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How are technology-related workplace resources associated with techno-work engagement among a group of Finnish teachers?

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Abstract

Teachers perceive the digitalisation of teaching not only as demanding but also as an inspiring aspect of their work. Prior studies have mainly focused on teachers' negative experiences, such as technostress. Therefore, the aim of the current study was to explore how technology-related workplace resources, such as technology-related self-efficacy and autonomy, predict teachers' positive well-being and techno-work engagement. Based on prior studies, it was hypothesised that three technology-related job resources are associated with higher techno-work engagement, and technology-related self-efficacy is associated with higher techno-work engagement. Data were collected from Finnish teachers and principals (N = 183) via a web-based questionnaire as part of a larger research project. Most of the participants were female teachers. The hypotheses were tested with structural equation modelling. The key findings indicated that technology-related self-efficacy had the strongest impact on techno-work engagement. In addition, technology-related autonomy and technology-related competence support were statistically significant predictors of techno-work engagement. The findings suggest that similar workplace resources, which predict *general work engagement, are also relevant in the context of techno-work engagement. Some practical recommendations are made concerning the enhancement of teachers' technology-related self-efficacy at schools.*

Keywords: digitalisation, educational technology, teacher, well-being, techno-work engagement, workplace resources

Introduction

Digitalisation is a global megatrend in the educational sector. Some teachers perceive the digitalisation of schools and teaching as a demanding aspect of their job (Syvänen, Mäkiniemi, Syrjä, Heikkilä-Tammi, & Viteli, 2016), but in general, they have more positive perspectives. For example, according to a report, 70% of Finnish teachers view the digitalisation of education in a positive light, and 75% would like to use more digital applications (Tanhua-Piiroinen et al., 2016). Although the use of educational technology is often regarded positively, the focus of prior studies has often been on teachers' negative experiences related to the use of educational technology, such as technostress experiences (e.g. Al-Fudail & Mellar, 2008; Joo, Lim, & Kim, 2016; Syvänen et al., 2016). Therefore, in the current study, we focus on teachers' well-being experiences, particularly on their techno-work engagement, which can be defined as a positive state of well-being in which one feels fulfilled regarding the use of technology at work. Techno-work engagement is a novel concept based on the notion of work engagement, which is a widely used construct for describing and measuring employees' positive affective–motivational well-being work (Mäkiniemi, Ahola, & Joensuu, 2019; Mäkiniemi, Ahola, Syvänen, Heikkilä-Tammi, & Viteli, 2017). Work engagement is commonly divided to three main dimensions: vigour (e.g. high levels of energy at work), dedication (e.g. high inspiration to work) and absorption (e.g. full concentration on work), and it has been shown to be associated with positive outcomes, such as commitment to work and good work performance (Albrecht, 2013; Bakker, Albrecht, & Leiter, 2011). The main difference between the two above-mentioned two concerns the fact that although techno-work engagement and work engagement both capture the positive state of well-being at work, the former focuses on (digital) technology-intensive or (digital) technology-assisted work or work processes, whereas the latter focuses on work in general. Since the focus of the current study is on teachers' well-being experiences related to their use of educational technology at work – not their work in general – we suggest that the concept of techno-work engagement is well suited to our framework.

Moreover, since some teachers perceive the digitalisation of schools as stressful and demanding, it is important to identify so-called protective factors that can serve as a buffer to stress as well as divergent factors that can enhance well-being (e.g. work autonomy, social support). An understanding of those factors or resources will make it possible to influence teachers' well-being by supporting and developing them. This is an important strategy that takes into account the fact that it is generally not possible to eliminate demanding factors (e.g. time pressures). In the current study, we aim to identify which workplace resources are associated with teachers' techno-work engagement.

