Technology use and employee well-being among teachers during Covid-19: moderating effects of school support and detachment from work

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Abstract

Purpose – This study examined whether job and personal resources could buffer the negative effects of technostrain and information and communication technology (ICT) availability demands on employee well-being.

Design/methodology/approach – The data were collected among Finnish comprehensive school teachers ($n = 323$) between December 2020 and February 2021 through an online questionnaire. Hierarchical multiple regression analyses were employed to analyse the main and moderating effects.

Findings – The results indicated that technostrain was positively associated with burnout and negatively associated with work engagement. These associations were stronger than those of ICT availability demands. The moderated regression analyses revealed that psychological detachment buffered the negative effects of technostrain on cynicism and a sense of inadequacy. School support acted as a moderator by buffering the negative impact of technostrain on emotional exhaustion and cynicism. Furthermore, school support was found to be an important job resource in terms of boosting work engagement when ICT availability demands were high.

Originality/value – This study provides insights into the role of resources in buffering possible burdening effects of technology on teacher well-being when adopting online teaching in the context of the Covid-19 pandemic.

Keywords Teacher, Burnout, Work engagement, Employee well-being, Technostress,
ICT availability demands

Paper type Research paper

Introduction

Increased educational technology use caused by the Covid-19 pandemic produced wide-ranging changes in teachers' working conditions. In Finland, the Covid-19 situation and restrictions were relatively mild compared to most countries. However, due to government-imposed restrictions on schools in the early pandemic stages, most teachers had to work remotely in spring 2020, rapidly adopt online teaching and align technology with their pedagogical practices, thereby affecting the way they taught and communicated with pupils, parents and colleagues (König *et al.*, 2020). This rapid adoption of technology may have

affected employee well-being, as indicated by increased teacher burnout during the pandemic (Lavonen and Salmela-Aro, 2022). In Finland, schools were required to provide adequate equipment, software, instructions and assistance to teachers and pupils, but schools were not always able to meet this need (Bordi and Nuutinen, 2023). Although teachers and pupils in Finland have relatively high digital competences (Lavonen and Salmela-Aro, 2022), it may not have been enough to maintain employee well-being if school support for technology-mediated teaching was lacking.

Finding suitable ways to implement technology is important, as heavy use of educational technology during the pandemic made teachers more prone to high levels of anxiety and stress (Lizana and Lera, 2022). For primary school teachers, the Covid-19 pandemic meant a transition to employ educational technology more intensively. Thus, teachers faced more challenges in technology use, and consequent feelings of technostrain (i.e. negative feelings due to technology use) were more prevalent (Chou and Chou, 2021; Wang *et al.*, 2023). Therefore, increased reliance on technology may have negative implications in terms of growing technology-related demands that exceed an individual's available resources (Tarafdar *et al.*, 2007).

In this study, information and communication technology (ICT)-related job demands, namely technostrain and ICT availability demands, represented technology-related factors at work that employees considered stressful and that required physical and/or psychological efforts (Day *et al.*, 2010). Generally, technostrain is defined as a negative psychological state following the use of information systems (IS) in an organizational context (Tarafdar *et al.*, 2015). Therefore, at the heart of technostrain lie individuals' negative feelings stemming from situations where technology is considered to impede efficient job performance. ICT availability demands manifest when individuals experience the need to be available through ICT during nonwork times (Day *et al.*, 2010).

The negative impact of technology use can be reduced by supportive organizational ICT practices, such as technical support, literacy facilitation and involvement in IS initiations (Ragu-Nathan *et al.*, 2008). However, concentrating on technical support may be too restrictive, as studies have revealed the importance of the larger organizational culture (Tarafdar *et al.*, 2015), social support (Joo *et al.*, 2016) and personal resources (e.g. technology self-efficacy) (Ma *et al.*, 2021) as essential factors buffering technostress. Most studies have treated technostrain as a result of technostressors (e.g. techno-overload), paying less attention to broader conditions that could help manage negative feelings induced by technology use.

This study aimed to investigate whether teachers' perceptions of school support and detachment from work helped prevent potentially harmful effects of technology use on well-being. Detachment as a resource refers to the ability to disengage from work-related actions and thoughts during leisure time (Sonnentag and Fritz, 2007; Sonnentag *et al.*, 2013). School support refers to guidance and structures schools provide to support teachers' abilities and competencies to use technology in teaching (see, e.g. Dong *et al.*, 2020; Özgür, 2020). School support may include technical aspects, such as infrastructure and technical support, and social aspects, such as collaborative practices and support from managers and colleagues (see, e.g. Dong *et al.*, 2020; Özgür, 2020).

Considering increased technology use, teachers may need a supportive work environment to be capable of integrating technology into students' learning and buffer possible negative consequences of technology use on their well-being (Schildkamp *et al.*, 2020). By concentrating on resources, it may be possible to design a working environment that prevents adverse effects of technology. Considering the extensive negative consequences of technostress on employees' behaviours and attitudes, it is crucial to gain a deeper knowledge of the role of job and personal resources in supporting employee well-being when using technology (Ragu-Nathan *et al.*, 2008).

ICT availability demands and technostrain as job demands

The job demands–resources (JD–R) model is acknowledged as a suitable framework for examining technology-related work characteristics (Marsh *et al.*, 2022). Job demands refer to a job's physical, psychological, social and organizational aspects that require psychological and physical effort. Job resources refer to job-related factors that facilitate individuals' goal achievements (Bakker and Demerouti, 2007). More specifically, job demands are divided into challenge and hindrance demands. Challenge demands are job aspects that elicit problem-solving that can promote learning and achievement, whereas hindrance demands inhibit personal growth and goal attainment (Crawford *et al.*, 2010).

