9-22-2023

SCHOOLTEACHERS' EXPERIENCES OF THE CHALLENGES ASSOCIATED WITH INFORMATION TECHNOLOGY USE IN TRADITIONAL AND ONLINE EDUCATION

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Research paper

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Abstract

In the aftermath of COVID-19, it is important to examine the different aspects of educational IT use in their respective contexts, including considerations to the potential well-being outcomes associable with IT use (e.g., technostress and related strains). In 26 semi-structured interviews with comprehensive school teachers, this study explores the challenges related to IT use in traditional (on-site) and online education. The results suggest that, although similar challenges can be identified in both settings (e.g., technical challenges and detrimental effects on teachers' well-being), their prevalence and circumstances can vary. For example, while directing focus from IT use to schoolwork is viewed as a challenge for traditional education, reaching pupils and fostering interaction can become problematic for online education. However, the teachers have formed practices to address the challenges and can identify IT use-related opportunities for education as well. Future research should consider the multidimensionality of IT use that is present in different educational contexts.

Keywords: online education, traditional education, information technology use, teachers, comprehensive school

1 Introduction

This study focuses on comprehensive school teachers' views on the challenges of information technology (IT) use in traditional (on-site) and online education. Because of COVID-19, many teachers had to quickly transfer to online education (see, e.g., Mäkelä et al., 2020). Although the online education period often remained relatively brief and the schools could eventually migrate back to traditional education, IT has been used in schools in different ways for decades and is expected to hold a role in school practices in the future. Thus, teachers' experiences of online education provide an intriguing parallel to contemplate the role of IT use in school practices and the characteristic qualities that can be associated with different educational contexts (i.e., traditional and online education).

Teachers' attitudes toward IT use in teaching and learning can affect the degree of IT use in the classroom (Player-Koro, 2012). However, teachers' attitudes can vary (e.g., according to country of residence or age), and enthusiasm does not necessarily manifest in the form of increased IT use (Eickelmann and Vennemann, 2017). Personal attributes such as IT-related self-efficacy can also be viewed as influential (Ertmer and Ottenbreit-Leftwich, 2010). Additionally, IT use can be affected by organizational factors. For example, the innovation processes that are present in schools might be connected to the degree of IT use (Petko et al., 2015). Traditionally, top-down approaches and external motivators have not been considered as successful drivers of IT adoption, especially in higher education con-

texts (see, e.g., Reid, 2014) . Nevertheless, IT use can bring many benefits for education, which makes it important to understand the potential challenges for using IT to support modern teaching and learning activities under diverse circumstances. The COVID-19 situation created an external force that had not been encountered in working life before, with the key distinction from characteristic IT adoption projects being that the education practices needed to change to ensure the continuance of education. Because teachers have had different experiences with IT before, during, and after COVID-19, their insights provide invaluable information about how teachers, pupils, and schools with varying IT readiness levels can tackle the challenges associated with IT use.

The data in the present study were collected through semi-structured interviews with 26 Finnish comprehensive school teachers. The aim of the research is to build understanding of IT use-related challenges that are characteristic to educational environments employing varying levels of IT use. The study answers the following question: *What kind of challenges related to online education or IT use in traditional education can affect the capabilities of teachers to organize and pupils to participate in education activities?* This includes both the teachers' own experiences associated with IT use and their perceptions of their pupils. In Finland, teachers can often leverage modern devices and applications for teaching and learning activities. However, even before the coronavirus pandemic, the individual characteristics of teachers could affect the degree of educational IT use (see, e.g., Kaarakainen and Saikkonen, 2021). Because the teachers have had time to process the online education period and migrate back to traditional classroom education, the interviews could inform research by going beyond acute stress and fear experiences related to COVID-19 and online education, possibly allowing for a deeper contemplation of the role of IT in education. The results also have high practical relevance because the experiences relate to the teachers' everyday teaching praxis.

2 Background

In school environments, IT-related practices have been studied for decades. This includes IT features that are relevant for class environments (e.g., Kennewell and Beauchamp, 2007) and the teachers' perceptions of and attitudes toward IT use (e.g., Jimoyiannis and Komis, 2007), as well as their effects on actual IT use (see, e.g., Seufert, Guggemos and Sailer, 2021). The COVID-19-related, often abrupt migration to online practices has also been the topic of many studies, including the identification of the disadvantages and benefits associated with online education (Abumalloh et al., 2021; Mäkelä et al., 2020). Currently, educational institutions also have an opportunity to rethink their teaching-learning practices and the role of IT in the "post-COVID19" era (Zhao and Watterston, 2021). However, different dimensions of IT use should be carefully studied to ensure that specific benefits can be achieved without forgetting the possible drawbacks, such as detrimental effects on teachers' and pupils' well-being.

Technostress (i.e., stress related to IT use) has been a widely studied topic, especially in the organizational context (Mahapatra and Pillai, 2018). In recent years, technostress has also been studied in leisure contexts, including online environments such as social networking services (see, e.g., Salo, Pirkkalainen and Koskelainen, 2019; Tarafdar et al., 2020). Although technostress experiences (e.g., underlying reason, degree, and duration of stress) can vary among individuals, their common denominators include being IT use related and, according to the person-environment definition of stress, "*— appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being*" (Lazarus and Folkman, 1984 p. 21). The stressors often referred to in the literature include techno-invasion, techno-complexity, techno-overload, techno-uncertainty, and techno-insecurity (Ragu-Nathan et al., 2008), which address the different dimensions of the IT use process. Stressors can also be connected with strains (i.e., outcomes of technostress; see, e.g., Tarafdar et al., 2010). These can include physical symptoms (e.g., headache) and psychological outcomes such as problems with concentration (see, e.g., Salo, Pirkkalainen and Koskelainen, 2019). The technostress experiences of teachers have been studied in the past, such as their prevalence and effects on IT use (intention) (Chou and Chou, 2021; Estrada-Muñoz et al., 2020; Joo, Lim and Kim, 2016). Similarly, university students have been the topic of many studies, including the role of technostress in learning and academic

productivity (Qi, 2019; Upadhyaya, 2021, Wang, Tan and Li, 2020). Unlike teachers and higher education, the technostress experiences of younger IT users remain scarce in the literature. However, a few studies have focused on children, showing that they can have stressful IT use experiences and use different strategies to cope with them (Mehtälä et al., 2022; Schmidt, Frank and Gimpel, 2021).