According to Nielsen et al. (2017), workplace resources are factors within a workplace that help an employee to achieve goals and complete work tasks. Workplace resources can be divided into four main types: individual (also called personal resources, such as self-efficacy, competence and self-esteem), group-level (e.g. social support, good interpersonal relationships between employees), leader-level (e.g. leadership style) and organisational-level resources (e.g. autonomy, possibilities to develop capabilities, human resources practices). Based on a large body of empirical findings, the authors found that these kinds of workplace resources (also called personal resources and job resources) enhance work motivation, well-being (e.g. work engagement) and performance (Nielsen et al., 2017). Since the concept of techno-work engagement is based on the concept of work engagement, we assume that workplace resources are also associated with techno-work engagement.

Techno-work engagement

Recently, a new concept and scale of techno-work engagement was developed to identify the positive well-being aspects of technology use at work (Mäkiniemi et al., 2019). This was considered necessary since prior research has mostly focused on the negative or demanding aspects of technology use (e.g. Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008). Further, the fact that an employee reports no or few negative well-being experiences, such as technostress, related to technology use does not necessarily indicate that he or she is having positive experiences. Consequently, it is not possible to measure positive experiences with scales that focus on negative experiences. Relatedly, Tarafdar, Cooper and Stich (2017) recently suggested that there is a need to consider the positive aspect of technostress, which they refer to as techno-eustress (i.e. the perception of technology use as challenging, thrilling and motivating). They argued that mastering such challenges could lead to positive outcomes, such as greater work engagement. Techno-work engagement refers to employees' technology-related experiences of well-being, and it is defined as a fulfilling state of mind associated with the use of technology (Mäkiniemi et at., 2017; Mäkiniemi et al., 2019). Similar to work engagement, it is a positive motivational state characterised by vigour, dedication and absorption.

Technology-related group- and organisational-level workplace resources

So-called supportive workplace factors may enhance techno-work engagement as well as the willingness to use educational technology. In the current study, we call these kinds of factors 'technology-related workplace resources'. In line with the definition presented above, we suggest that workplace resources are factors that help teachers to integrate and use educational technology at work and complete related work tasks. Prior studies on work engagement suggest that individual-, group- and organisation-level workplace resources, such as social support, autonomy and self-efficacy (Schaufeli & Bakker, 2004; Ventura, Salanova, & Llorens, 2015; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2007), are associated with higher work engagement. In line with these findings, we assume that high technology-related autonomy (i.e. teachers can freely make decisions regarding the use of educational technology), technology-related social support (i.e. colleagues give advice concerning educational technology) and technology-related competence support (i.e. individuals have enough time to use educational technology) are all associated with higher techno-work engagement.

Technology-related self-efficacy as an individual workplace resource

Self-efficacy is an important individual resource that is associated with employee well-being, such as higher work engagement (Xanthopoulou et al., 2007; Nielsen et al., 2017; Skaalvik & Skaalvik, 2014) and lower burnout in various occupations, including educational occupations (Skaalvik & Skaalvik, 2007; Shoji et al., 2016). According to social cognitive theory, self-efficacy is defined as an individual's beliefs regarding his or her capability to control situations and challenging demands. People with high levels of self-efficacy tend to set challenging goals, persist in achieving their goals, even under difficult and stressful circumstances, and recover quickly from failure, even in conditions that would appear to be overwhelming to the average person (Bandura, 1997). Self-efficacy can be measured at either a general or situation- or domain-specific level. One domain-specific concept, teaching or teacher efficacy, is defined as a teacher's future-oriented competency-based expectation, which is related to his or her ability to plan, organise and carry out the activities required to attain given educational goals. This expectation is a balanced judgement influenced by the teacher's perceived capacity to carry out the acts as well as the perceived demands of the working situation (Reeve & Su, 2014). In the current paper, we focus on teachers' (educational) technology-related self-efficacy as a personal workplace resource. We assume that a teacher has high technology-related self-efficacy, for example, when he or she understands the possibilities of educational technology well enough to maximise them in teaching and when he or she feels confident that he or she can help students when they have difficulties (c.f. Wang, Ertmer, & Newby, 2004). In line with previous findings assuming the link between self-efficacy and work engagement among teachers (e.g. Skaalvik & Skaalvik, 2014), we suggest that technology-related self-efficacy is associated with higher techno-work engagement.

