JYU DISSERTATIONS 655

Saana Mehtälä

The Role of Information Technology in the Well-Being of Young People in School and Leisure Contexts

Perspectives from IT Use and Design

UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF INFORMATION TECHNOLOGY

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Perspectives from IT Use and Design

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ABSTRACT

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Information technology (IT) and its applications have become integral parts of modern society. The implications of IT use have been widely discussed, including both the beneficial and adverse effects on the well-being of individuals. In the case of young people under 18 years of age, the amount of time spent using IT on a daily basis has received much attention in the literature. However, there is limited knowledge about the complexities surrounding young people's stressful IT use experiences, coping and well-being as well as challenges related to online education and school life. Thus, the present doctoral dissertation aims to add an understanding of how young people's use of IT relates to their well-being. More specifically, the main contributions of the current dissertation include uncovering the following: 1) young people's stressful IT use experiences, 2) problem-focused coping strategies used by young people to address stressful IT use experiences, 3) teachers' views of IT use–related challenges with online and onsite education, 4) teachers' views of the challenges related to pupils' online interactions and strategies to facilitate school life, and 5) the design features of ITs designed to promote the mental health and well-being of children and young people. Young people's stressful experiences relate to different dimensions of IT use, and they can effectively use problem-focused strategies to address them. Teachers can identify challenges associated with IT use for onsite and online education that seem to be affected by the degree and pace of IT use. Teachers can find addressing the online interactions of pupils as taxing, creating the need for establishing clearer roles and responsibilities for different actors. Finally, the ITs targeted to young people could benefit from paying more attention to the mental health and well-being context, as well as focusing on young people as a user group. The results of the dissertation show that the connections of IT use to well-being relate to the technological, social, and individual characteristics that should be considered in their respective IT use contexts. Future research should aim to further explore the dimensionality of young people's IT use that might contribute to different level well-being outcomes.

Keywords: information technology, well-being, young people, leisure, school, teachers

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Mehtälä, Saana
Informaatioteknologian rooli nuorten hyvinvoinnille koulun ja vapaa-ajan konteksteissa: Näkökulmia IT:n käyttöön ja suunnitteluun
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Informaatioteknologiasta (IT) ja sen sovelluksista on tullut kiinteä osa nykyaikaista yhteiskuntaa. IT:n käytön mahdollisista vaikutuksista yhteiskunnan eri aloilla on keskusteltu laajasti, pitäen sisälleen myönteiset ja kielteiset vaikutuksen yksilöiden hyvinvointiin. Alle 18-vuotiaiden nuorten kohdalla IT:n parissa päivittäin vietetty aika on saanut erityisen paljon huomiota kirjallisuudessa. Nuorten stressaavat IT:n käyttökokemukset, selviytymiskeinot ja hyvinvointi sekä online-opetus ja kouluelämä muodostavat kuitenkin monitahoisia kokonaisuuksia, joihin liittyvä ymmärrys on rajallista. Tämä väitöskirja pyrkii lisäämään tietämystä IT:n käytön yhteyksistä nuorten hyvinvointiin. Väitöskirjan pääasiallisina kontribuutioina rakennetaan ymmärrystä 1) nuorten stressaavista IT:n käyttökokemuksista 2) nuorten ongelmakeskeisistä selviytymisstrategioista stressaavien IT:n käyttökokemusten hallintaan 3) opettajien näkemyksistä IT:n käyttöön liittyvistä haasteista perinteisessä ja online-opetuksessa 4) opettajien näkemyksistä oppilaiden online-vuorovaikutukseen liittyvistä haasteista ja niihin liittyvistä strategioista kouluarjen helpottamiseksi sekä 5) lapsille ja nuorille suunnattujen mielenterveys- ja hyvinvointisivustojen ja -sovellusten suunnitteluelementeistä. Nuorten stressaavat IT:n käyttökokemukset voivat liittyä useisiin IT:n käyttöulottuvuuksiin ja he osaavat tehokkaasti käyttää ongelmakeskeisiä selviytymiskeinoja tilanteiden hallintaan. Opettajat voivat tunnistaa IT:n käyttöön liittyviä haasteita sekä perinteisessä että online-opetuksessa ja havaittuihin haasteisiin näyttäisi vaikuttavan IT:n käytön aste ja tahti. Oppilaiden sosiaalisen vuorovaikutuksen haasteiden ratkaiseminen voi tuntua opettajista kuormittavalta, luoden tarpeen eri toimijoiden roolien ja vastuiden selkeämpään määrittämiseen. Lapsille ja nuorille suunnatut digitaaliset ratkaisut voisivat puolestaan hyötyä mielenterveyskontekstin sekä nuorten käyttäjien paremmasta huomioimisesta. Väitöskirjan tulokset osoittavat, että IT:n käytön yhteydet hyvinvointiin liittyvät teknologisiin, sosiaalisiin ja yksilökohtaisiin tekijöihin, joita tulisi tarkastella omassa IT:n käyttökontekstissaan. Tulevan tutkimuksen tulisi pyrkiä selvittämään IT:n käytön moniulotteisuutta sekä siihen liittyviä eritasoisia hyvinvointivaikutuksia yhä syvemmällä tasolla.