The concept of technostrain, a hindrance demand, refers to feelings of anxiety, fatigue, scepticism and inefficacy induced by technology use (Salanova *et al.*, 2013). Anxiety is characterized by experiences of ICT-induced discomfort and tension (Berger *et al.*, 2016). While anxiety is an experience of heightened activation, technostrain can also manifest as reduced levels of psychological activation, namely ICT-induced fatigue and exhaustion (Salanova *et al.*, 2013). Scepticism is described as a distant and indifferent attitude towards ICT use (Salanova *et al.*, 2013), which can be seen as a coping method of cognitive distancing when ICT is perceived as too burdensome (Berger *et al.*, 2016). Inefficacy refers to difficulties in using ICT due to a reduced sense of ICT-related efficacy and, as such, to the cognitive dimension (Salanova *et al.*, 2013; Berger *et al.*, 2016).

ICT availability demands refer to the extent to which employees are expected to be available and respond to work-related requests through ICT, especially during nonwork time (Day *et al.*, 2010). Employing various technologies, employees can stay connected to their work outside regular working hours (Ter Hoeven *et al.*, 2016). We consider ICT availability demands a hindrance, since most studies emphasize the negative implications of constant availability for employee well-being and work–family balance (Dettmers, 2017). We acknowledge that availability demands partly overlap with challenge demands (Baumeister *et al.*, 2021), as ICT may provide employees with greater autonomy to organize their own work.

Technology use and employee well-being

Based on the JD-R model, job demands adversely affect employee well-being (Bakker and Demerouti, 2007). To indicate employee well-being, we conceptualize work engagement and burnout, which are considered separate but related constructs (Schaufeli *et al.*, 2002). Schaufeli *et al.* (2002, p. 74) describe work engagement as a "positive, fulfilling, work-related state of mind that is characterized by vigour, dedication and absorption". They define work engagement as entailing high energy, enthusiasm, pride in one's work and intense concentration. Conversely, burnout is generally defined as a negative manifestation of employee well-being, characterized as mental and physical exhaustion comprising emotional exhaustion, cynicism and decreased efficacy (Maslach and Leiter, 2008).

Scholars have found that employees with greater availability expectations outside their working hours report higher burnout and difficulties in recovery (Baumeister *et al.*, 2021; Van Laethem *et al.*, 2018). At the heart of ICT availability demands lie employees' experiences of expectations to monitor work-related communication outside working hours (Dettmers, 2017). In practice, this places additional demands on employees, as they are tied to their work, which may deplete their resources (Park *et al.*, 2011). Constant absorption in work through technology outside working hours may diminish positive feelings towards work in terms of lower work engagement (Vayre and Vonthron, 2019).

When employees experience technostrain they may be overwhelmed and experience higher burnout and lower work engagement. Technostrain may expose employees to perceiving technology as weakening their efficiency, resulting in negative implications for

employee well-being (Ter Hoeven *et al.*, 2016). Borle *et al.*'s (2021) meta-analysis revealed the detrimental effect of technostressors on job performance, job satisfaction and burnout. However, prior research largely concerns the impacts of technostressors (i.e. the circumstances and conditions giving rise to technostrain) on employee well-being, neglecting affective aspects of ICT use. Thus, we referred to research that demonstrates the role of negative emotions as a source of lower work engagement (Burić and Macuka, 2018) and higher burnout (Genoud and Waroux, 2021), expecting technostrain to have a parallel negative association with work engagement and a positive connection to burnout.

H1. ICT-related job demands, namely technostrain and ICT availability demands, are positively related to burnout and negatively related to work engagement.

Detachment from work and school support as potential buffering factors

According to the JD-R model, various job and personal resources may protect against the negative effects of job demands on employee well-being and related physiological and psychological costs (Bakker and Demerouti, 2007). In this study, we define detachment from work as a personal resource and school support as a job resource. We suggest they may serve as potential buffering factors against the negative effects of technostrain and ICT availability demands on burnout and work engagement.

Detachment as a personal resource

The Covid-19 pandemic caused rapid changes in ways of working (e.g. the transition to remote teaching) and led to uncertainty, highlighting the importance of employees' ability to recover from job-related demands. According to the JD-R model, employees use personal resources, such as self-efficacy, to deal with excessive job demands and strive for work-related goals (Bakker and Demerouti, 2007). Especially for teachers, remote work and rapid adoption of online teaching may emphasize the importance of mentally switching off from work.

Detachment is considered an important factor in recovery from work (Sonnentag and Fritz, 2007), as it means employees can mentally disconnect from their work in nonwork times (Sonnentag, 2012). In practice, this encompasses two separate but intertwined aspects: withdrawing from job-related activities (e.g. not checking work-related emails) and trying to avoid thinking about job-related problems outside work (Sonnentag, 2012).

In the stressor-detachment model, detachment from work is both a mediator and a moderator (Sonnentag and Fritz, 2015). Perceiving detachment as a mediator suggests that job demands lead to detachment difficulties, making employees more vulnerable to impaired well-being. Regarding ICT-related job demands, evidence suggests that, due to extended work times (i.e. being available and working through ICT in nonwork times), employees find it difficult to switch off mentally (Park *et al.*, 2011). For instance, employees who used their smartphones for work-related purposes during their leisure time experienced more difficulties detaching from work (Van Laethem *et al.*, 2018). This could be because engagement in work-related activities during nonwork hours is negatively associated with psychological detachment (Wendsche and Lohmann-Haislah, 2017).

A meta-analysis by Wendsche and Lohmann-Haislah (2017) found detachment to be associated with positive well-being outcomes, such as lower levels of exhaustion and fatigue, higher levels of perceived life satisfaction and well-being and better sleep and recovery. In terms of the antecedents of detachment, job demands (e.g. quantitative, social and emotional) were negatively associated with detachment, and job resources, such as job control and social support, were positively associated with detachment. In addition, individual characteristics, such as neuroticism and the tendency to be highly invested in one's work, may also hinder detachment (Wendsche and Lohmann-Haislah, 2017.)