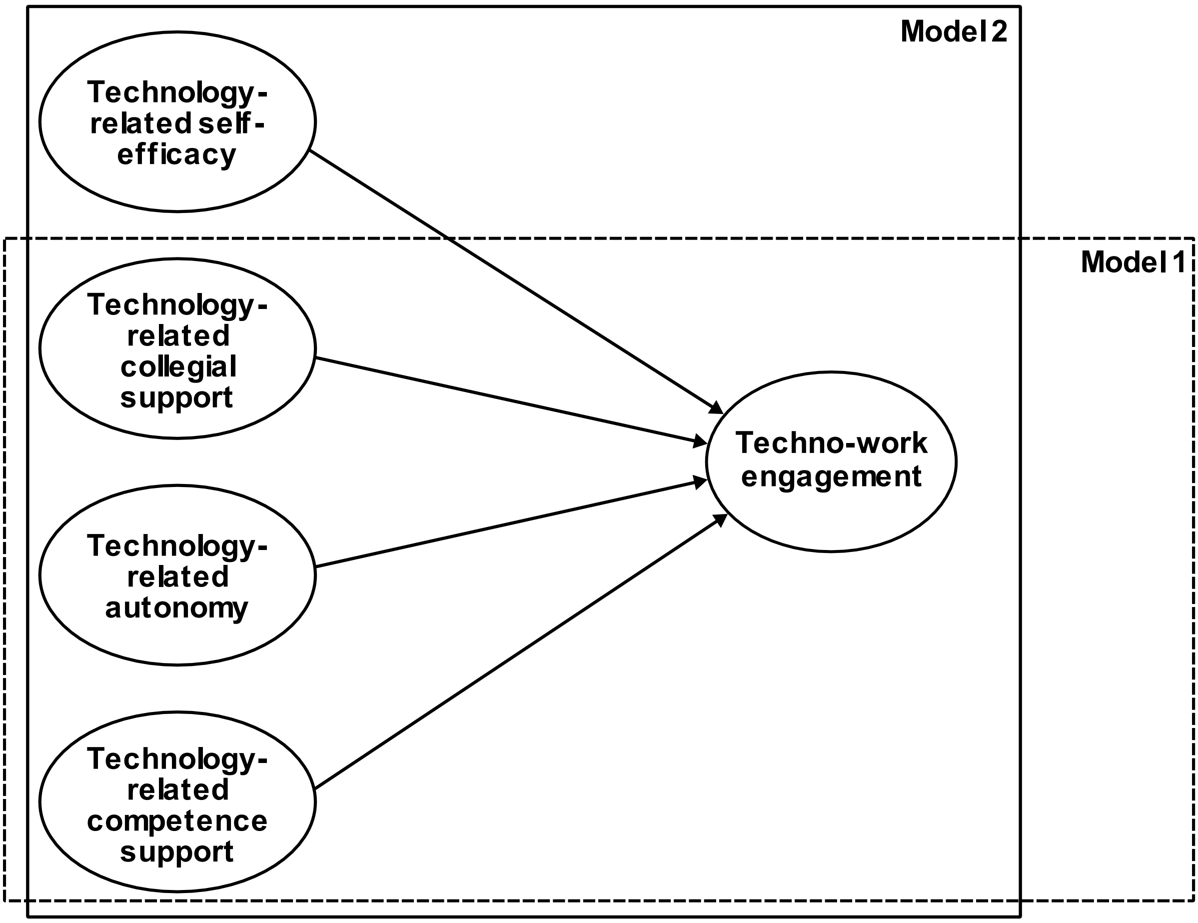

Figure 1. Hypothetical models.