Another relevant topic related to online education and technostress is the increasing body of literature on distance work. The COVID-19 situation enabled the employees of many organizations to work remotely, even in positions where remote work was not previously viewed as possible. Although remote work provides employees with many benefits, including higher job satisfaction and job-related well-being (Felstead and Henseke, 2017), challenges such as maintaining organizational collaboration networks (Yang et al., 2022) or fostering productivity and work engagement (Galanti et al., 2021) remain. Because online education leads to a situation where teachers need to perform their work remotely, they might face similar challenges as other employee groups that have been forced to change their work practices.

It is evident that online education, technostress, and remote work are all phenomena that relate to individuals' capabilities and experiences of IT use. While the COVID-19-related migration to online education was not often a voluntary action taken by the teachers, there are potential benefits to be achieved through IT use. However, online education has characteristics that need to be considered when contrasted with other types of remote work, such as the interaction with pupils and the use of educational technologies. Additionally, the teachers' experiences can be affected by the capabilities of their school, including the quality and quantity of the IT-related resources available. The experiences of the teachers can be especially relevant due to their ability to address different layers of IT use, from adoption to continuous practices, as well as the multitude of individuals participating in the process of online teaching and learning (e.g., pupils, teachers, parents, etc.).

3 Data Collection and Analysis

In this study, semi-structured interviews were used to explore comprehensive school teachers' experiences regarding IT use in traditional and online education. In Finland, comprehensive school is a term used to portray primary and lower secondary education, typically including pupils between the ages of 7-16. Challenges and possibilities of IT use were viewed as a topic that might bring up very different views and emotions based on past conceptions and experiences, hence calling for an approach that would consider this depth of knowledge. Thus, a qualitative approach was seen as fitting the present research (see, e.g., de Farias et al., 2021). Semi-structured interviews include advantages such as flexibility and diversity, making it possible to react to the narratives provided by the interviewees (see, e.g., Kallio et al., 2016). This approach also enabled a richer contemplation of current and past IT use practices in relation to the COVID-19 situation. Altogether, 26 interviews with teachers were conducted by two researchers in 2022 from January to July. The average length of an interview was 49.5 minutes. All the interviewees were teachers from Finnish schools, and the interviews were conducted in Finnish. Even though the interviewees were predominantly female (80%), the number of female teachers tends to be high in the Finnish comprehensive education (European Commission, 2019).

The invitation to participate was disseminated at the municipality or school level, and in some cases, individual teachers were approached based on existing networks or according to the recommendations made by other interviewees (i.e., snowball sampling was used; see, e.g., Parker, Scott and Geddes, 2019). Permission for the teachers to participate was acquired from the municipality or school level, depending on each case. For the individual teachers, it was stressed that they should have permission from their institution to participate or do so in their free time. The teachers received information regarding the study and could decide for themselves whether they wanted to participate. The interviewees were asked for a permission to record the interviews, which was granted by all participants.

The interviews followed semi-structured interview schemes, focusing on open-ended questions but also including closed supportive and demographic questions. The interview questions were informed by the themes discussed in previous research (e.g., technostress, challenges with online education), which is typical for this interview type (see e.g., Kallio et al., 2016). The comprehensive education

context was also considered upon formulating the questions. Because the purpose of the research was to gain an understanding of the teachers' personal experiences, the interviewers attempted to follow the train of thought that seemed natural for the interviewee and the situation itself. Customarily to semi-structured interviews, the themes discussed—especially the focus point of the interviews—could be different depending on the interviewee in question (Myers and Newman, 2007). However, all the interviews revolved around the teachers' experiences with using IT in traditional and online education settings. This could include, for example, discussing the feelings of stress associated with IT use (*Have you ever experienced stress associated with IT use, that is, technostress, in your work?*) or the strategies used by teachers to address problems *(How have you resolved situations where the use of IT devices disturbs the education activities/causes other unpleasant feelings? Have the strategies been helpful?*).

The resulting data consisted of 26 transcribed recordings that were coded using NVivo qualitative data analysis software. Initially, one interview was coded to see which dimensions could be identified in the data. The resulting coding scheme was then applied to another interview, creating a process where similar themes across interviews were categorized together but also allowing deeper hierarchies to be formed within categories. Even though the resulting data was guided by the original interview scheme, the approach of the thematic analysis attempted to capture the different information layers present in the data as closely as possible. Thus, in this study, the processes of coding and analysis are viewed as processes that are closely intertwined together (Weston et al., 2001). For the purposes of the present research, it was specified that, to be included, each mention had to be associated with online education or other forms of IT use in traditional education. Thus, the analysed data consist of teachers' experiences or observations regarding themselves, their class, or individual pupils in relation to challenges and opportunities of IT use for teaching–learning processes in different educational settings. However, experiences related to hybrid education were left outside the scope of the present research because, due to its complexity, this setting can make it difficult to distinguish the role of IT use in the process.

Other background information was also collected from the interviewees. The interviewees were from different age groups, including 39 and below (7), 40–49 (11), and over 50 (8). The teaching experience of the interviewees also varied, with over half of the interviewees having over 15 years of teaching experience. The interviewees included both class and subject teachers from comprehensive education, with some working on other education levels as well (multiple roles). One rector was included because they also worked as a subject teacher.

4 Results

The results indicate that the teachers could identify specific IT use-related challenges affecting the capabilities of teachers to organize and the pupils to participate in traditional and online education. Although some of the identified challenges might seem similar, there were also clear differences in their manifestations and the dimensions emphasized by the teachers. The teachers also discussed the possibilities of IT use, solutions to specific problems or factors mitigating or eliminating the adverse effects associated with IT use.