Detachment as a moderator suggests that detachment buffers the impact of job demands on strain (Sonnentag and Fritz, 2015). Regarding ICT-related demands, employees' ability to withdraw mentally from work-related activities may protect them from harmful well-being consequences. For instance, according to the extent to which smartphone users could engage in behaviours promoting detachment from work, the more positively they viewed the fluency of the work–home interface (Derks and Bakker, 2014). Thus, ICT-related job demands (i.e. technostrain and ICT availability demands) may increase the need to restore psychological resources, when detachment may act as a protective factor.

A meta-analysis by Rohwer *et al.* (2022) found that employees with high levels of technostrain who reported more coping strategies had less difficulties in mentally switching off from their work during leisure time. Thus, detachment may help employees tackle the pressures of being available through ICT and decrease job demands by offering a break and alleviating negative feelings associated with ICT use (Sonnentag and Fritz, 2007). Similarly, research has demonstrated that detachment from work buffers the negative impact of workplace conflict on well-being (Sonnentag *et al.*, 2013), while Sonnentag and Binnewies (2013) observed that employees with higher psychological detachment suffer less from the harmful impacts of work-related negative emotions.

Hence, we hypothesize the following:

H2a. Detachment from work acts as a moderator against the negative effects of technostrain on burnout and work engagement.

H2b. Detachment from work acts as a moderator against the negative effects of ICT availability demands on burnout and work engagement.

School support as a job resource

Due to the Covid-19 pandemic, teachers were compelled to adopt online teaching, resulting in new demands to manage pedagogical practices with technological tools. Thus, unsurprisingly, organizational support became essential during the pandemic regarding employee well-being (Trinidad, 2021). Extra efforts were required from teachers to adjust pedagogical content to online teaching requirements, underlining the importance of school-provided guidance and organization in demanding circumstances.

School support can be conceptualized as technical support, peer support to help colleagues and organizational support in terms of providing guidance to organize work and facilitate educational technology use (Dong *et al.*, 2020). Herein, school support refers to how teachers' work was coordinated during the Covid-19 pandemic, based on Lam *et al.* (2010), who use the term to refer to the extent to which teachers consider that their schools provide guidance and structures to support teachers' competencies in carrying out project-based learning. In the pandemic context, school support included directions and guidelines on how to carry out ICT-mediated teaching. Support and satisfaction with organizational decisions can play a major role during crises in determining employee well-being (Trinidad, 2021). In this study, school support refers to support and guidance for carrying out work tasks and consideration of workload and time management during the pandemic.

A study of Chinese primary school teachers during the Covid-19 pandemic found that technology intensity had a less harmful effect on teachers' health and work–family conflict when teachers reported receiving more support from their school (Wang *et al.*, 2023). School support is also key in enhancing teachers' technology skills, and teachers with high technical competence were found to be more successful in online teaching during the Covid-19 pandemic (Kapuza *et al.*, 2022). Consequently, school support may cultivate teacher self-efficacy in managing online teaching requirements. For instance, organizational communication is seen as functional in alleviating the effects of technostress by enhancing self-efficacy (Zito *et al.*, 2021).

A meta-analysis by Rohwer *et al.* (2022) notes the importance of organizational support: organizational policies concerning work-related technology use during nonwork hours can help employees recover from their work. Thus, a work-related ICT culture may determine whether employees are able to switch off or perceive pressure to work during their leisure time. Dettmers *et al.* (2016) found that control over job contacts, predictability and equipment adequacy were essential job resources in mitigating the adverse effects of availability demands on employee well-being. Prior studies indicate that during the pandemic, individual teachers had significant responsibility for ICT adoption (Bordi and Nuutinen, 2023) and that experiencing online teaching preparation as burdensome could disturb the work–family life balance (Wang *et al.*, 2023).

In summary, school support can act as a valuable resource for alleviating technostress (Özgür, 2020). In line with this, teachers have found external factors, such as poor equipment and a lack of instructions, to be barriers to online teaching (Kapuza *et al.*, 2022). Overall, in addition to technical support, management and colleagues also play a significant role (e.g. by offering help and guidance and serving as role models) in reducing technostress (Joo *et al.*, 2016). Thus, aligning technology with pedagogical practices might be facilitated by communication with colleagues and broader factors such as supervisor support and organizational policies. Likewise, a study of university lecturers indicated that those who avoided using technology for educational purposes found institutional support less useful (Kaqinari *et al.*, 2022). Based on prior findings, we hypothesize the following:

> *H3a.* School support acts as a moderator against the negative effects of technostrain on burnout and work engagement.

> *H3b.* School support acts as a moderator against the negative effects of ICT availability demands on burnout and work engagement.

Method

Participants and procedure

This study was part of a larger research project. Data were collected between December 2020 and February 2021 through an online questionnaire employing Microsoft Forms. A survey link and a privacy notice containing information about the study's purpose were sent to comprehensive schoolteachers working for the City of Tampere through the schools' information-sharing platform Wilma. We received 361 responses, of which 38 nonteacher responses were excluded, resulting in 323 responses (28% response rate). The respondents' mean age was 47.7 years (standard deviation [SD] = 9.1). Most were women ($n = 275$, 85%), and their prior teaching experience averaged 19.6 years (SD = 9.4). Most respondents ($n = 167$, 52%) were primary schoolteachers (grades 1–6), 30% were upper comprehensive schoolteachers (grades 7–9), and the remaining 19% taught in both.

At the beginning of the pandemic (spring 2020), schools in Finland adopted remote learning for two months. During the data collection period, teachers were back in school after the government-ordered school closure. However, they still provided remote and hybrid teaching when needed due to locally-issued quarantines.

Of the respondents, 82% reported working only remotely, 4% only in schools and the rest in both scenarios during spring 2020. After spring 2020 (the period covered by the questionnaire), the teachers worked primarily in schools and taught in classrooms and in a hybrid manner.

Measures

The study's survey included six scales (27 items in total) that measured job demands (ICT availability demands and technostrain), job resources (detachment from work and school support) and factors related to well-being (work engagement and burnout).

