school infrastructure (S17), good digital competences of teachers (S23), and a stable internet connection (S32). With an average importance rating of 3.52 (*SD* = 0.17), the cluster is considered important by the expert teachers.

Discussion

The expert teachers generated a large number of factors that are potentially relevant as job resources or demands for the well-being of teachers in the context of ICT use in schools. Furthermore, these factors were grouped into clusters based on how they were sorted by the teachers and evaluated in terms of their importance.

Looking at the CM with reference to the interpreted x-axis, what stands out is the relatively even balance between job resources and demands on the CM. This implies that the advantages and disadvantages of ICT use were taken into account equally by the expert teachers. Clusters 3, 5, 8, and 9 contain only resources, while clusters 1, 2, 4, 6, and 7 comprise job demands. This is significant in that teachers were not specifically prompted to mention both the advantages and disadvantages of ICT use for teachers’ well-being, but were completely free to generate their statements. Given the stronger emphasis on negative consequences for teachers’ well-being in previous research, this finding is surprising. Furthermore, a comparison of the ratings of importance yielded interesting insights. It is noticeable that clusters containing resources were rated as more important on average than clusters containing job demands. When individual cluster pairs were tested for significant differences with a Tukey post-hoc test, Clusters 4 ("Digital Stressors and Competence Gaps") and 5 ("Educational Value through the Use of Digital Technologies") differed significantly (0.49; 95% CI: 0.02-0.97; $p = 0.04$). Therefore, it can be assumed that the expert teachers place a higher value on the benefits of digital technologies for teachers' well-being.

As mentioned, further information on the interplay between individual factors can be obtained from the spatial distance. On this basis, it can be observed that statements were often grouped together if they represent external or internal job demands or resources: At cluster level, clusters 1 and 6 are close to each other and describe external conditions that have a negative impact on teachers' well-being. While cluster 1 ("Challenges of Hybrid and Online Learning") contains external stressors that can arise specifically in the course of hybrid and online learning, cluster 6 ("Unfavorable Framework Conditions") includes factors of an unprepared school in relation to digitalization. Like clusters 1 and 6, the neighboring Clusters 8 and 9 describe external conditions, but this time with positive effects on teachers' well-being. Cluster 8 ("Support and Recognition in ICT Integration") includes factors of a supportive social working environment. Cluster 9 ("Basic Requirements for ICT Use in Schools"), on the other hand, addresses the fundamental (technical) prerequisites for the successful use of ICT in schools. Opposite of these clusters, cluster 2 and 4 describe mostly internal job demands for teachers that have a negative impact on teachers' health. Cluster 2 ("Communication overload") focuses on the problem of managing a large volume of emails and using different platforms for communication, while Cluster 4 ("Digital Stressors and Competence Gaps") contains thematically diverse negative consequences of ICT use that partly arise due to the lack of digital competences. Clusters 5 ("Educational Value through the Use of Digital Technologies") and 3 ("Facilitation of Work") address the benefits of ICT that individual teachers can make use of and that have positive effects on teachers' health. These clusters include both internal and external resources, making a clear classification not possible.

Reflecting on our findings with previous studies on technostress, we see clear parallels between clusters related to job demands and technostress dimensions according to Tarafdar et al. (2007). Thus, techno-invasion is closely related to issues in Cluster 2 ("Communication Overload"), such as availability pressure and work-life conflict. Similarly, Cluster 4 ("Digital Stressors and Competence Gaps") reflects aspects of techno-overload and techno-complexity, as the increased workload and problems stemming from a lack of digital skills are addressed in different statements. In addition, the dimension techno-insecurity can be linked to some statements in this cluster that address doubts about one's own digital skills compared to colleague. The findings of Bordi and Nuutinen (2023) on important technostressors during the COVID-19 pandemic among Finnish comprehensive school teachers are also reflected in the clusters. Specifically, the theme of rapid ICT adoption identified in their study corresponds with Cluster 4, which address the stress experienced by teachers who are struggling to keep up with the advancing ICT integration. Statements in Cluster 6 can be related to the technostressor category "technological inadequacies" (Bordi & Nuutinen, 2023), which includes technical problems, a lack of adequate digital infrastructure and technical support. Lastly, another main stressor labeled "multichannel communication and availability pressure" by the authors can be linked to Cluster 2. Both describe the stress of managing multiple communication channels and constant availability pressure.