Asiasanat: informaatioteknologia, hyvinvointi, nuoret, vapaa-aika, koulu, opettajat

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Jyväskylä 11.5.2023
Saana Mehtälä

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II Mehtälä, S., Salo, M., Tikka, S., & Pirkkalainen, H. (2022). Exploring early adolescents' problem-focused strategies for coping with stressful IT use experiences. In *Proceedings of the 30th European Conference on Information Systems (Article 6)*. European Conference on Information Systems.

III Mehtälä, S., Salo, M., Rinne, A., Koskelainen, T., & Pirkkalainen, H. (2023). Schoolteachers' experiences of the challenges associated with information technology use in traditional and online education. Article accepted to the *14th Scandinavian Conference on Information Systems (SCIS2023)*.

IV Mehtälä, S., Salo, M., & Pirkkalainen, H. (2023). Teachers' perceptions of the challenges with pupils' online social interaction. Article under review in a journal.

V Mehtälä, S., Kankaanranta, M., Rousi, R., & Clements, K. (2019). Digital mental health resources for children and youth: Evaluation of strengths in user interface design. In *EdMedia+ Innovate Learning* (pp. 1863–1871). Association for the Advancement of Computing in Education (AACE).

Saana Mehtälä is the first author of all included articles and made the most significant contribution to each one. In addition to article writing, this included data collection and analysis tasks regarding the interviews with young people (articles I and II) and teachers (articles III and IV), as well as the heuristic evaluation carried out in article V. Master's students Aleksiina Rinne and Sara Tikka collected a part of the interview data for their master's theses. Mehtälä used the initial version of the interview scheme created by Sara Tikka with the assistance of their supervisor Markus Salo as a basis for the interviews she collected and further developed it for the purposes of her dissertation research. Other authors of the articles contributed to writing and commenting. Additionally, they provided comprehensive guidance and insight into the design and execution of each study that they were affiliated with.

1 INTRODUCTION

Information technology (IT) use has become integrated into the activities that many people engage in their daily lives. Devices such as smartphones are used both for leisure and work-related communication, and the use of online platforms (e.g., social media) has enabled the blending of activities occurring in both the physical and online worlds. Although prior research on information systems (IS) has noted that IT use can include benefits such as perceptions of increased productivity in organizational contexts (see, e.g., Aral et al., 2012; Brynjolfsson & Yang, 1996) or enjoyment related to hedonic use (Van der Heijden, 2004), negative outcomes can also be connected with different forms of IT use. For example, comparing oneself to others on social media platforms has been connected to a decrease in a person's self-esteem (Krause et al., 2021). Thus, understanding IT use requires attention to the technological, social, and individual characteristics that might underlie specific outcomes.

In the school environment, IT can be used to support learning and provide new opportunities for the teaching–learning processes (see, e.g., Dede, 2008; Haßler et al., 2016). However, IT use in education can be seen as a complex process that is affected by different factors, such as the attitude and skills of teachers (Jimoyiannis & Komis, 2007; Seufert et al., 2021). In turn, young people are often viewed as active IT users who tend to spend time in online environments. However, IS research has traditionally viewed IT users through a relatively narrow scope, calling for a better understanding of the contextual and social characteristics associated with IT use (Lamb & Kling, 2003). Because the IT used and the school/work and leisure contexts might differ from one another, it is important to consider the various aspects that might affect IT use. For instance, the conventions of using IT for work and school purposes can include characteristics (e.g., different motives and restrictions) that are not present in leisure-related IT use. Additionally, the design features of IT artifacts can create boundaries for IT use, making the design and use dimensions inherently intertwined perspectives. The experiences of individuals are also personal, stressing the importance of gathering insights from a multitude of individuals who are acting in different roles (e.g., from young people and teachers).