Well-being indicators
Work engagement was measured using the three-item Utrecht Work Engagement Scale (UWES-3) (Schaufeli *et al.*, 2017). Each item covering the following: vigour (energy, resilience and persistence in one's work), dedication (experiences of significance, enthusiasm, inspiration, pride and challenges) and absorption (full concentration and absorption) (Schaufeli *et al.*, 2002). The scale comprises the following items measured with a seven-point Likert scale (0 = never, 6 = every day) (Schaufeli *et al.*, 2017): (1) "At my work, I feel bursting with energy", (2) "I am enthusiastic about my job" and (3) "I am immersed in my work". To measure work engagement. Cronbach's alpha was 0.82.

Burnout was measured with the nine-item Bergen Burnout Inventory (BBI-9), covering emotional exhaustion, cynicism and a sense of inadequacy, each measured with three items (Feldt *et al.*, 2014; Salmela-Aro *et al.*, 2011). For example, *emotional exhaustion* includes "I am snowed under with work", *cynicism* was measured with "I feel dispirited at work and I think of leaving my job", and *inadequacy* encompassed "I frequently question the value of my work". The items were scored on a six-point rating scale (1 = completely disagree, 6 = completely agree). The Cronbach's alphas of the three ranged from 0.75 to 0.84.

ICT-related job demands
ICT availability demands were measured with a slightly modified version of Day *et al.*'s (2012) ICT Demand Scale's response expectations and availability components (four items) (Cronbach's alpha = 0.88). A sample item is "I am expected to be accessible at all times (e.g. through cell phone, e-mail, instant messaging)". *Technostrain* was measured with four items covering experiences of anxiety, fatigue, scepticism and inefficacy in ICT use, such as "It is difficult for me to relax after a day's work using ICT", and it had a Cronbach's alpha of 0.82 (Salanova *et al.*, 2013).

Moderators
Detachment from work was measured using the three-item Detachment Scale (Sonnentag and Fritz, 2007), including, for example, "I didn't think about work at all", with a Cronbach's alpha of 0.87. *School support* was measured with three items based on Lam *et al.*'s (2010) *competence support* component of *perceived school support*. As the original items were developed to measure school support for project-based learning, in this study, the items were modified to measure school support during the Covid-19 pandemic (e.g. "My school provided sufficient guidance to us on how to implement teaching during the Covid-19 pandemic"). Cronbach's alpha was 0.77.

ICT availability demands, technostrain, detachment from work and school support were all measured with a five-point Likert scale (1 = completely disagree to 5 = completely agree).

Data analysis
Moderated regression analysis was conducted to analyse the direct and interaction effects of ICT-induced job demands and the two moderators (detachment and school support) on the well-being indicators. All the variables were standardized, and the interaction terms based on standardized scores were calculated to avoid multicollinearity (Anguinis and Gottfredson, 2010).

We performed hierarchical multiple regression for each dependent variable using the following procedure: (1) control variables (gender, age and job role) were entered; (2) ICT-related job demands were included; (3) job/personal resources (detachment or school support) were introduced; and finally, (4) the interaction terms of each ICT-related job demand with job resources (technostrain × detachment, ICT availability demands × detachment,

technostrain × school support and ICT availability demands × school support) were calculated. Because job role was a three-level categorical variable, comprising primary school teachers, upper comprehensive school teachers and teachers in both grades, dummy coding was used, with teachers in both grades as the reference group.

As we conducted separate regression analyses for detachment and school support, eight regression models were computed. The magnitude of the change in R^2 during each successive step of the analysis was used to delineate the variance explained by each set of variables. Lastly, if an interaction term was statistically significant, the results were plotted to examine the pattern of the relationship more carefully. The simple slope analyses recommended by Aiken and West (1991) were performed to test the significance of the predictors of the outcome variable at different levels of (+ 1/− 1 SD) of the moderators. The interaction effect implies that a relationship is dependent on the values of another variable. Simple slope analysis is used to investigate interactions by testing the significance of the simple slopes of regression lines of single values of a second predictor. Consequently, simple slope analysis can be characterized as the conditional effect of the focal predictor at different values of the moderator (Anguinis and Gottfredson, 2010). The analyses were conducted using SPSS Statistics Version 27.

Results
Descriptive results
Table 1 presents the study variables descriptive statistics and intercorrelations. Technostrain correlated positively with all the burnout components ($0.42 \leq r \leq 0.45$, $p < 0.001$) and negatively with work engagement ($r = -0.29$, $p < 0.001$). ICT availability demands correlated positively and statistically significantly with the burnout components ($0.26 \leq r \leq 0.39$, $p < 0.001$) but were not significantly associated with work engagement. As expected, ICT-related job demands were more strongly correlated with burnout components than with work engagement. All the burnout components were highly positively correlated with each other ($0.52 \leq r \leq 0.78$, $p < 0.001$) and negatively associated with work engagement ($-0.22 \leq r \leq -0.55$, $p < 0.001$). However, no correlation exceeded the 0.85 threshold, which indicates that the constructs are adequately distinct from each other (Hair *et al.*, 2010). Regarding the control variables, the women reported fewer ICT availability demands ($r = -0.12$, $p = 0.031$), less cynicism ($r = -0.12$, $p = 0.036$), a lower sense of inadequacy ($r = -0.11$, $p = 0.033$) and more work engagement ($r = 0.15$, $p = 0.006$) than the men.

Regression analysis results
Table 2 (detachment) and Table 3 (school support) present the regression analysis results. After controlling for demographics, entering the ICT-related job demands provided partial support for the hypothesized main effects (H1). As expected, technostrain was positively associated with all the burnout components (the beta coefficients varied between 0.29 and 0.39, $p < 0.001$) and negatively with work engagement (beta coefficient − 0.27 and − 0.32, $p < 0.001$). ICT availability demands predicted higher levels of a sense of inadequacy (beta coefficients between 0.16, $p = 0.003$ and 0.18, $p = 0.001$) and emotional exhaustion (beta coefficients between 0.19 and 0.28, $p < 0.001$). Together, these two ICT-related job demands explained 30% of the variance in emotional exhaustion, 21% of the variance in cynicism and 23% of the variance in a sense of inadequacy. When work engagement served as a dependent variable in the equation, ICT-related job demands explained only 9% of the variation.