Regarding clusters related to positive experiences of ICT on well-being, there are similarities between Cluster 8 ("Support and Recognition in ICT Integration") and the technostress inhibitors of Ragu-Nathan et al. (2008), specifically regarding “literacy facilitation” and “technical support provision.” As reported, statements within this cluster address the importance of a good introduction to the use of new ICT and participation in training courses on digital technologies, which are crucial for enhancing teachers’ digital competences. Additionally, the availability of technical support and peer support from colleagues in the event of technical problems is addressed, helping teachers resolve ICT-related issues efficiently. Furthermore, Cluster 5 (“Educational Value through the Use of Digital Technologies”) can be related to the concept of “techno-enabled innovation”, which Tarafdar et al. (2015) define as the development and implementation of creative ideas and solutions through the application of ICT in work. This applies, for example, to new possibilities for lesson design, such as the addition of podcasts, quizzes, and videos into teaching. Additionally, an improved exchange and solution finding with customers – or in the school context, with colleagues, parents, and students – via ICT is referred to as “technology-enabled performance” (Tarafdar et al., 2015). This concept is addressed in Cluster 3 (“Facilitation of Work”), encompassing easier sharing of materials with colleagues, easier communication and more intensive contact with parents, and teachers supporting each other with lesson preparation.

At the level of individual statements, it is also interesting to take note of the evaluated importance in relation to previous studies and the seemingly paradoxical effects of ICT on teachers’ well-being. Statements on the burden of having to be constantly available due to digital communication tools (S63) and the resulting impact on the work-life balance (S24) were rated as particularly important by the expert teachers. At the same time, easier contact with parents and students was considered important (S10). The fact that digital communication tools can function as both a job resource and demand has already been highlighted in previous studies (Bordi et al., 2018; Day et al., 2019). The results of the present study indicate that this also applies to teachers. Interestingly, teachers highlighted the easier contact with students as a major advantage. This might be because teachers in Germany did not have regular telephone contact with students in the past. Unlike, for example, the case of customer contacts in the business world, digital communication tools make communication with students outside of school possible for the first time. For future studies, it would be of interest to investigate the conditions under which teachers can leverage these benefits of digital communication without being overwhelmed by the more demanding aspects, such as constant availability. Baumeister et al. (2021), for example, show that an important factor is whether employees use ICT during work hours or non-work hours.

Another group of statements rated as important refers to increased work flexibility (S46) and the facilitation of organizational tasks (S61). These findings support the findings of Mäkiniemi (2022), where participants reported techno-work engagement when ICT effectively simplified and streamlined their tasks. Similarly, ter Hoeven and van Zoonen (2015) highlighted the potential of flexible work designs to improve employee well-being. In contrast, statements were also made regarding the increased workload and higher time costs associated with ICT use (S57). However, they may only represent the initial costs of ICT integration, which could develop into resources with continued ICT use and higher digital competences (Bećirović, 2023).

Further statements that were rated as important relate to (technical) support provided by colleagues and the school (S64). They are in line with the findings of previous studies that demonstrate an association between a supportive environment and lower technostress (Joo et al., 2016; Özgür, 2020) and higher well-being (Mäkiniemi et al., 2020; Moreira-Fontán et al., 2019).

In addition, the expert teachers considered the better opportunities for individualized support of students' learning (S65), high student motivation (S5), and new possibilities for shaping instruction (S34) as important. This implies that digitally enhanced instruction not only has positive consequences for students, but also has a positive impact on teachers' well-being. Similar findings were reported by Mäkiniemi (2022), who found that teachers experience techno-work engagement when digital technologies create novelty value.

Finally, the expert teachers assigned high importance ratings to statements regarding digital competences (S23), digital infrastructure (S17), and negative consequences when technical issues arise (S77). These findings are in line with those of previous research (Pablos-Pons et al., 2013; Stan, 2022) and demonstrate that digital competences and functioning technology can be seen as a fundamental prerequisite for the successful integration of ICT into schools.