4.1 Traditional education

The teachers brought up different challenges related to IT use in traditional (on-site) educational settings. It was common for the challenges to relate to the ability of the teacher and their pupils to focus on schoolwork. The teachers also identified technical difficulties, differences between pupils' IT capabilities, and detrimental effects of IT on their own well-being. Other problematic aspects for the teachers included IT-enabled communication and reachability, blending of work and leisure time, and the knowledge or attitudes of teachers. Furthermore, new technologies and the pace of IT adoption could be viewed as challenges (Table 1).

Challenges in traditional education	N of mentions	N of teachers
Directing focus to school work	91	15
Detrimental effects on teacher's well-being	43	11
Differences between pupils' IT use capabilities	31	13
Technical difficulties	30	13
Amount of IT-enabled communication received by teacher	17	10
Blending of work and leisure time	14	9
New technologies and the pace of IT adoption	14	8
Specific attitudes held by the teachers or lack of IT-related knowledge	8	6

Table 1. IT use-related challenges in a traditional education setting

For traditional education, it was common for specific visual or audio content to distract a pupil or the entire group from the task at hand. For example, when a teacher was sharing their screen for the class, a notification could appear on the screen, capturing the attention of the pupils. Additionally, fast-paced online environments were sometimes viewed as problematic to the pupils' concentration.

> *I think those can sort of drive the children wild when a random advertisement pops up. First, you're like explaining that "Alright, we're going to watch a video about the different parts of a plant," and then, you open YouTube and there is a Coca-Cola commercial or something like that, whatever happens to pop up. After that, they can't … They are sort of so excited about the fact that the advertisement popped up instead of the right video. If you have had this special concentration or flow until that point, it sort of breaks. -T12*

> *I've noticed that this specific kind of patience and determination has sort of disappeared. Everything is expected to be solved in 10 seconds. And sometimes, I've thought about, for example, Instagram, and how you can only put a video lasting a maximum of one minute in there and everything [happens] so fast. It is a bit disturbing. And I think it reflects the concentration of children; they don't have the energy to do anything for a long time. For example, reading a book can be very consuming because it takes so long. -T13*

The devices used by pupils can affect class work in multiple ways. Although the notifications arriving at pupils' devices could disrupt class activities, pupils can also be drawn to their own devices during class for other reasons, which might affect their concentration. The content that the pupils come across on these devices can be stimulating for them, sometimes leading to going astray from the assignment given by the teacher. In certain situations, some pupils are also specifically drawn to leisure-related activities, sometimes at the cost of schoolwork (e.g., difficulty to stop using the device after the weekend or recess, gaming is more attractive than homework, etc.).

> *If we are doing some specific activity and we're using a computer for that purpose, the pupils might go onto another website or start playing games. Therefore, the focus does not remain on the activity. -T2*

> *Even though for the majority, it is easy, some people really get stuck with it. For example, in the spring term, it is very hard for some pupils on certain days to put their phone onto the teacher's table in the morning; it basically seems like the end of the world as we know it for them. But when we start doing activities, it usually levels, but there are clear differences -T14*

Previous research has noted that the use of IT for leisure purposes can affect pupils' schoolwork (Raza et al., 2020). Additionally, excessive smartphone use can relate to adverse well-being outcomes, such as poor sleep (Claesdotter-Knutsson et al., 2021), making it an important topic to be discussed in the school context. According to the teachers, concentration on schoolwork could be encouraged through specific IT-related preparations and practices. For example, the teacher could eliminate stimuli from

their own devices by muting them beforehand, or the pupils might learn from their experiences and start to mute their devices as well. The teachers could also react to specific situations while they occur in the classroom, for example, by telling the pupils to put their devices away. Getting used to IT-related stimuli and practising how to work in different situations also play a role, and IT use might even support some pupils' concentration on schoolwork.

> *Of course, they really like it when they get to use their own devices, so if you just ask them to find some information from somewhere, it feels that being able to use your own device can be activating as well. -T4*

In addition to their class-related observations, the teachers identified IT-related challenges that affect their own work. One frequently mentioned aspect was the amount of IT-enabled communication. For example, the number of messages could make it difficult to find relevant information, and the process of going through the messages could take time and feel frustrating. Some teachers mentioned that they were taxed by the need for continuous reachability, even during the school day. The teachers could also be bothered by their work and leisure time blending together, and IT use itself might relate to specific health or well-being outcomes, such as feelings of stress, headache, or neck and shoulder pains.

> *I think it might be precisely the information overflow and this thing where you should react to messages quickly that probably creates stress. So it is related to this kind of amount of information and when you sort of have to be constantly reachable. Of course, it is not determined [by school] that you should be, but I think there is this kind of stress associated with information overflow and its management. -T25*

The qualities associated with the teaching profession (e.g., time pressure, amount of work and adapting to change) can affect the stress experienced by teachers (Kyriacou, 2001). Although the teachers' use of educational technologies has been connected to feelings of stress (see, e.g., Fernández-Batanero et al., 2021), the significance of the IT use for this process might be difficult to establish. The challenges with managing the number of messages, reachability, and blending of work and free time could be addressed through similar means, such as muting the device or ignoring incoming messages at specific times. The teacher could also make a clear division between work and leisure time, where work-related ITs were only used in the work environment. Well-being could be fostered by addressing the specific problems associated with IT use, for example, by reducing the time spent looking at a screen.

> *I try to keep these … And sometimes, it succeeds very well ... These [practices] that, for example, after 6 p.m., I do not open the tablet anymore, which has my email on it. -T23*

In addition, poorly functioning IT can be viewed to affect both teachers and pupils. For example, network problems or the age of the devices could make it difficult to use IT for education purposes. New technologies and the pace of IT adoption could also be viewed as taxing. Finally, the teachers brought up that IT use in the classroom can be affected by individual pupils or the class as a whole because the capabilities of their pupils can vary, for example, because of their age or specific learning needs.