The interaction effect between technostrain and detachment from work was found to be significant in two of the four models, suggesting that detachment moderated the effects of technostrain on cynicism ($\beta = -0.13$, $p = 0.005$) and a sense of inadequacy ($\beta = -0.16$,

Descriptive statistics and correlations

Variables	Mean/%	SD	1	2	3	4	5	6	7	8	9	10
1. Gender[a]	85.0[b]											
2. Age	47.74	1.32	– 0.04									
3. Technostrain	3.11	0.95	0.01	0.09	-							
4. ICT availability demands	3.65	1.04	– 0.12*	0.09	0.27***	-						
5. School support	3.08	0.87	0.05	– 0.05	– 0.36***	– 0.34***	–					
6. Detachment from work	2.32	0.98	– 0.10	– 0.04	– 0.32***	– 0.37***	0.23***	–				
7. Emotional exhaustion	3.64	1.18	0.07	– 0.08	0.45***	0.39***	– 0.37***	– 0.57***	–			
8. Cynicism	2.80	1.22	– 0.12*	– 0.05	0.43***	0.26***	– 0.37***	– 0.30***	0.57***	–		
9. Sense of inadequacy	3.12	1.29	– 0.11*	– 0.04	0.42***	0.32***	– 0.43***	– 0.28***	0.52***	0.78***	-	
10. Work engagement	4.50	1.32	0.15**	0.10	– 0.29***	– 0.05	0.23***	0.12*	– 0.22***	– 0.55***	– 0.50***	-

Note(s): [a]Gender: 0 = other than women, 1 = women. [b]% of women. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$
Source(s): Created by authors

Table 1.
Means, standard
deviations and
correlations between
variables

Table 2.
Results of the
moderated regression
analysis for
detachment

Independent variables	Cynicism		Sense of inadequacy		Emotional exhaustion		Work engagement	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1: Demographic variables	0.02		0.01		0.01		0.03**	
Age		− 0.10		− 0.10*		− 0.11*		0.13*
Gender		− 0.12*		−0.10		0.05		0.15**
Job role[a] (Dummy 1 vs Dummy 3)		0.09		0.07		0.04		− 0.05
Job role[a] (Dummy 2 vs Dummy 3)		0.12		0.08		−0.03		− 0.10
Step 2: ICT-related job demands	0.21***		0.23***		0.30***		0.09***	
Technostrain		0.39**		0.38***		0.29***		− 0.32***
ICT availability demands		0.09		0.18***		0.19***		0.07
Step 3: Resource	0.02**		0.01*		0.13***		0.00	
Detachment from work		− 0.20***		− 0.15**		− 0.42***		0.09
Step 4: Interactions	0.02**		0.03**		0.01		0.01	
Technostrain × Detachment from work		− 0.13**		− 0.17***		− 0.04		0.10
ICT availability demands × Detachment from work		− 0.04		− 0.02		− 0.07		0.03
R^2	0.27***		0.28***		0.45***		0.14***	
adjR^2	0.26***		0.26***		0.44***		0.12***	

Note(s): [a]Job role coded as 1 = primary school teacher (grades 1–6), 2 = upper comprehensive school teacher (grades 7–9), 3 = teacher in both grades, β = Standardized beta coefficients from the final step of the models, ΔR^2 = change in explanation rate in each step, R^2 = explanation rate. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Source(s): Created by authors

$p < 0.001$), thus partly supporting Hypothesis 2a (see Table 2). The graphical presentations of the interactions were obtained using the standardized regression coefficients of the regression lines for teachers with high (+ 1 SD above the mean) and low (− 1 SD below the mean) scores on the moderator variables. Simple slope analyses offered support for this interpretation: the positive relationship between technostrain and inadequacy was significant in teachers with both low detachment ($\beta = 0.58$, $p < 0.001$) and high detachment ($\beta = 0.23$, $p < 0.001$), but the relationship was stronger among the low detachment group (see Figure 1). The relationship between technostrain and cynicism pointed in the same direction, although the difference in strength was not verified by the level of statistical significance: $\beta = 0.56$, $p < 0.001$ in the teachers with low detachment and $\beta = 0.26$, $p < 0.001$ in the teachers with high detachment (see Figure 2). No relationship could be found for the interaction term between ICT availability demands and detachment; thus, Hypothesis 2b was not supported.
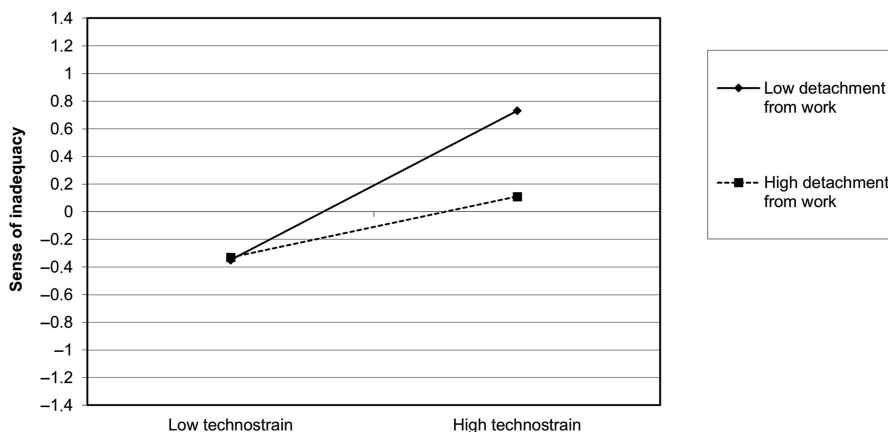
Hypothesis 3a was partly supported, as two of the four interaction terms between technostrain and school support were found to be significant, suggesting that school support moderated the effects of technostrain on emotional exhaustion ($\beta = − 0.15$, $p = 0.004$) and cynicism ($\beta = − 0.12$, $p = 0.023$). The simple slope analyses confirmed the differences: the negative standardized regression coefficients were higher for the teachers with low school support ($\beta = 0.48$ and 0.46, $p < 0.001$) compared to those with high school support ($\beta = 0.26$ and 0.24, $p < 0.001$) with regard