Other statements were considered significantly less important by the expert teachers. These statements encompass the following aspects: "Overwhelmed by students' better knowledge of digital technologies (compared to the teacher)" (S8), "Insufficient number of training sessions" (S78), "Personal doubt about the added value of digital technologies" (S76), "Lack of teacher's skills in handling digital technologies" (S7), "Promotion of self-directed learning" (S37), and "Confusion arising from the high number of different apps" (S33). Most of these factors contribute to negative affect in teachers. This finding is not surprising because, as reported above, clusters containing job demands were rated as less important than clusters associated with resources. Moreover, it is notable that expert teachers considered their lack of skills in operating ICT to be relatively less relevant (S7). A possible explanation for this is that the day-to-day operation of ICT may be perceived as relatively unproblematic in comparison to dealing with unexpected technical problems (S23).

Limitations

Regarding the method implemented in this study, the process of labeling the clusters by the participating teachers during the video conference proved to be somewhat challenging, because some of the clusters were assigned relatively generic labels. For instance, Cluster 2 was originally named “Multiple Burdens on Teachers,” which did not reflect the strong focus of the statements on communication overload. As reported, the labels of clusters 2, 4, 8, and 9 were adjusted by the authors after the labeling process for this reason.

Additionally, the sample size of 13 participants completing the sorting task and 12 participants completing the rating task is rather small, although it falls within the suggested range of 10 to 40, which Kane and Trochim (2007) proposed as a good framework. However, this may have influenced the resolution and clarity of the results, as a smaller sample size could lead to limited diversity in perspectives. Following on from this, the results may also have been influenced by self-selection bias in the sample. Some of the participating teachers held ICT-related roles within their schools. While they were intentionally recruited, it is plausible that these teachers had a certain affinity for ICT, which could have potentially led to a particularly positive assessment of the use of ICT and its consequences.

Finally, it should be emphasized that the professional conditions and teacher training as well as the progress of digitalization in schools can vary between countries (Fraillon et al., 2020; Schleicher, 2016). Further research in different regions would therefore be worthwhile to enhance our comprehension of the relationship between ICT use and teachers’ well-being.

Conclusion

The present study compiled and structured a broad range of job demands and resources related to ICT use by teachers in schools in Germany. Data-driven structuring was achieved through the generation of clusters, which were significantly influenced by the involvement of expert teachers who validated them in a video conference. Furthermore, the applied method made it possible to directly compare the negative and positive effects of ICT use on well-being. Consequently, the importance of the positive aspects of ICT use was highlighted. On average, the expert teachers rated clusters of statements related to the positive effects on well-being as more important than those containing statements on the negative effects. The results therefore underscores the assertion of Passey (2021) that the positive effects of ICT are significant in the development of well-being and deserve greater focus. Future studies should therefore consider the positive effects of ICT on teachers’ well-being more extensively. Furthermore, the more holistic approach on the positive and negative consequences of ICT use for teachers’ well-being helped to gain information about the interplay of ICT-related factors. Based on the spatial distance, the clusters could mostly be divided into internal and external job demands and resources. This adds to previous research on how the same factors can positively and negatively influence well-being (Bordi et al., 2018; Day et al., 2019; Hill et al., 2024; ter Hoeven & van Zoonen, 2015). Additionally, the complex relationship between the individual factors and the well-being of teachers was reflected in the evaluated importance of the statements. Thus, some statements that actually contradict each other were rated as important. It would be of interest to conduct further studies to examine these findings in more detail. Furthermore, the rated importance of the statements supports previous findings regarding the significance of school conditions, particularly in terms of technical equipment and support offers from colleagues. In addition, teachers' digital competences and new learning experiences for students have proven to be important for teachers' well-being.

Electronic Supplementary Material

The electronic supplementary material is available at https://journals.oslomet.no/index.php/seminar/article/view/5718/4999

References

Al-Fudail, M. (2008). An exploration of teacher stress when using ICT in technology-rich classrooms [Dissertation]. University of London. https://discovery.ucl.ac.uk/id/eprint/10019300/

Ashforth, B. E., Kreiner, G. E., & Fugate, M. (2000). All in a Day's Work: Boundaries and Micro Role Transitions. Academy of Management Review, 25(3), 472–491. https://doi.org/10.5465/amr.2000.3363315