Taken together, the main aims of the current study are to analyse how technology-related individual-, organisation- and group-level resources are associated with techno-work engagement among a group of Finnish teachers and determine which are the most influential predictors of techno-work engagement. We pose two hypotheses (Figure 1): technology-related job resources, namely, collegial support (H1a), autonomy (H1b) and competence support (H1c), are associated with higher techno-work engagement, and technology-related self-efficacy is associated with higher techno-work engagement (H2). Based on prior findings and theoretical formulations, it is not possible to hypothesise which predictors are the most influential. In practise, we tested two hypothetical models, as shown in Figure 1. The first model (Model 1) tested how three technology-related job resources – technology-related collegial support, technology-related autonomy and technology-related competence support – are associated with techno-work engagement. In the second model (Model 2), technology-related self-efficacy as an individual resource was added to the model to test whether technology-related job resources and an individual resource together are associated with techno-work engagement and which of these are the best predictors of techno-work engagement (Figure 1).

Methods

Data collection and participants

Quantitative data were collected from 15 schools in Finland as a part of a larger research project. Altogether, 183 teachers and principals answered a web-based questionnaire (in Finnish). Three principals had missing values on the Techno-Work Engagement Scale (TechnoWES) and were therefore excluded from the analyses. Of the remaining 180 respondents, 137 (76%) were females, and their mean age was 45 years. The respondents were class teachers (52.2%), subject teachers (43.3%) and principals (4.4%).

Measures

Techno-work engagement was measured with the TechnoWES (Mäkiniemi et al., 2019), which captures positive well-being aspects of technology use at work. The TechnoWES consists of nine items that represent the three aspects of techno-work engagement (i.e. techno_vigor, techno_dedication, and techno_absorption; measured with three items each). The respondents were asked to evaluate how often they have certain kinds of feelings and thoughts using a 7-point scale (1 = never; 7 = daily). An example of an item describing techno_vigor is 'When I utilise technology in my work, I feel that I am bursting with energy.' An exemplary item measuring techno_dedication is 'I am enthusiastic about utilising technology in my job." Finally, an example techno_absorption item is 'I feel happy when I am immersed in using technology in my work.' The respondents were asked to think about educational technology in particular when answering.

Technology-related self-efficacy, as an individual workplace resource, was measured by three items (e.g. 'I feel confident that I have the necessary skills in educational technology') on a 5-point scale (1 = strongly disagree; 5 = strongly agree; items adapted from Wang et al., 2004).

Technology-related job resources were assessed with three subscales (adapted from Lam, Cheng, & Choy, 2010). Technology-related collegial support (e.g. 'My colleagues support me if I encounter difficulties in using educational technology'), technology-related competence support (e.g. ‘Our school provides sufficient training in using educational technology’) and technology-related autonomy (e.g. ‘I use educational technology voluntarily in my teaching’) were each measured with three items on a 5-point scale (1 = strongly disagree; 5 = strongly agree; for the Finnish versions of the items, see Mäkiniemi et al., 2017).

Data analysis

First, the mean scores were calculated for each main variable, and differences between gender (calculated by an independent sample t-test) and teacher type (calculated by a one-way analysis of variance, ANOVA) were analysed with IBM SPSS 22. Subsequently, structural equation modelling (SEM) was used to identify the antecedents of techno-work engagement. The hypotheses were tested with SmartPLS 3, which is based on the partial least squares (PLS) SEM theory. A PLS-SEM modelling approach was developed to maximise the explained variance of the dependent variable (Hair, Ringle, & Sarstedt, 2011; Hair, Hult, & Ringle, 2017). This approach was appropriate in this study due to the non-normality of the data and the small sample size (n = 180). Additionally, PLS-SEM is considered appropriate for exploratory research and the early stages of theory development (Hair, Sarstedt, Ringle, & Mena, 2012). As we were interested in testing and comparing the antecedents of techno-work engagement, which is a recently developed concept, the explorative nature of PLS modelling was advantageous for our study (Henseler, Ringle, Sinkovics, 2009).