> *Well, the first thing is probably that we constantly get new applications and platforms that need to be adopted. So there is kind of this change, that when you have adopted one thing, then you already have to adopt the next—that is probably the biggest [source of technostress]. -T16*

> *Before we have even retrieved those computers and logged in, then the lesson is already over [laughter]. It is so much slower with younger kids, when it takes so much more time to perform basic actions on the computer, so the actual activities tend to become forgotten; you don't have the time. -T3*

The challenges and opportunities associated with the digitalization of education have been studied in previous research (see, e.g., Lindqvist and Pettersson, 2019; Qureshi et al., 2021). This includes assessing the features of different technologies used for educational purposes, as well as understanding the changes in the teacher's role (Kalimullina, Tarman and Stepanova, 2021). IT adoption is also a widely studied topic in other organizational settings, including the notions of organizational and IT

affordances (see, e.g., Kuusisto, 2017). Teachers can address technical challenges through preparative actions, such as making sure that they are up to date in their knowledge or ensuring that the devices will work. The teachers also discussed the technical opportunities that IT brings to education. For example, teachers could feel that it is easy for them to use IT in their own subject or that IT use makes it easier to carry out specific teaching activities. Additionally, the teachers brought up the development of their own abilities to use IT, viewing IT as a useful tool for education purposes. The pupils' increasing capabilities, as well as their perceptions of IT, were also mentioned.

> *Maybe [I've] become braver so that there is no more cowering away; you do not have to [be afraid of] it. If you don't know how to use something, it's not like they break. There is IT support in the school that you can contact and through trial and just by using—maybe at first there was some cowardness when they came [into education] for the first time, but not these days as they are an automatic part. -T7*

> *I think the pupils probably are, and [I] know that they are, already skilful. So you do not have to start from the beginning with anyone. -T13*

Although the teachers could face various challenges associated with IT use in traditional education, they also had different means to control their effects in the classroom. These could include specific IT-oriented actions targeting, for example, the teacher's or pupils' devices, or more traditional teaching actions that aim to foster concentration. In addition to the classroom situation, the teachers could use different means to address the negative effects of work-related IT use on their own well-being. Thus, the actions used by teachers can be compared with problem-focused strategies to mitigate technostress, such as modifying IT features or the routines related to IT use (Salo et al., 2022). Additionally, the teachers brought up possibilities of IT use for education, emphasising that the teachers' perceptions of IT are not two-dimensional or overly affected by their potential negative experiences.

4.2 Online Education

In addition to their IT use–related experiences in traditional education settings, the teachers also discussed their experiences regarding online education. For online education, it was common for the teachers to bring up challenges related to their own well-being. Additionally, the planning of education activities was often viewed as problematic. Regarding their class, the teachers discussed challenges such as fostering interaction and following the progress and well-being of individual pupils. Both the teachers and pupils faced technical challenges, which could relate to insufficient skills to use IT. Sometimes, the IT readiness level of the school was not at an expected level and specific challenges related to the IT adoption process could be identified (Table 2).

Challenges in online education	**N of mentions**	**N of teachers**
Interaction with pupils and reachability	46	16
Detrimental effects on teacher's well-being	39	13
Technical difficulties	34	12
Planning education activities	27	15
Following the progress of pupils and their well-being	26	14
New technologies and IT adoption	24	13
The IT readiness level of school and received support	17	11
Blending of work and leisure time or prolonged work days	13	7
Differences in the pupils' IT use capabilities	12	5

Table 2. Challenges in an online education setting

Most of the teachers brought up different ways in which online education affected their well-being. For example, the teachers could see an increase in their working hours, how their work and leisure time blended together, and their IT use-related stress. The need for technical support given to colleagues was also sometimes viewed as taxing.

> *You would notice that there was no leisure time whatsoever when you were pretty much constantly glued to work. You had to instruct the preservice teachers; all the meetings were online, and it was so pervasive. -T18*

> *Especially in the beginning of online education, when everyone was in online education [mode], you would work around the clock just trying to find out how something can be done. -T20*

The COVID-19-related negative effects on well-being that affected teachers specifically have been studied (see, e.g., Alves, Lopes and Precioso, 2021). For example, there could be a dramatic change in the workload for teachers, affecting their ability to organize education (Giovannella, Marcello and Donatella, 2020; Kaden, 2020). However, despite the feelings of overwhelmingness, many of the interviewed teachers had a positive attitude toward online education, at least at some level. After the online education period, IT itself could be viewed more as an opportunity for education. The teachers could feel that they survived the COVID-19 situation well or that they could use online education in the future in specific situations. There were also a few mentions of different measures to promote well-being during online education.

> *Right now, I know things that I could have done in a way better manner, but I still think that [online education went] quite well. It didn't become a very negative thing for me. On the contrary, now I would know things to try out, and you never know how many of these situations can resurface in the future. -T19*

Many of the challenges identified by the teachers were related to problems with interaction and reachability. For example, it was common that the teacher could not see whether their pupils were online and/or following the teaching. The teachers also felt that online interactions could not replace the low-threshold interaction that happens casually and effortlessly with pupils in a traditional classroom.

> *If you think about the hours spent teaching and planning of work. [The content of work changed] pretty much because all the interactive situations did not exist anymore. Basically, everything was done electronically, sending emails and the pupils' assignments. They are also electronic, and you're just looking at different files instead of the interaction. -T22*

> *For some, it went very well, and some, on the other hand, put in minimum effort, so you would notice that some of the children do need this sort of beautiful control from the adult, meaning that in a positive way [you say that] stop and concentrate on this thing or relax, there is no hurry anywhere right now – So this kind of [interaction] is skipped, which is especially probably needed by the younger pupils. -T6*

Even though interaction abilities were often brought up as challenges, some teachers found new ways to promote interaction by activating their pupils through questions or calling them on the phone. In some cases, casual interaction between the teacher and their group that was not present in traditional education could also emerge through online interactions.

> *You really try to ask them directly and things like that. So if they do not raise their hands, then you'll choose [the person] who gets to reply and such. -T4*

Another major theme brought up by the teachers was the challenges associated with planning education, which was found to require a different approach, potentially taking more time than with traditional education. The teachers were also concerned about how to keep the education engaging to the pupils and consider the different preferences and needs of their pupils without burdening them with school or homework.