There are many ways to define what constitutes the age group of young people. In the present dissertation, this terminology is mainly used to portray the age group of children and adolescents. In addition to the aforementioned terms, wordings such as young IT users, youth, and early adolescents can also be used. However, especially in the original articles underlying the current dissertation, terminology has been chosen that most fittingly describes the age group in question (e.g., *early adolescents* for the interviewees who were between 9 and 15 years of age). Nevertheless, defining specific age boundaries for these terms can be difficult. In the literature, adolescence is often viewed as the age period between 10 and 19 years, but extending even up to 24 years (Sawyer et al., 2018). From the point of view of the dissertation as a whole, it is important that the discussions represent all the age groups included in the studies in the best way possible, without becoming tedious to the reader.

The current research aims to build an understanding of how IT use and design can contribute to the well-being of young people. This topic is important because IT use is an integrated part of young people's lives and has seen an increase in its significance in different domains, such as the school environment (e.g., because of the COVID-19 pandemic). However, past research has identified the barriers related to online education (Mäkelä et al., 2020), and even ITs that are explicitly designed for well-being purposes might not meet the expectations of young people (Wetterlin et al., 2014). Additionally, young people can experience technostress (i.e., stress related to IT use), but their experiences and related coping strategies have received little research attention thus far (Schmidt et al., 2021). Thus, the current dissertation aims to embrace the multidimensionality of adolescents' IT use and its contexts (e.g., school and leisure) to bring forth more implicit aspects that might contribute to well-being.

The articles comprising the current dissertation discuss the topics of stressful IT use and problem-focused coping, IT use–related challenges in online and onsite education, online social interactions, and the design features of mental health and well-being websites and applications. The aim of the current dissertation is to build understanding of the complex social, technological and individual aspects that connect IT use/design and the well-being of young people. The overall objective of the dissertation is to uncover *what kind of connections can be found between the well-being of young people and the ITs and related environments that are relevant for them*. Thus, while emphasizing the meaningfulness of human experience, the research also sheds light on IT artifacts and IT use as complex entities that should not be reduced to their physical or temporal representation. The majority of the articles use semi-structured interviews (with 31 young people and 26 teachers) and thematic analysis as the main methods for data collection and analysis. These approaches were chosen because of their ability to provide rich results that take into account the depth of individual experiences. Additionally, heuristic evaluation of 49 well-being applications and websites has been used in one article to address the well-being topic from a design perspective. The more specific research questions and the contributions of each sub-study are presented in Table 1.

TABLE 1 The research questions, research methods used for data collection/analysis, and contributions of the dissertation

Research Question	Main Method(s)	Contribution
What kind of stressful experiences do young people have in relation to IT use? (addressed in article I)	Semi-structured Interview & Thematic Analysis	The study explores young people's stressful experiences in school and home contexts and discusses them in relation to different aspects of IT use.
What kind of problem-focused coping strategies can young people use to address the stressful experiences related to IT use? (addressed in article II)	Semi-structured Interview & Thematic Analysis	The study explores young people's IT use–related coping strategies and aligns them with the level of IT use.
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? (addressed in article III)	Semi-structured Interview & Thematic Analysis	The study explores and compares comprehensive school teachers' experiences of the challenges related to IT use in onsite and online education.
What kind of challenges affecting daily school life relate to pupils' online social interactions and how can they be addressed? (addressed in article IV)	Semi-structured Interview & Thematic Analysis	The study explores comprehensive school teachers' experiences and views regarding pupils' online social interactions and their effects on everyday school life.
What are mental health and well-being websites and applications designed for young people like in terms of design? (addressed in article V)	Heuristic Evaluation	The study provides IT design heuristics in the context of young people's mental health and well-being and identifies design strengths and weaknesses in existing ITs.