Ayyagari, R., Grover, V., & Purvis, R. (2011). Technostress: technological antecedents and implications. MIS Quarterly, 35(4), 831–858. https://doi.org/10.2307/41409963

Bakker, A. B., & Demerouti, E. (2007). The Job Demands-Resources model: state of the art. Journal of Managerial Psychology, 22(3), 309–328. https://doi.org/10.1108/02683940710733115

Bar, H., & Mentch, L. (2017). R-CMap – an open-source software for concept mapping. Evaluation and Program Planning, 60, 284–292. https://doi.org/10.1016/j.evalprogplan.2016.08.018

Baumeister, V. M., Kuen, L. P., Bruckes, M., & Schewe, G. (2021). The Relationship of Work-Related ICT Use With Well-being, Incorporating the Role of Resources and Demands: A Meta-Analysis. SAGE Open, 11(4), 215824402110615. https://doi.org/10.1177/21582440211061560

Bećirović, S. (2023). Digital Pedagogy: The Use of Digital Technologies in Contemporary Education (1st ed. 2023). SpringerBriefs in Open and Distance Education. Springer Nature Singapore; Imprint Springer. https://doi.org/10.1007/978-981-99-0444-0

Bordi, L., & Nuutinen, S. (2023). Experiences of technostressors during the Covid-19 pandemic among Finnish comprehensive school teachers. Seminar.Net, 19(1), 18. https://doi.org/10.7577/seminar.5257

Bordi, L., Okkonen, J., Mäkiniemi, J.-P., & Heikkilä-Tammi, K. (2018). Communication in the Digital Work Environment: Implications for Wellbeing at Work. Nordic Journal of Working Life Studies, 8(53). https://doi.org/10.18291/njwls.v8iS3.105275

Borg, I., & Groenen, P. J. F. (2005). Modern multidimensional scaling: Theory and applications (2. ed.). Springer series in statistics. Springer. http://dx.doi.org/10.1007/978-1-4757-2711-1

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

Califf, C. B., & Brooks, S. (2020). An empirical study of techno-stressors, literacy facilitation, burnout, and turnover intention as experienced by K-12 teachers. Computers & Education, 157, 103971. https://doi.org/10.1016/j.compedu.2020.103971

Cascio, W. F., & Montealegre, R. (2016). How technology is changing work and organizations. Annual Review of Organizational Psychology and Organizational Behavior, 3(1), 349–375. http://dx.doi.org/10.1146/annurev-orgpsych-041015-062352

Chou, H.-L., & Chou, C. (2021). A multigroup analysis of factors underlying teachers' technostress and their continuance intention toward online teaching. Computers & Education, 175, Article 104335. https://doi.org/10.1016/j.compedu.2021.104335

Çoklar, A. N., Efilti, E., Sahin, Y. L., & Akçay, A. (2016). Investigation of techno-stress levels of teachers who were included in technology integration processes. The Turkish Online Journal of Educational Technology, 16, 1331-1339.

Day, A., Barber, L. K., & Tonet, J. (2019). Information Communication Technology and Employee Well-Being. In R. N. Landers (Ed.), Cambridge handbooks in psychology. The Cambridge handbook of technology and employee behavior (pp. 580–607). Cambridge University Press. https://doi.org/10.1017/9781108649636.022

Del Rey-Merchán, M. C., & López-Arquillos, A. (2022). Occupational Risk of Technostress Related to the Use of ICT among Teachers in Spain. Sustainability, 14(14), 8746. https://doi.org/10.3390/su14148746

Dong, Y., Xu, C., Chai, C. S., & Zhai, X. (2020). Exploring the structural relationship among teachers' technostress, technological pedagogical content knowledge (TPACK), computer self-efficacy and school support. The Asia-Pacific Education Researcher, 29(2), 147–157. https://doi.org/10.1007/s40299-019-00461-5

Donnelly, J. P. (2017). A systematic review of concept mapping dissertations. Evaluation and Program Planning, 60, 186–193. https://doi.org/10.1016/j.evalprogplan.2016.08.010

Effiyanti, T., & Sagala, G. H. (2018). Technostress among teachers: a confirmation of its stressors and antecedent. International Journal of Education Economics and Development, 9(2), Article 92197, 134–148. https://doi.org/10.1504/IJEED.2018.092197