> *It was more like when you woke up, you would basically turn on the computer and start thinking about instructions for the next day, or you have done it in the previous evening, but then, you start looking at the results coming in. So it was sort of this activity that just kept happening over and over, and you had to constantly come up with solutions for something like craft education and music-T9*

> *And even a bigger change was the change in pedagogy, so what and how could education be organized through technology and held in practice. Those were probably the greatest leaps. -T24*

Despite the challenges, positive experiences were also associated with online education. Typically, these were related to being able to find functional/good practices for organizing education. Some teachers also mentioned that online education made it easier for them to focus on the actual education activities. In addition, the teachers' and pupils' increased IT-related knowledge was discussed.

> *In my own education, this sort of low-threshold technology use has remained, where you can foster participation among children—even the more quiet ones. Asking for their opinions or different information retrieval tasks and such. So some things have remained in use. -T25*

> *I have this one colleague who still likes to use Teams; they have gotten so much out of it like "'Oh, this is so handy and you can do this and this and this…"-T2*

Online environments can have very different affordances when compared with traditional teaching-learning settings, affecting how education can be organized. This can affect the teacher–pupil interactions, for example, through a lack of engagement (Bray et al., 2021). Additionally, teachers' technostress experiences can be connected to their self-efficacy regarding the ability to deliver online teaching (Chou and Chou, 2021). The teachers also brought up technical challenges and difficulties with the IT adoption process. For example, there were some challenges in providing enough devices to the pupils. Additionally, network connectivity caused problems for both pupils and teachers alike. With IT adoption, the difficulties were often associated more with the rapid pace because of the time constraints set by the COVID-19 situation. Many teachers noted that migration to online education was a significant change in their lives, with some describing feelings of general insecurity in relation to IT use or online education. Finally, the support received from school, as well as the IT readiness level, was not always sufficient.

> *First, I thought about whether I could reach the children. Like, how can we get these connections to work so that the learning is even possible. But the working of the devices is probably something that left me wondering what if these things do not work. If you have to adopt a new software or something else in a very short amount of time, then, of course, it can be stressful. -T19*

Teachers' technostress experiences can relate to their IT use competence, fit between IT use and teaching style and the support received from school (Syvänen et al., 2016). In the case of online education, the pace of migration could cause situations where the IT affordances or the support provided by the school were not at the level required by the new education mode (Solís García et al., 2021). However, in contrast to technical challenges, the teachers mentioned different ways to overcome IT-related difficulties, as well as the technical possibilities of online education. For example, the software used could be changed, and it was noted that IT use can bring flexibility to arranging work. Additionally, many teachers noted that the IT readiness in their school was on a good level or had improved over time. In addition to official channels, the teachers could receive support for using IT from their close colleagues or networks. Finally, some teachers mentioned that migration to online education went surprisingly well.

> *Everyone was just learning, so it was in that sense nice that no one was alone, that everyone was fighting with the same problems. So together, we tried to solace them and think about how we could move forward. -T19*

High level of support from school and positive attitude towards IT can be connected with low levels of technostress (Syvänen et al., 2016). Thus, both organizational and individual factors can underlie IT use experiences. Finally, the teachers discussed the topic of following the progress of their pupils' learning, as well as the impacts that online education and isolation might have on their well-being. For example, it was mentioned that certain pupils might require more support, which could be difficult to provide online. The effects of prolonged online education were also discussed.

> *Sitting in front of the screen is not a very natural way for many children, even though you might think that because they are digital natives. Many viewed sitting by the screen as taxing. -T1*

> *It is precisely about getting to work, and it might feel too abstract that the teacher sends you the assignments and then you discuss and say that you meet in the evening or something like that. It's like the self-regulation skills that are easy for us [adults] – It is too abstract for them -- and at that time, I could see many of these pupils who kind of began the process of marginalization. So the [time period] was so long that they could get left behind. -T14*

These challenges can be seen to relate to the COVID-19 situation itself, the limitations of IT-enabled education, and the individual traits of the pupils. For example, the effects of the COVID-19 situation on well-being can differ across people (Möhring et al., 2020). The teachers were able to find solutions to some of the challenges, for example by giving additional support to certain pupils (e.g., by calling them on the phone), or by providing more flexibility in how the pupils completed their assignments. The teachers also noted that online education suited some pupils very well (e.g., getting assignments done quicker or being able to complete assignments at their own pace).

> *And of course, there were the ones who thought that remote mode was the best thing ever, like you spent two hours on assignments, and the rest of the time, you could relax or play games. -T15*

Often, the teachers' actions to cope with the challenges related to using the beneficial affordances of the IT at hand to foster learning. Outside the classroom context, the teachers could also take action to promote their own well-being or that of their pupils. Many of the actions identified by the teachers can be viewed as problem-focused strategies to solve technology-related problems and, thus, as connected to the technostress mitigation literature (see, e.g., Salo et al., 2022). However, the role and characteristics of different actors, including pupils and the school, should not be overlooked and might sometimes be outside the control of an individual teacher.

5 Discussion

Although the results exemplified various IT use-related challenges in traditional and online education, different actions can also be taken to address and prevent problems. Additionally, certain dimensions of IT use that might include challenges can also be viewed from an opportunistic point of view. However, educational settings can include complexity because different actors (e.g., teacher, pupils) and affordances (e.g., available hardware and software, school practices) can have an influential role in how education can be organized in different situations. Because the challenges and solutions identified in the present study are complementary to the literature and are expected to be useful for schools in different ways, the results have relevance for both research and practice.

5.1 Research contributions

Because of their dimensionality, the findings of this study can be connected with various research areas, such as online/distance learning, remote work, technostress, and IT use in schools. While these topics overlap with each other, they also provide different aspects to consider depending on the phenomenon studied. For example, technostress can be experienced by children and adults alike (see, e.g., Mahapatra and Pillai, 2018; Schmidt, Frank and Gimpel, 2021), and leisure-related technostress might differ from the type experienced in work contexts (Salo, Pirkkalainen and Koskelainen, 2019). Simi-

larly, specific characteristics of remote work might be associated with stress (see, e.g., Galanti et al., 2021), but employees working in seemingly similar work settings might not have the same experiences. Thus, although the role and context in which stressful experiences occur are important, the experiences of individuals need to be considered in relation to their own perceptions, feelings, and explanations given to different situations.