Results

The level of techno-work engagement was quite high ($M = 3.93$, $SD = 1.49$). There was no statistically significant difference between females ($M = 3.86$, $SD = 1.46$) and males ($M = 4.17$, $SD = 1.57$; $t(178) = 1.21$, $p = .229$). However, there were differences between different types of teachers ($F(2, 177) = 6.78$, $p = .001$). Post-hoc comparisons conducted with the Scheffe test indicated that the mean score for principals ($M = 5.71$, $SD = 1.26$) was significantly higher than those for class teachers ($M = 3.75$, $SD = 1.37$) and subject teachers ($M = 3.97$, $SD = 1.54$) at $p <. 01$ (Table 1).

Table 1. Descriptive statistics for the study variables (n = 180).

	All		Female (n = 137)		Male (n = 43)		Class teacher (n = 94)		Subject teacher (n = 78)		Principal (n = 8)	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
1. Techno-work engagement	3.93	1.49	3.86	1.46	4.17	1.57	3.75	1.37	3.97	1.54	5.71	1.26
2. Technology-related self-efficacy (individual)	2.98	1.02	2.79	0.98	3.58	0.89	2.94	1.01	2.97	1.04	3.54	0.75
3. Technology-related collegial support (job)	3.83	0.86	3.77	0.89	4.01	0.75	3.80	0.76	3.80	0.99	4.38	0.55
4. Technology-related competence support (job)	3.26	0.77	3.21	0.77	3.45	0.76	3.23	0.75	3.23	0.78	4.04	0.58
5. Technology-related autonomy (job)	4.09	0.63	4.01	0.60	4.35	0.65	4.05	0.56	4.11	0.70	4.42	0.77

Outer model

The assessment of PLS models is twofold; an acceptable judgement of the outer model allows one to proceed with the inner model evaluation. The outer model is assessed by analysing the reliability and validity of the constructs. Reliability and validity are determined for reflective indicators based on factor loadings, composition reliability (CR), average of variance extracted (AVE) and discriminant validity (Henseler et al., 2009). The estimated loadings of the reflective indicators were all high (0.58–0.92) and statistically significant (see Appendix 1). Statistical significance was achieved by the bootstrap procedure using 5,000 samples. The composite reliability (CR) of constructs can be regarded as more suitable than Cronbach's alpha when using the PLS method (Hair et al., 2012). CR values indicate the reliability and consistency of constructs (Table 2) (Hair et al., 2011). Convergent validity of constructs is achieved when AVE values are greater than 0.51. Using the Fornell–Larcker criterion to assess the discriminant validity between the constructs, it was determined that the square roots of the AVEs of each construct were larger than the constructs' correlations with each other (Table 2) (Fornell & Larcker, 1981).

Table 2. Construct validity, reliability, discriminant validity, correlations, means and standard deviations for constructs (PLS models, n = 180).

	CR1	**AVE2**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Technology-related self-efficacy (1)	0.915	0.783	0.885				
Technology-related collegial support (2)	0.914	0.781	0.291	0.884			
Technology-related autonomy (3)	0.811	0.592	0.502	0.422	0.770		
Technology-related competence support (4)	0.760	0.518	0.387	0.397	0.375	0.720	
Techno-work engagement (5)	0.949	0.673	0.529	0.274	0.511	0.425	0.821
Mean			2.98	3.82	4.08	3.28	3.94
SD			1.00	0.87	0.65	0.75	1.50

[1] Composite reliability, [2] Average variance extracted.

Inner model

To establish the role of technology-related self-efficacy in techno-work engagement, we tested the two models shown in Figure 1. In Model 1, three exogenous variables explain an endogenous variable (H1a,b,c). Model 2 includes an additional exogenous variable, technology-related self-efficacy (H2). To establish the additional explained variance of techno-work engagement, we compared the predictive relevance of the models using the squared coefficient of determination (R^2) and blindfolding procedure (Stone-Geisser's Q^2). Using R^2 values as a criterion to assess endogenous variables, we employed Chin's (1998) boundaries (0.67, 0.33 and 0.15 as substantial, moderate and weak, respectively). According to these boundaries, the first model was interpreted as moderate (see Table 3). The path coefficients of technology-related job resources to techno-work engagement met expectations, excluding the path from technology-related collegial support, which lacked statistical significance (t statistics < 1.96) and was therefore interpreted as zero. Taken together, in Model 1, two job resources, namely, technology-related autonomy and technology-related competence support, were statistically significantly and positively associated with the techno-work engagement; thus, hypotheses H1b and H1c were supported. However, unexpectedly, technology-related collegial support was not statistically significantly related to techno-work engagement, and therefore hypothesis H1a was not supported. To better understand this finding, we performed an additional analysis: Estimation of a model with only one exogenous variable (technology-related collegial support) for techno-work engagement and comparison with Model 1 indicated that correlation between job resources reduced the separate effect of collegial support in Model 1. This may be due to multicollinearity problems, as technology-related job resources are highly correlated by nature.