Efilti, E., & Naci Çoklar, A. (2019). Teachers' technostress levels as an indicator of their psychological capital levels. Universal Journal of Educational Research, 7(2), 413–421. https://doi.org/10.13189/ujer.2019.070214

Fernández-Batanero, J.-M., Román-Graván, P., Reyes-Rebollo, M.-M., & Montenegro-Rueda, M. (2021). Impact of Educational Technology on Teacher Stress and Anxiety: A Literature Review. International Journal of Environmental Research and Public Health, 18(2). https://doi.org/10.3390/ijerph18020548

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Duckworth, D. (2020). Preparing for Life in a Digital World: Iea International Computer and Information Literacy Study 2018 International Report (1st ed. 2020). Springer eBook Collection. Springer International Publishing; Imprint Springer. https://doi.org/10.1007/978-3-030-38781-5

Hassan, N., Yaakob, S. A., Halif, M. M., Aziz, R. A., Majid, A. A., & Sumardi, N. A. (2019). The effects of technostress creators and organizational commitment among school teachers. Asian Journal of University Education, 15(3), 92-102. https://doi.org/10.24191/ajue.v15i3.7563

Hill, N. S., Axtell, C., Raghuram, S., & Nurmi, N. (2024). Unpacking Virtual Work's Dual Effects on Employee Well-Being: An Integrative Review and Future Research Agenda. Journal of Management, 50(2), 752–792. https://doi.org/10.1177/01492063221131535

Joo, Y. J., Lim, K. Y., & Kim, N. H. (2016). The effects of secondary teachers' technostress on the intention to use technology in South Korea. Computers & Education, 95, 114–122. https://doi.org/10.1016/j.compedu.2015.12.004

Kane, M. A., & Trochim, W. M. K. (2007). Concept mapping for planning and evaluation. SAGE Publications Inc.

Kultusministerkonferenz. (2016). Bildung in der digitalen Welt: Strategie der Kultusministerkonferenz. Kultusministerkonferenz. https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2017/Strategie_neu_2017_datum_1.pdf

Kuusimäki, A.-M., Uusitalo-Malmivaara, L., & Tirri, K. (2019). The role of digital school-home communication in teacher well-being. Front. Psychol., 10, Article 2257. https://doi.org/10.3389/fpsyg.2019.02257

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. Springer Publishing Company. http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10265641

Mäkiniemi, J.-P. (2022). Digitalisation and work well-being: a qualitative study of techno-work engagement experiences related to the use of educational technology. International Journal of Educational Management, 36(2), 152–163. https://doi.org/10.1108/IJEM-07-2021-0276

Mäkiniemi, J.-P., Ahola, S., & Joensuu, J. (2020). A Novel Construct To Measure Employees' Technology-Related Experiences of Well-Being: Empirical Validation of the Techno-Work

Engagement Scale (TechnoWES). Scandinavian Journal of Work and Organizational Psychology, 5(1), Article 4. https://doi.org/10.16993/sjwop.79

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.91.7990

Moreira-Fontán, E., García-Señorán, M., Conde-Rodríguez, Á., & González, A. (2019). Teachers' ICT-related self-efficacy, job resources, and positive emotions: Their structural relations with autonomous motivation and work engagement. Computers & Education, 134, 63–77. https://doi.org/10.1016/j.compedu.2019.02.007

Mußmann, F., Hardwig, T., Riethmüller, M., & Klötzer, S. (2021). Digitalisierung im Schulsystem 2021: Arbeitszeit, Arbeitsbedingungen, Rahmenbedingungen und Perspektiven von Lehrkräften in Deutschland. Kooperationsstelle Hochschulen und Gewerkschaften der Georg-August-Universität Göttingen. https://www.gew.de/fileadmin/media/sonstige_downloads/hv/Service/Presse/2021/2021-09-29-STUDIE-Digitalisierung-im-Schulsystem-2021-Gesamtbericht-web.pdf https://doi.org/10.3249/ugoe-publ-10

Nimrod, G. (2018). Technostress: Measuring a new threat to well-being in later life. Aging & Mental Health, 22(8), 1080–1087. https://doi.org/10.1080/13607863.2017.1334037