As a whole, the results of the present dissertation contribute to the intertwined perspectives of IT use and design by addressing the different layers of IT use that might be connected with young people's well-being. Because IT-related phenomena can be viewed as dynamic and emerging by default (see, e.g., Monteiro et al., 2023), IS researchers have the opportunity to embrace the complex entities that constitute IT use, creating continuity and making sense of the wider context. The current dissertation contributes to research by showing that, although young people can have stressful experiences in relation to IT use, their experiences can vary in the degree of stress. Additionally, the experiences of the participants can often be characterized as mild or moderate and are generally associated with different dimensions of social media use or

notifications arriving at one's phone (article I). Young people are also skillful in using problem-focused strategies to cope with stressful experiences, and they can modify their own behavior or the characteristics of the IT used, depending on the situation at hand (article II). In the school environment, teachers have identified similar challenges relating to IT use in onsite and online education (e.g., the well-being of teachers and technical difficulties). Because these educational settings differ (e.g., in terms of the extent of IT use), frequent challenges in online education include difficulties with planning education activities and not knowing whether or not the pupils are following and keeping up with the education (article III). Teachers can also identify challenges related to pupils' online social interaction (e.g., online conflicts) that might affect the daily life in schools. From the teachers' perspective, one of the most significant challenges is the obscurity and the boundaries of the role of the teacher in solving situations that might cross the traditional boundaries between school and home. However, teachers can use strategies to address problematic situations, such as solving them case by case in collaboration with parents or by raising general discussions with the whole class (article IV). The final article of the present dissertation (article V) evaluates the design features of mental health and well-being websites and applications targeted at young people. The findings suggest that, although websites and applications can follow basic design guidelines, there might be a need to pay more attention to design that better takes into account young people as a target group and the sensitivity of the mental health and well-being context (e.g., by establishing a narrower age range or by providing sources to content provided).

Although the current dissertation represents IS research, the results can also be connected with research on other fields as well (e.g., education). In discussing young people's well-being, the dissertation has clear societal relevance, and the results have the potential to inform teachers' everyday praxis. The present dissertation can be beneficial for different stakeholders interacting with young people, such as school social workers, school psychologists, and parents. In addition, the results can help inform design, making the dissertation relevant for organizations developing IT for young people (e.g., edtech companies).

The next part of the current dissertation introduces the theoretical foundation underlying the research, presents the related topics including IT use among young people, the connections between IT use and well-being (e.g., technostress), and the design of ITs for well-being purposes. In the research methodology, the methodological basis of the research is discussed, including the descriptions and rationale for the data collection and analysis methods used. After this, the contents of the five articles that comprise the present dissertation are summarized to provide an overview of the research (the original articles can be found at the end of the dissertation). This is followed by a discussion of the dissertation's contributions in terms of research and practical relevance. Additionally, the limitations are discussed along with topics for future research. Finally, a Finnish summary of the contents of the research is provided at the end.

2 THEORETICAL BACKGROUND

The present chapter discusses the research underlying the doctoral dissertation with the help of two overarching themes. First, the topic of IT use among young people is discussed. This includes references to leisure and school contexts, extending the content of this section to IT use in teaching–learning processes. Second, the connections between IT use and well-being are discussed. Because there is an exhaustive body of literature covering different aspects of these topics, this chapter aims to focus on research that is especially relevant from the viewpoint of the dissertation topic. Both negative and positive well-being outcomes associated with IT use are introduced, with particular attention paid to the topics of technostress and related coping. The chapter concludes with considerations for designing IT to promote well-being, focusing on the role of IT characteristics in the process.

IT use is one of the most widely studied themes within the IS discipline (Córdoba et al., 2012; Straub & del Guidice, 2012) because of its various favorable and unfavorable consequences (e.g., related to well-being) (Burton-Jones et al., 2017). It is a crucial topic for connecting the IT artifact with human factors because IT use itself can reflect different motivations, influencers, and outcomes depending on the use context, IT artifact, individual, or group in question. In IS research, IT use is generally discussed in the work or leisure context, with the former being the most prominent perspective in the organization-dominant research tradition. However, together with technological development and the fact that IT use has been gaining increasing significance in the everyday life of people, leisure-related research endeavors have also become more influential. IT users can have various roles in the different contexts in which they have agency (Lamb & Kling, 2003). This continuity makes it crucial to find the connections between the contexts and to pay attention to the individual who might play a role in defining the nature of an IT use experience. Thus, the characteristics of different dimensions of IT use, as well as their connections, should be thoroughly explored to understand their underlying processes.