Adding technology-related self-efficacy into Model 2 resulted in higher R^2 and Q^2 values (Table 3). In addition to R^2 and Q^2 values, inner model assessments should consider Cohen's f^2 values and the magnitude and direction of the path coefficients (Henseler et al., 2009). Considering the magnitude of the estimated path coefficients and effect sizes, we found that technology-related self-efficacy had the strongest impact on techno-work engagement ($\beta = 0.311$, $f^2=0.112$; Table 3, Figure 2). Both technology-related autonomy and competence support were positive and statistically significant, with path coefficients of 0.286 and 0.205, respectively. Using Cohen's (1998) limits to interpret f^2 values, the effect sizes of self-efficacy, autonomy and competence support varied from weak to medium. The collegial support path was interpreted as zero ($t < 1.96$) in this model. Taken together, Model 2, which in addition to three job resources includes an individual resource (technology-related self-efficacy), had slightly better predictive power than Model 1. Further, in Model 2, technology-related self-efficacy had the strongest unique contribution to techno-work engagement, followed by technology-related autonomy and technology-related competence support. Therefore, hypotheses H2, H1b and H1c were supported, and again unexpectedly technology-related collegial support was not statistically significantly related to techno-work engagement (c.f. H1a).

Table 3. Standardised path coefficients and t statistics of compared models and effect sizes for Model 2.

	Model 1		Model 2		
	Path coeff.	**t statistic**	**Path coeff.**	**t statistic**	**f^2**
Technology-related self-efficacy → Techno-work engagement			0.311**	4.189	0.112
Technology-related collegial support → Techno-work engagement	-0.009	0.105	-0.019	0.237	0.000
Technology-related autonomy → Techno-work engagement	0.416**	6.656	0.286**	4.222	0.088
Technology-related competence support → Techno-work engagement	0.272**	3.937	0.205**	3.198	0.052
R^2	0.33		0.39		
Q^2	0.20		0.24		

** indicates statistical significance at a risk level of 0.01.

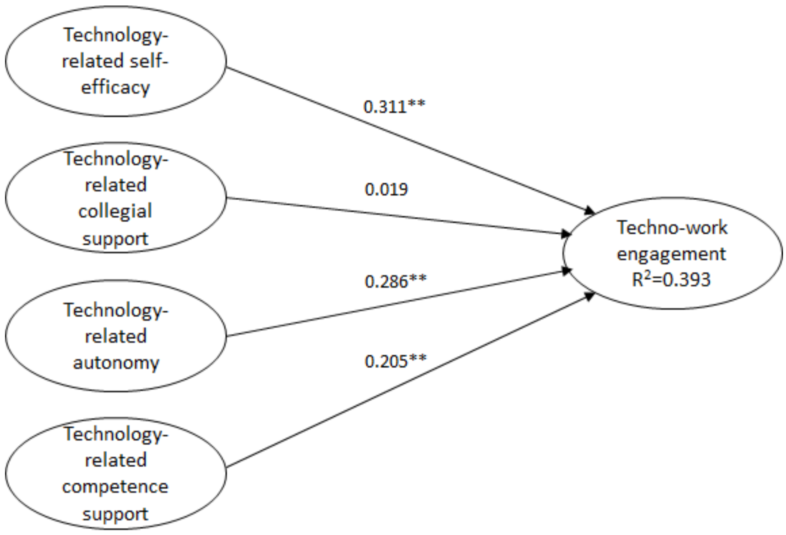

Figure 2. Inner model path coefficients and their statistical significance.
** indicates statistical significance at a risk level of 0.01.