Independent variables	Cynicism		A sense of inadequacy		Emotional exhaustion		Work engagement	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1: Demographic variables	0.02		0.01		0.01		0.03**	
Age		−0.09		−0.10*		−0.15*		0.14**
Gender		−0.12*		−0.08		0.13*		0.13*
Job role[a] (Dummy 1 vs Dummy 3)		0.08		0.04		−0.01		−0.06
Job role[a] (Dummy 2 vs Dummy 3)		0.04		0.09		−0.11		−0.09
Step 2: ICT-related job demands	0.21***		0.23***		0.30***		0.09***	
Technostrain		0.35***		0.29***		0.34***		−0.27***
ICT availability demands		0.09		0.16**		0.28***		0.07
Step 3: Resource School support	0.04***		0.06***		0.03***		0.02**	
School support		−0.21***		−0.27***		−0.17***		0.15**
Step 4: Interactions	0.01		0.01		0.02**		0.03**	
Technostrain × School support		−0.12*		−0.05		−0.15**		0.08
ICT availability demands × School support		0.03		−0.04		−0.01		0.13*
R^2	0.28***		0.31***		0.36***		0.17***	
adjR^2	0.26***		0.30***		0.34***		0.15***	

Note(s): [a]Job role coded as 1 = primary school teacher (grades 1–6), 2 = upper comprehensive school teacher (grades 7–9), 3 = teacher in both grades, β = Standardized beta coefficients from the final step of the models, ΔR^2 = change in explanation rate in each step, R^2 = explanation rate. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Source(s): Created by authors

Table 3.
Results of the moderated regression analysis for school support

Source(s): Created by authors

Figure 1.
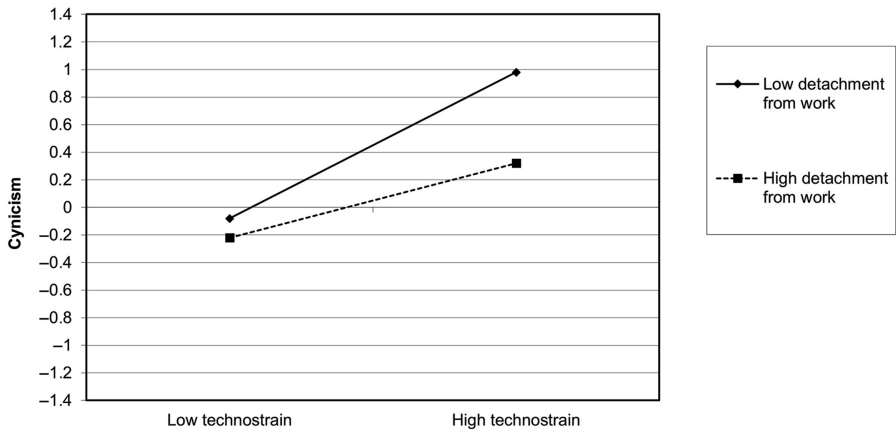Interaction plot for technostrain and detachment from work on inadequacy

Source(s): Created by authors

to emotional exhaustion and cynicism, respectively. Under conditions of high technostrain, teachers with low support from their schools reported more feelings of inadequacy and cynicism (Figures 3 and 4). The interaction term between ICT availability demands and school support was found to be significant in one of the four models, suggesting that school support moderated the effects of ICT availability on work engagement ($\beta = 0.13, p = 0.019$) but not on burnout. Figure 5 shows that under conditions of high ICT availability demands, the teachers perceiving school support reported more work engagement than teachers with low school support. A simple slope analysis indicated that the positive relationship between ICT availability demands and work engagement was only significant among teachers with higher school support ($\beta = 0.19, p = 0.016$ vs $\beta = -0.15, p = 0.077$, ns).

Discussion

This study examined how technostrain and ICT availability demands were associated with employee well-being during the Covid-19 pandemic, manifested as burnout and work
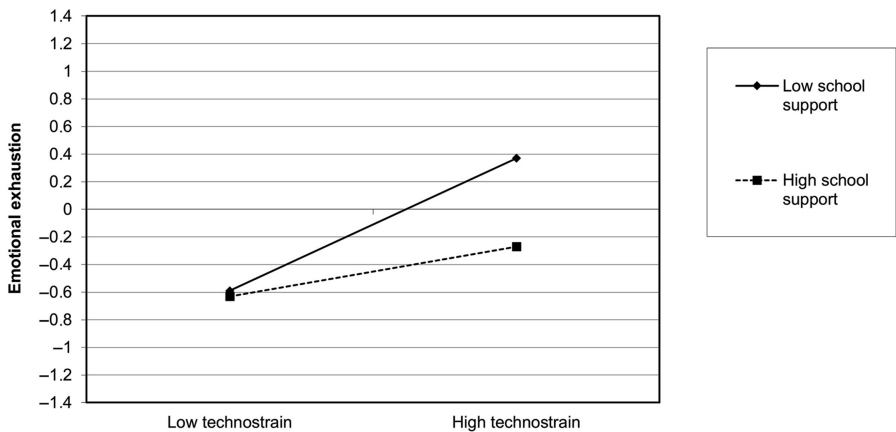
Source(s): Created by authors
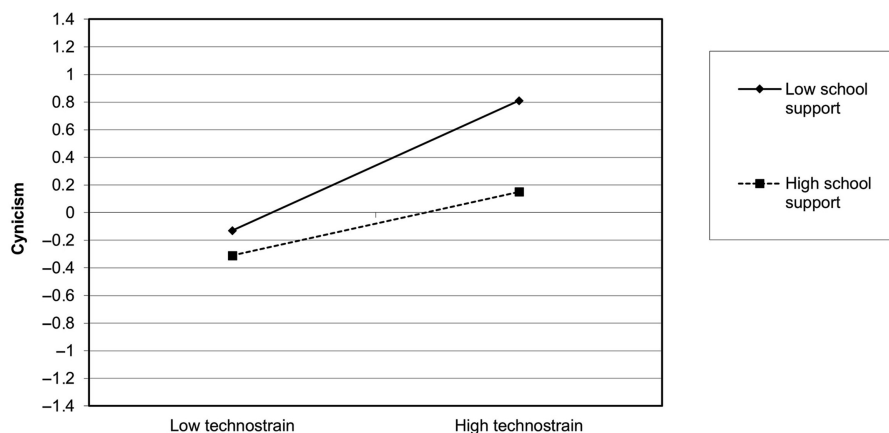
Source(s): Created by authors