Özgür, H. (2020). Relationships between teachers' technostress, technological pedagogical content knowledge (TPACK), school support and demographic variables: a structural equation modeling. Computers in Human Behavior, 112, Article 106468. https://doi.org/10.1016/j.chb.2020.106468

Pablos-Pons, J. de, Colás-Bravo, P., González-Ramírez, T., & Del Camacho Martínez-Vara Rey, C. (2013). Teacher well-being and innovation with information and communication technologies; proposal for a structural model. Quality & Quantity, 47(5), 2755–2767. https://doi.org/10.1007/s11135-012-9686-3

Park, J.-C., Kim, S., & Lee, H. (2020). Effect of work-related smartphone use after work on job burnout: moderating effect of social support and organizational politics. Computers in Human Behavior, 105, 106194. https://doi.org/10.1016/j.chb.2019.106194

Passey, D. (2021). Digital technologies – and teacher wellbeing? Educ. Sci., 11, 11030117. https://doi.org/10.3390/educsci11030117

R Core Team. (2022). R: A language and environment for statistical computing [Computer software]. R Foundation for Statistical Computing. https://www.r-project.org

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(4), 417–433. https://doi.org/10.1287/isre.1070.0165

Redecker, C., & Punie, Y. (2017). European Framework for the Digital Competence of Educators. https://op.europa.eu/en/publication-detail/-/publication/fcc33b68-d581-11e7-a5b9-01aa75ed71a1/language-en

Rosas, S. R., & Kane, M. (2012). Quality and rigor of the concept mapping methodology: A pooled study analysis. Evaluation and Program Planning, 35(2), 236–245. https://doi.org/10.1016/j.evalprogplan.2011.10.003

Schaufeli, W. B. (2017). Applying the Job Demands-Resources model. Organizational Dynamics, 46(2), 120–132. https://doi.org/10.1016/j.orgdyn.2017.04.008

Schleicher, A. (2016). Teaching Excellence through Professional Learning and Policy Reform. OECD. https://doi.org/10.1787/9789264252059-en

Stan, R. (2022). Personality traits, technology-related teaching skills, and coping mechanisms as antecedents of teachers' job-related affective well-being and burnout in compulsory and higher education online teaching settings. Front. Psychol., 13, Article 792642. https://doi.org/10.3389/fpsyg.2022.792642

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, 96–109. https://doi.org/10.7577/seminar.2281

Tarafdar, M., Gupta, A., & Turel, O. (2013). The dark side of information technology use. Information Systems Journal, 23(3), 269–275. https://doi.org/10.1111/isj.12015

Tarafdar, M., Pullins, E. B., & Ragu-Nathan, T. S. (2015). Technostress: negative effect on performance and possible mitigations. Information Systems Journal, 25(2), 103–132. https://doi.org/10.1111/isj.12042

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. https://doi.org/10.2753/MIS0742-1222240109

ter Hoeven, C. L., & van Zoonen, W. (2015). Flexible work designs and employee well-being: examining the effects of resources and demands. New Technology, Work and Employment, 30(3), 237–255. https://doi.org/10.1111/ntwe.12052

Trochim, W. M. K. (1989). An introduction to concept mapping for planning and evaluation. Evaluation and Program Planning, 12, 1–16. https://doi.org/10.1016/0149-7189(89)90016-5

Trochim, W. M. K. (1993). The Reliability of Concept Mapping: Paper presented at the annual conference of the American Evaluation Association, Dallas, Texas, November 6, 1993 [Paper presented at the Annual Conference of the American Evaluation Association, Dallas, Texas, November 6, 1993]. http://www.billtrochim.net/research/Reliable/reliable.htm

Voogt, J., & Knezek, G. (2018). Rethinking Learning in a Digital Age: Outcomes from EDUsummIT 2017. Technology, Knowledge and Learning, 23(3), 369–375. https://doi.org/10.1007/s10758-018-9383-y

Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2007). The role of personal resources in the job demands-resources model. International Journal of Stress Management, 14(2), 121–141. https://doi.org/10.1037/1072-5245.14.2.121

Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2009). Reciprocal relationships between job resources, personal resources, and work engagement. Journal of Vocational Behavior, 74(3), 235–244. https://doi.org/10.1016/j.jvb.2008.11.003