The teachers brought up IT use-related technical challenges in both traditional and online education settings. In terms of technostress, this can sometimes relate to feelings of techno-overload. In techno-overload, it is characteristic for a greater number of work activities to be carried out using IT, with the perception that IT can create additional work because of its complexity or other qualities (Tarafdar et al., 2007). This was especially true for online learning because many activities needed to be transferred into online environments. In general, technical problems seem to be characteristic barriers for online education (Mäkelä et al., 2020).

IT use could also invade or strain the lives of teachers and pupils alike. The teachers discussed how the blending of work and leisure time, the demand for continuous reachability, or prolonged workdays negatively affected them. These kinds of experiences can be viewed as being associated with techno-invasion, which refers to IT-enabled connectivity that might blur the boundaries between work and leisure time (see Tarafdar et al., 2007). The teachers also brought up IT use-related physical and psychological well-being outcomes experienced by their pupils or themselves, especially during online education. These can be termed strains, which are the adverse outcomes associated with technostress experiences (see, e.g., Tarafdar, Pullins and Ragu-Nathan, 2015). In terms of work well-being, adverse effects of IT use can also be portrayed through an individual's personal tendencies, as opposed to the demands placed by the institution (Ninaus et al., 2015). Additionally, online education has been viewed to negatively affect the lifestyle and rhythm of children (Wang et al., 2020).

Although the degree of IT use can greatly vary in different educational settings, the varied IT skills of teachers and pupils came up in the experiences related to both traditional and online education. In some cases, these challenges can be linked with techno-complexity (see Tarafdar et al., 2007) as an individual's abilities to learn to use a new IT might be limited by time constraints or viewing ITs as too complex for other reasons. Some problems identified with the school's IT adoption processes could also be associated with techno-uncertainty. This refers to the feeling that there is a constant need for learning to use new ITs or changes to the ITs used (Tarafdar et al., 2007). In school environments, new ITs need to be adopted at an increasing rate as the technologies and demands for both teachers and pupils change. Even though the COVID-19 situation accelerated the digitization process of education, the experiences of both teachers and pupils alike should be considered in the future to ensure that IT adoption processes do not exceed the capabilities of individuals. Additionally, the pedagogical value of IT should not be overlooked (see, e.g., Gellerstedt, Babaheidari and Svensson, 2018).

IT use could also create challenges for the concentration of pupils. In the case of traditional education, these effects were clearly visible to the teacher, as, for example, an unwanted advertisement might make it difficult to maintain the attention of the pupils on the intended task. However, for online education, the concentration of the pupils can sometimes be "a black box" for the teacher, and following the progress of pupils might become challenging. Even though a pupil would seemingly be online, the teacher does not have the same means as in traditional education to ensure that the pupils are listening and, more importantly, understanding the topic. Similar observations have also been made in previous studies (see, e.g., Bray et al., 2021). In this sense, some mundane but significant interaction practices used in the classroom can be lost in online education, calling for more attention toward social contacts and fostering online collaboration (see Mäkelä et al., 2020). The skills of teachers to use IT for education purposes, as well as the pupils' ability to use IT for learning, become especially crucial in online education. Thus, in addition to looking at the IT affordances, consideration must also be placed on the ways of using IT and the different layers that make up the teaching–learning processes. The IT readiness level of the school and the different support channels that are present should also be considered.

The findings of this study suggest that the characteristics of IT use in traditional and online education can comprise a complex whole, where different actors, technical capabilities, and (IT) practices can

have a noteworthy role in defining the fluency of educational activities. Even though teachers are resourceful and can address various challenges through problem-focused strategies, they are limited by the skills of their pupils (e.g., because of age level) and the resources provided by their institution (e.g., devices). Similarly, having up-to-date IT does not ensure proficient education activities because reaching teaching–learning goals requires the ability to use IT in a meaningful manner. The teachers in the current study also discussed the possibilities of using IT for education purposes. Similar advantages, such as flexibility and positive learning outcomes for some pupils, have been reported in earlier research on online education (see, e.g., Mäkelä et al., 2020). Even though many education activities can be performed through IT environments, some forms of interaction that are present in traditional classrooms can be difficult to replace. Thus, in addition to the IT skills of the teachers and pupils and the IT equipment available for them, attention should be placed on the age and education level of pupils, as well as the pedagogical meaningfulness of the teaching-learning processes that are placed in online environments.

5.2 Practical implications

The findings of the present study have practical relevance, especially to the everyday praxis of teachers. IT use has become an integral part of the teaching-learning activities carried out in modern schools, and the COVID-19 situation has given rise to a new era of the digitization of education. The interviewed teachers had the ability to discuss their IT use-related experiences in traditional education, and at the time of the interviews, some time had moved out of the online education period as well. Thus, the interviews provided rich data on teacher's experiences during very different times, including contemplations of the relevance of IT use for teaching. In addition to teachers, this study includes relevant information to schools and educational personnel within municipalities and cities.

The teachers also discussed the adverse effects associated with IT use in traditional and online education settings, as well as different strategies to address these problems. Although this information can be used by teachers themselves in planning school activities and looking after their own and their pupils' well-being, it can also be helpful for other parties. For example, well-being services (e.g., school or work psychologists) can use the results to build an understanding of the different dimensions of IT use that might be significant for specific physical or psychological well-being outcomes. Additionally, both parents and pupils alike can use the results to become more informed about the realities of IT use in schools and the possible well-being outcomes. Finally, the strategies used to address IT use-related problems can provide relevant actors concrete steps to take in various situations.