Figure 4.
Interaction plot for
technostrain and
school support on
cynicism
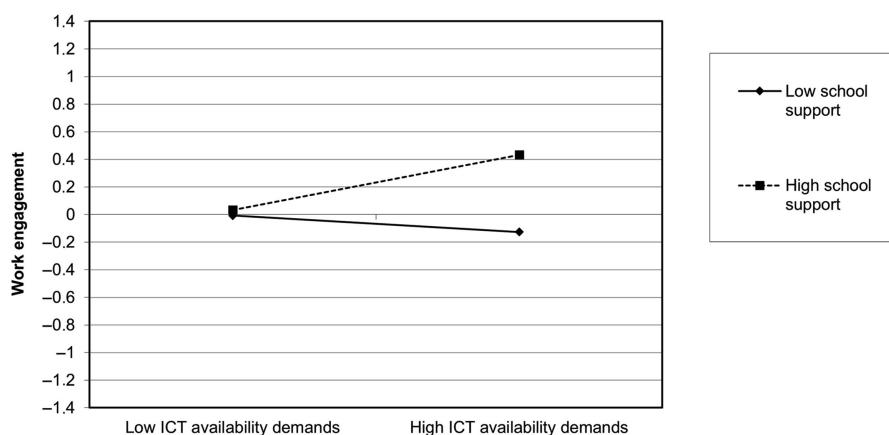
Source(s): Created by authors

Figure 5.
Interaction plot for ICT
availability demands
and school support on
work engagement

engagement among Finnish comprehensive school teachers. Furthermore, the moderating effects of school support as a job resource and detachment from work as a personal resource were investigated. This study contributes to the field by addressing the roles of job and personal resources in tackling the burdening effects of technology, as most studies focus on technology-related aspects of working conditions. In support of Hypothesis 1, technostrain had an adverse effect on burnout and work engagement, whereas ICT availability demands were positively associated with two components of burnout (emotional exhaustion and inadequacy). In line with the JD-R model, ICT-related job demands were more robustly related to the components of burnout than to work engagement.

The greater relative importance of technostrain could follow from the construal overlap between the burnout dimensions and technostrain. The scale adopted to measure technostrain is based on burnout constructs such as scepticism, inefficacy and fatigue (Salanova *et al.*, 2013). The correlations between technostrain and burnout dimensions were

moderate ($0.42 \leq r \leq 0.45$), indicating a mild construal overlap. However, understandably, negative feelings, such as those induced by technology use, were also related to experiences of overall burnout. This aligns with previous research showing that exhaustion due to technology use directly influences general work-related exhaustion (Maier *et al.*, 2015).

This study's findings indicate that ICT availability demands resemble hindrance demands with negative consequences for employee well-being more than challenge demands (i.e. demands increasing, for example, motivation). Possibly the Covid-19 pandemic, as a sudden disruption, highlighted the burdening aspects of ICT, as teachers were compelled to use technology to communicate with pupils and their parents, which may have caused a significant increase in teachers' digital communication. In essence, being available through ICT means longer workdays and difficulties in terms of recovery and consequent feelings of exhaustion (Park *et al.*, 2011). In turn, excessive workloads and prolonged working hours increase feelings of emotional exhaustion (Baeriswyl *et al.*, 2021), possibly explaining the positive association between availability expectations and exhaustion. A burdening aspect of availability expectations could also be explained by blurring the work-nonwork boundaries (Dettmers *et al.*, 2016), possibly exposing feelings of inadequacy.

Hypotheses 2a and 2b predicted that detachment would buffer the harmful effects of technostrain and ICT availability demands on employee well-being, respectively. The hypothesized moderating role of detachment in the relationship between technostrain and employee well-being (H2a) was partly supported. Teachers with high technostrain had less cynicism and inadequacy when engaging in behaviours cultivating detachment from work. A possible reason could be that detachment helps attenuate the duration of negative emotions (Sonnentag and Binnewies, 2013). Thus, teachers capable of mentally switching off from work might suffer less from negative emotional responses caused by ICT.

However, we did not find an interaction effect for ICT availability demands and detachment on employee well-being (H2b). Possibly, detachment may mediate between availability expectations and employee well-being, meaning that availability expectations expose employees to difficulties regarding detachment, in turn increasing feelings of burnout (Park *et al.*, 2011). A theoretical implication for the JD-R model could be that whether detachment serves as a job resource might depend on the nature of a specific ICT-related job demand. Interestingly, Wendsche and Lohmann-Haislah's (2017) meta-analysis found that qualitatively different types of job demands were all negatively associated with difficulties in detachment. Therefore, it could be that ICT availability demands translate into sustained work-related behaviours and thoughts during leisure time, impeding mental disengagement from work. Based on Rohwer *et al.*'s meta-analysis (2022), it is possible that coping strategies, such as asking for social support or distancing from ICT, may be needed for individuals to mentally disengage from work-related activities and thoughts. This study's findings are in line with the stressor-detachment model, which acknowledges the varying role of detachment as a moderator or mediator (Sonnentag and Fritz, 2015).