Discussion

The aims of the study were to explore how technology-related workplace resources are related to techno-work engagement among a group of Finnish teachers and determine which predictors of techno-work engagement are the most influential. We hypothesised that technology-related job resources are associated with higher techno-work engagement (H1a,b,c) and that technology-related self-efficacy is associated with higher techno-work engagement (H2). The current study is novel in its positive focus; prior studies have focused on negative experiences and a lack of well-being related to the use of educational technology in teaching (e.g. Al-Fudail et al., 2008).

The findings of the statistical analysis show that teachers experience positive technology-related well-being quite often (i.e. at least nearly on a weekly basis), which supports the notion that techno-work engagement is an important phenomenon (c.f. Mäkiniemi et al ,. 2017; Mäkiniemi et al., 2019). Consequently, when framing the digitalisation of schools as an emerging phenomenon in the media and when speaking about the use of educational technology at schools or in public, it is important to take into account and highlight its associations with teacher well-being (i.e. to focus on its positive aspects, not just the stressful aspects, which currently seems to be a more common frame of reference).

As expected, techno-work engagement was positively correlated with all workplace resources. Further, the key findings of the main analysis indicated that technology-related self-efficacy made the strongest unique contribution to techno-work engagement (Model 2), which supports our hypothesis (H2; i.e. technology-related self-efficacy is associated with techno-work engagement). In addition, technology-related autonomy and competence support were relevant to the promotion of teachers' technology-related well-being (based on Models 1 and 2). Hence, H1 b and c were also supported. The findings support the basic assumption of the job demands-resources theory: a combination of job resources (e.g. autonomy) and personal resources (e.g. self-efficacy) predict work engagement (e.g. Nielsen et al., 2017; Schaufeli & Bakker, 2004; Ventura et al., 2015). Further, our findings are in line with prior studies indicating that self-efficacy is an important personal resource and is associated with higher work engagement (Nielsen et al., 2017; Skaalvik & Skaalvik, 2014; Xanthopoulou et al., 2007). Unexpectedly, technology-related collegial (i.e. social) support was not associated with techno-work engagement. Therefore, H1a was not supported. This may be due to the high correlation between technology-related autonomy, competency support and collegial support. This finding could also be explained by the fact that teachers still work very independently and autonomously or that those who are highly engaged in technology-related work do not feel the need for support. The role of technology-related collegial support in teacher well-being needs more attention in future studies, as the development of technology-related self-efficacy and technology-related competence support requires shared collaboration (i.e. collegial activities), as explained in more detail below.

A key limitation of the study is that the sample was quite small and not nationally representative. Further, in the current study, we focused on the main effects between workplace resources and techno-work engagement. Since the study of techno-work engagement is in its early stages, we considered this to be a suitable approach. However, there seem to be complex relationships between work engagement, personal resources and job resources. For example, personal resources have been shown to mediate the relationship between job resources and engagement and influence the perception of job resources (Xanthopoulou et al., 2007, Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Therefore, as an additional analysis, we tested the mediating model that included paths from technology-related work resources to self-efficacy. Although the paths from collegial support and autonomy to self-efficacy were positive and significant, the predictive relevance of the model did not improve. Since the PLS method emphasises prediction, the redundant paths were omitted. Finally, we believe future studies should consider the broader context of the schools, as a community-oriented approach has been found to enhance the integration of educational technology (Niemi, Kynäslahti, & Vahtivuori-Hänninen, 2013), and in the current study we did not focus on all the workplace resources presented by Nielsen et al. (2017). Therefore, in the future, the effect of leader-level workplace resources on techno-work engagement should be analysed. In addition, the current study was quantitative by nature, which means that it could only answer certain types of research questions, such as how workplace resources are associated with techno-work engagement, how often teachers experience techno-work engagement and whether there are differences between respondent groups. Evidently, there is also a need for qualitative research since there are still many unanswered questions, which are not possible to answer using a quantitative questionnaire. Interesting questions for qualitative inspection could include why some teachers perceive the use of educational technology as inspiring while some experience it as more stressful, the role of workplace resources in educational technology and how teachers in practise tackle technostress and enhance their technology-related well-being.