5.3 Limitations and future research

Although the present study addresses an important topic, it is not without limitations. First, the current study focused on the experiences of Finnish teachers. Although their experiences provide rich data about IT use in various educational settings and during different time periods, the findings might not be applicable to teachers working in other countries. Future research is needed to establish how the experiences of teachers might differ depending on the country or education system in question. Second, the teachers in the current study taught in comprehensive school. Even though many of the teachers simultaneously taught in upper secondary school as well, more research is required to build a better understanding of the digitization of teaching-learning activities at different educational levels. Third, at the time of the interviews, some time had passed from the initial online education period. Thus, to a degree, the teachers' experiences might be limited by their ability to recollect the events and feelings that occurred during this time. However, having time between the online education period and the interviews can also be viewed as a strength because the teachers' narratives might not be too closely entwined with the initial stress responses. Thus, the chosen timing might provide a more fruitful setting for bringing forth solutions and opportunities, alongside challenges. Fourth, the semi-structured interviews provided information about the teachers' personal experiences with IT use in traditional and online education settings. Collecting quantitative data (e.g., heart rate) could be used to provide other kinds of information about the stress responses of teachers. The IT use-related implications to pupils'

focus and class cohesion is a continuously evolving topic that requires understanding of the school IT environment as a whole. Although the teachers could describe and hold certain perceptions of their class or individual pupils, their pupils also have their individual views and perceptions. Future studies should continue exploring the complexity of children's IT use capabilities, practices, and preferences by focusing on different environments and actors that might be relevant in their daily lives (e.g., leisure time, parents).

6 Conclusions

The current research focused on the challenges associated with IT use in traditional and online education settings, as well as the actions taken to prevent, mitigate, or eliminate the effects of the problems on teachers' and pupils' everyday lives. Even though IT can be used in a different way in traditional education when compared with online education, similar challenges can be found in both settings. However, the dimensions of IT use emphasized in each context can vary. For example, the pace and degree of IT use in performing education activities might affect the identified challenges, as well as the available means to address them. Exploring the challenges, solutions, and opportunities associated with IT use in different educational settings is crucial for building a better understanding of the enablers and barriers of digitalization in education.

References

Alves, R., Lopes, T. and J. Precioso (2021). "Teachers' well-being in times of Covid-19 pandemic: Factors that explain professional well-being," IJERI: International Journal of Educational Research and Innovation (15), 203-217.

Anh, L. T., Whelan, E. and A. Umair (2022). "'You're still on mute'. A study of video conferencing fatigue during the COVID-19 pandemic from a technostress perspective," *Behaviour and Information Technology*, 1-15.

Bray, A., Banks, J., Devitt, A. and E. Ní Chorcora (2021). "Connection before content: Using multiple perspectives to examine student engagement during Covid-19 school closures in Ireland," *Irish Educational Studies* 40 (2), 431-441.

Chou, H. L. and C. Chou (2021). "A multigroup analysis of factors underlying teachers' technostress and their continuance intention toward online teaching," *Computers & Education* 175, 104335.

Claesdotter-Knutsson, E., André, F., Fridh, M., Delfin, C., Hakansson, A. and M. Lindström (2021). "Gender-based differences and associated factors surrounding excessive smartphone use among adolescents: Cross-sectional study," *JMIR Pediatrics and Parenting* 4 (4), e30889.

de Farias, B. G., Dutra-Thomé, L., Koller, S. H. and T. G. de Castro (2021). "Formulation of themes in qualitative research: Logical procedures and analytical paths," *Trends in Psychology* 29 (1), 155-166.

Eickelmann, B. and M. Vennemann (2017). "Teachers 'attitudes and beliefs regarding ICT in teaching and learning in European countries," *European Educational Research Journal* 16 (6), 733-761.

Ertmer, P. A. and A. T. Ottenbreit-Leftwich (2010). "Teacher technology change: How knowledge, confidence, beliefs, and culture intersect," *Journal of research on Technology in Education* 42(3), 255-284.

Estrada-Muñoz, C., Castillo, D., Vega-Muñoz, A. and J. Boada-Grau (2020). "Teacher technostress in the Chilean school system," *International Journal of Environmental Research and Public Health* 17(15), 5280.

European Commission (2019). *Education and training monitor 2019 - Finland.* Publications Office of the European Union. URL: https://education.ec.europa.eu/sites/default/files/document-library-docs/et-monitor-report-2019-finland_en.pdf (14.11.2022).

Felstead, A. and G. Henseke (2017). "Assessing the growth of remote working and its consequences for effort, well-being and work-life balance," *New Technology, Work and Employment* 32(3), 195-212.

Fernández-Batanero, J. M., Román-Graván, P., Reyes-Rebollo, M. M. and M. Montenegro-Rueda (2021). "Impact of educational technology on teacher stress and anxiety: A literature review," *International Journal of Environmental Research and Public Health* 18 (2), 548.

Galanti, T., Guidetti, G., Mazzei, E., Zappalà, S., and F. Toscano (2021). "Work from home during the COVID-19 outbreak: The impact on employees' remote work productivity, engagement, and stress," *Journal of Occupational and Environmental Medicine* 63 (7), e426.

Gellerstedt, M., Babaheidari, S. M. and L. Svensson (2018). "A first step towards a model for teachers' adoption of ICT pedagogy in schools," *Heliyon* 4 (9), e00786.

Giovannella, C., Marcello, P. and P. Donatella (2020). "The effects of the Covid-19 pandemic on Italian learning ecosystems: The school teachers' perspective at the steady state," *Id&a Interaction Design & Architecture(s)* 45, 264-286.

Joo, Y. J., Lim, K. Y. and N. H. Kim (2016). "The effects of secondary teachers' technostress on the intention to use technology in South Korea," *Computers & Education* 95, 114-122.

Kaarakainen, M. T., & Saikkonen, L. (2021). "Multilevel analysis of the educational use of technology: Quantity and versatility of digital technology usage in Finnish basic education schools," *Journal of Computer Assisted Learning*, 37(4), 953-965.

Kaden, U. (2020). "COVID-19 school closure-related changes to the professional life of a K–12 teacher," *Education Sciences* 10 (6), 165.

Kalimullina, O., Tarman, B. and I. Stepanova (2021). "Education in the context of digitalization and culture: Evolution of the teacher's role, pre-pandemic overview," *Journal of Ethnic and Cultural Studies* 8 (1), 226-238.

Kallio, H., Pietilä, A. M., Johnson, M. and M. Kangasniemi (2016). "Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide," *Journal of Advanced Nursing* 72 (12), 2954-2965.