Hypothesis 3a was partly supported, as school support moderated the negative effect of technostrain on emotional exhaustion and cynicism. This aligns with Wang *et al.*'s (2023) findings, showing that school support buffered the negative effect of technostress on work–family conflict and health issues among primary school teachers during Covid-19. As an essential job-specific resource in the face of Covid-19, school support may reduce the extent to which teachers perceive external barriers (e.g. a lack of instructions) that prevent technology adoption (Kapuza *et al.*, 2022). The importance of school support could be due to teachers being more prone to negative feelings stemming from ICT use, as they had to rapidly engage in online teaching. It has been shown that teachers have more positive feelings towards technology when a positive climate and collaboration are provided (Mäkiniemi, 2022).

School support may prevent experiences of loneliness, which appeared to cause feelings of technostrain during the pandemic, as teachers were required to integrate technology into

teaching without adequate support (Bordi and Nuutinen, 2023). Support from school may manifest itself as better possibilities for developing digital competences without being left on one's own. Therefore, facilitating behaviours that promote knowledge-sharing and consequent development of teachers' expertise may foster digital skills mentioned as obstacles to adopting technology (Kapuza *et al.*, 2022).

Hypothesis 3b was partly supported, as school support moderated the association between ICT availability demands and work engagement but in an unexpected direction. School support appeared to boost the effect of ICT availability demands on work engagement, implying that teachers with high availability expectations had greater work engagement under conditions of higher school support. Thus, if school support is provided, availability expectations may have positive implications for work engagement. Based on the JD-R model, school support potentially acts as an essential job resource with respect to work engagement, producing possible positive aspects of availability expectations. Consequently, being available through ICT during nonwork times might help achieve work-related goals by increasing support from colleagues and providing flexible working methods not dependent on time and place. It could also be that, especially during the novel and unexpected Covid-19 pandemic situation, school support provision also meant increased communication. This might have expanded teachers' need to monitor communication channels but also, in turn, have provided teachers with relevant information and support regarding working practices during the pandemic.

Contrary to expectations, neither school support nor detachment buffered the negative effects of ICT availability demands on burnout. Instead of general school support for organizing work and providing guidance under Covid-19, more specific support in terms of shared practices in digital communication might be required to prevent the harmful effects of ICT availability demands on burnout. Such school-level practices could provide teachers with better possibilities for engaging in behaviours that sustain their preferences regarding the segmentation or integration of work and nonwork domains, which seem to play an important role (Maier *et al.*, 2015).

Limitations and directions for future research

This study has several limitations. First, due to the cross-sectional study design, causal inferences cannot be drawn regarding the relationships between the variables. It is possible that teachers with higher well-being initially viewed technology more positively and thereby perceived technology use as less burdensome. In the future, longitudinal study designs are needed to disentangle the relationships between technology use and employee well-being. Somewhat surprisingly, little evidence exists of how initial employee well-being level might define their later attitudes towards technology.

Second, our results may be affected by common method bias due to the self-report scales employed to measure the variables. To estimate the possible presence of common method bias, we performed Harman's single factor test (Podsakoff *et al.*, 2003), which is based on factor analysis. All the items were loaded onto a single factor in the factor analysis, revealing that the first factor accounted for 32% of the variance, which is below the recommended threshold of 50%. Third, our sample was somewhat limited, coming from only one Finnish city. The ways of organising teaching in schools during the Covid-19 pandemic varied worldwide and across regions limiting generalization. Fourth, an important limitation is that we were unable to identify individual respondents' schools and could not separate the effect of school-level factors, which have been found to play a role in the integration of ICT in teaching (Hsu and Kuan, 2013).

More in-depth knowledge is needed to identify conditions that help manage technostrain in schools, especially as technology is increasingly being integrated into pedagogical

practices. As detachment from work helps mitigate adverse effects of technostrain, more detailed knowledge of the factors conducive to detachment is needed. Furthermore, future studies could examine the functional nature and characteristics of school support and how these practices are negotiated among different stakeholders working in schools. Overall, future studies should pay attention to how availability demands and technostrain are associated with work engagement, which has not been studied as extensively as the relationship with burnout.

Practical implications

This study's findings support the burdening aspect of technostrain regarding employee well-being. Prior research acknowledges technological self-efficacy as an essential personal resource in reducing the harmful impact of technostressors on emotional exhaustion (Ma *et al.*, 2021). Thus, providing opportunities to cultivate technological competence through, for example, training programmes, is beneficial. Previous research indicated that teachers' digital competence played a major role when adopting online teaching during Covid-19 school closures (König *et al.*, 2020). Therefore, implementing technological practices with adequate support and learning timeframes could be important, not only to enable smooth digital transitions but perhaps also to support better possibilities for recovery.

To support employee well-being in digitalizing work, schools could also benefit from establishing clear coordination and assistance with online learning. This could take some burden off teachers, so they did not have to devise their own ways of organizing technology-mediated teaching. In conclusion, the development of organizational cultures that encourage knowledge-sharing regarding online teaching and support related to the ability to withdraw from work-related behaviours during leisure time is needed. Lastly, schools should consider not only digital aspects but also the broader organization of work and how it supports or hinders the possibilities for quality teaching and teacher well-being in the digitalizing work environment.

Although this study's results are limited to pandemic-induced situations and experiences, considering the rapid development of educational digital solutions and practices, the findings may also apply outside the pandemic context. Since teachers increasingly interact with pupils, pupils' parents and colleagues through digital communication channels, the risk of work spilling over into leisure time may be significant. This emphasizes schools' need to support teachers not only in technology use but also in detachment from work to enhance employee well-being.

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