Our main findings indicate the importance of three workplace resources – technology-related self-efficacy, technology-related autonomy and technology-related competence support – in the context of techno-work engagement. Therefore, we propose some key practical recommendations for schools. First, in terms of technology-related autonomy, teachers should have considerable freedom regarding the selection and use of educational technology. Their opinions and views should be heard, and they should be taking part in decision-making. This is also important because teachers usually have pedagogical expertise and knowledge about the motivation, learning preferences and abilities of their students and can thus evaluate the pedagogical value of the novel technological devices more critically than administrative personnel can. However, this kind of participatory approach requires high trust in teachers' know-how on the part of school leaders and other managers. Second, prior studies indicate that concrete ways to enhance teachers' technology-related self-efficacy include successful (and vicarious) teaching experiences, concrete instruction in how to utilise educational technology in practice, intentional goal-setting and encouraging feedback on teachers' performance (e.g. Bandura, 1997; Wang et al., 2004). It is worth noting that enhancing teachers' technology-related self-efficacy cannot be done in isolation or alone. For example, vicarious teaching experiences and receiving constructive feedback require the potential to follow others work, shared discussions and collaboration. Consequently, the development of technology-related self-efficacy is likely challenging in schools in which the individualistic school culture is strong and teacher collaboration is not supported (for a review of the benefits of teacher collaboration, see Vangrieken, Dochy, Raes, & Kyndt, 2015). Third, technology-related competence development could be supported in practise by discussing and clarifying expectations regarding the use of educational technology in teaching (e.g. how and how often teachers should use educational technology at school and what is perceived as valuable and important when considering the use of educational technology). In addition, teachers must have continuing opportunities to develop their expertise (e.g. through relevant and suitable courses). Finally, a lack of time should not limit the possibilities of teachers to learn and integrate novel educational solutions into their teaching practises.

The current study provided new knowledge about the technology-related well-being experiences of teachers and supported the notion that, in general, resources that enhance work engagement are also important predictors of techno-work engagement.

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Appendix 1

Measurement (outer) model of the constructs. Standardised indicator loadings and respective t-statistics.

	Standardised loading	**t-statistic**
Techno-work engagement		
Techno-work engagement_enthusiastic	0.800	24.316
Techno-work engagement_inspired	0.860	42.206
Techno-work engagement_proud	0.798	24.871
Techno-work engagement_persevere	0.640	11.646
Techno-work engagement_energy	0.829	32.957
Techno-work engagement_vigorous	0.859	40.572
Techno-work engagement_happy immersed	0.875	43.634
Techno-work engagement_immersed	0.821	27.699
Techno-work engagement_carried away	0.877	48.088

	Standardised loading	t-statistic
Technology-related self-efficacy		
Technology-related self-efficacy_know how to utilize	0.850	37.314
Technology-related self-efficacy_able to help	0.896	42.257
Technology-related self-efficacy_adequate skills	0.907	56.264
Technology-related competence support		
Technology-related competence support_training	0.743	11.102
Technology-related competence support_time	0.812	15.417
Technology-related competence support_what is expected	0.586	6.580
Technology-related autonomy		
Technology-related autonomy_opinions respected	0.803	15.491
Technology-related autonomy_voluntariness	0.858	35.412
Technology-related autonomy_freedom to decide	0.629	6.741

	Standardised loading	t-statistic
Technology-related collegial support		
Technology-related collegial support_colleagues support	0.842	17.073
Technology-related collegial support_tips	0.885	18.008
Technology-related collegial support_collaboration	0.922	22.368