Kennewell, S. and G. Beauchamp (2007). "The features of interactive whiteboards and their influence on learning," *Learning, Media and Technology* 32 (3), 227-241.

Kuusisto, M. (2017). "Organizational effects of digitalization: A literature review," *International Journal of Organization Theory and Behavior* 20(3), 341-362.

Kyriacou, C. (2001). "Teacher stress: Directions for future research," *Educational Review* 53 (1), 27-35.

Lazarus, R. S. and S. Folkman (1984). *Stress, appraisal, and coping*. New York: Springer Publishing Company.

Lindqvist, M. H. and F. Pettersson (2019). "Digitalization and school leadership: On the complexity of leading for digitalization in school," *The International Journal of Information and Learning Technology* 36(3), 218-230.

Mahapatra, M. and R. Pillai (2018). Technostress in organizations: A review of literature. In: *ECIS 2018 Proceedings* (Research papers, 99). Association for Information Systems (AIS).

Mehtälä, S., Salo, M., Tikka, S., and H. Pirkkalainen (2022). "Exploring early adolescents' stressful IT use experiences," *Behaviour and Information Technology*, 1-15.

Myers, M. D., and M. Newman (2007). "The qualitative interview in IS research: Examining the craft," *Information and organization* 17(1), 2-26.

Mäkelä, T., Mehtälä, S., Clements, K., and J. Seppä (2020). "Schools went online over one weekend – Opportunities and challenges for online education related to the COVID-19 crisis," in: *Proceedings of EdMedia + Innovate Learning* (pp. 77-85). The Netherlands: Association for the Advancement of Computing in Education (AACE). URL: https://www.learntechlib.org/primary/p/217288/.

Möhring, K., Naumann, E., Reifenscheid, M., Wenz, A., Rettig, T., Krieger, U., ... and A. G. Blom (2021). "The COVID-19 pandemic and subjective well-being: Longitudinal evidence on satisfaction with work and family," *European Societies* 23 (sup1), S601-S617.

Ninaus, K., Diehl, S., Terlutter, R., Chan, K. and A. Huang (2015). "Benefits and stressors–Perceived effects of ICT use on employee health and work stress: An exploratory study from Austria and Hong Kong," *International Journal of Qualitative Studies on Health and Well-being* 10 (1), 28838.

Parker, C., Scott, S. and A. Geddes (2019). *Snowball sampling*. SAGE Research Methods Foundations.

Player-Koro, C. (2012). "Factors influencing teachers' use of ICT in education," Education Inquiry, 3(1), 93-108.

Qi, C. (2019). "A double-edged sword? Exploring the impact of students' academic usage of mobile devices on technostress and academic performance," *Behaviour & Information Technology* 38(12), 1337-1354.

Qureshi, M. I., Khan, N., Raza, H., Imran, A. and F. Ismail (2021). "Digital technologies in education 4.0. Does it enhance the effectiveness of learning?," *International Journal of Interactive Mobile Technologies* 15(4).

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S. and Q. Tu (2008). "The consequences of technostress for end users in organizations: Conceptual development and empirical validation," *Information Systems Research* 19 (4), 417-433.

Raza, M. Y., Khan, A. N., Khan, N. A., Ali, A. and S. Bano (2020). "Dark side of social media and academic performance of public sector schools students: Role of parental school support," *Journal of Public Affairs* 20 (3), e2058.

Reid, P. (2014). "Categories for barriers to the adoption of instructional technologies," *Education and Information Technologies* 19 (2), 383-407.

Salo, M., Pirkkalainen, H., Chua, C. E. H. and T. Koskelainen (2022). "Formation and Mitigation of Technostress in the Personal Use of IT," *MIS Quarterly* 46(2), 1073-1108.

Salo, M., Pirkkalainen, H. and T. Koskelainen (2019). "Technostress and social networking services: Explaining users' concentration, sleep, identity, and social relation problems," *Information Systems Journal* 29 (2), 408-435.4

Schmidt, M., Frank, L. and H. Gimpel (2021). "How adolescents cope with technostress: A mixed-methods approach," *International Journal of Electronic Commerce* 25 (2), 154-180.

Seufert, S., Guggemos, J. and M. Sailer (2021). "Technology-related knowledge, skills, and attitudes of pre-and in-service teachers: The current situation and emerging trends," *Computers in Human Behavior* 115, 106552.

Syvänen, A., Mäkiniemi, J. P., Syrjä, S., Heikkilä-Tammi, K. & J. Viteli (2016, November). When does the educational use of ICT become a source of technostress for Finnish teachers?. In *Seminar. net* (Vol. 12, No. 2).

Tarafdar, M., Maier, C., Laumer, S. and T. Weitzel (2020). "Explaining the link between technostress and technology addiction for social networking sites: A study of distraction as a coping behavior," *Information Systems Journal* 30 (1), 96-124.

Tarafdar, M., Pullins, E. B. and T. S. Ragu-Nathan (2015). "Technostress: Negative effect on performance and possible mitigations," *Information Systems Journal* 25 (2), 103-132.

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

Upadhyaya, P. (2021). "Impact of technostress on academic productivity of university students," *Education and Information Technologies* 26(2), 1647-1664.

Wang, G., Zhang, Y., Zhao, J., Zhang, J. and F. Jiang (2020). "Mitigate the effects of home confinement on children during the COVID-19 outbreak," *The Lancet* 395 (10228), 945-947.

Wang, X., Tan, S. C. and L. Li (2020). "Technostress in university students' technology-enhanced learning: An investigation from multidimensional person-environment misfit," *Computers in Human Behavior* 105, 106208.

Weston, C., Gandell, T., Beauchamp, J., McAlpine, L., Wiseman, C. and C. Beauchamp (2001). "Analyzing interview data: The development and evolution of a coding system," *Qualitative sociology* 24(3), 381-400.

Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., ... and J. Teevan (2022). "The effects of remote work on collaboration among information workers," *Nature human behaviour* 6(1), 43-54.

Zhao, Y. and J. Watterston (2021). "The changes we need: Education post COVID-19," *Journal of Educational Change* 22 (1), 3-12.