2.1 IT use among young people

Traditionally, IS research has focused on organizations and IT use from an adult perspective. However, for a long time, the topic of IT use among young people has been discussed in various research domains, including child development, communication, and education. Because children and adolescents are already active users of IT (see, e.g., Kinnunen et al., 2022; Lenhart et al., 2011) and are expected to gain more roles (e.g., related to working life) in the future, it is crucial to understand their experiences and how they might be shaped in relation to the current technological affordances (i.e., opportunities provided by new ITs).

2.1.1 IT use during leisure

Younger generations have often been viewed as eager to embrace the possibilities provided by new technologies. In today's leisure context, IT use among children and adolescents often entails frequent digital game playing (Kinnunen et al., 2022) and social media use (Gray, 2018). In particular, young people seem to actively engage with online environments that enable social interaction (see, e.g., Mäntymäki & Salo, 2011). In terms of devices used, mobile devices (e.g., smartphones and tablets) seem to attract young IT users (Lauricella et al., 2014). However, changes in preferred online platforms (e.g., social media) can sometimes be quick, making it important for researchers to follow IT use trends (Adams et al., 2013; Drehlich et al., 2020). In addition to the types of online environments and devices used, it is also also important to pay attention to the nature of the IT use activities performed.

The different ways young people use IT can be inspected in many ways depending on the level of observation. For example, the aim of IT use can be to decrease feelings of boredom, but it can also include intentional relaxation activities or building meaningful connections with friends (Allaby & Shannon, 2019). Social media use, for example, can be divided into the technical (e.g., software and devices enabling social media use), material (e.g., text and images produced), social (e.g., the nature of peer interactions), and motivational dimensions (e.g., values that relate to young people's habits) (Swist et al., 2015). Individual motives (e.g., enjoyment, self-expression) can be identified when inspecting digital game playing among young people, but various personal, social, institutional, and even societal factors can play a role in the process (Meriläinen, 2023). Similarly, intrinsic motivation, self-efficacy and interpersonal influence can explain young people's continued use of online environments (Mäntymäki et al., 2014). Thus, the interplay between IT characteristics, related affordances, and user actions and habits can be seen as a multidimensional entity, the understanding of which requires a deeper understanding of situation-specific factors and the wider IT use context.

Although activities such as game playing or social media use can be viewed as a pleasurable pastime, different domains of children's and young people's IT use have been traditionally discussed in a critical light. For example, although

the parents' attitudes toward gaming can vary (e.g., because of life situation or experience), adolescent boys can perceive the attitudes of their parents even as very negative or indifferent (Meriläinen, 2021). In the educational context, the time spent playing digital games has been viewed as a negative predictor of academic performance (Jackson et al., 2008). Regarding social media use, common concerns have traditionally included dimensions such as privacy, safety, and social development (Ahn, 2011). Although the voices of parents can be prominent in the public discourse regarding the online safety of children, dimensions of (parental) control and trust can also be discussed together and exist simultaneously (Hartikainen et al., 2016).

Although leisure-related social media use has also been negatively connected to academic performance, current research has noted that social media use can also be used to support learning processes (Luo et al., 2020). Additionally, young people's leisure-related IT use can include socialization benefits (O'Keeffe et al., 2011; Pujazon-Zazik & Park, 2010). Thus, both beneficial and harmful effects can be connected with young people's leisure-related IT use depending on which dimension of IT use is under scrutiny. Although this might often include portraying IT use in research through utilitarian value (i.e., barriers or opportunities for learning and development), IT use (e.g., social media use and game playing) can be valuable to young people for various reasons (e.g., joyfulness of the activity itself). Learning and development can also be intrinsically motivational and be present in activities that are typically portrayed as hedonic (e.g., in digital gaming; see Meriläinen, 2023). Similarly, joyfulness can be present in different educational contexts (e.g., in informal technology education; see Pienimäki et al., 2021). Thus, understanding the dimensionality of leisure-related IT use requires an in-depth exploration of young people's personal experiences.

2.1.2 IT use in school

Devices such as tablets and laptops have been increasingly used in schools because their benefits for schoolwork have been acknowledged. For example, many publishers offer online learning and teaching materials for teachers and pupils to use. Similarly, digital games can be used to promote educational causes such as learning social skills (Zheng et al., 2021) or languages (Hung et al., 2018). However, there has been much debate regarding the ways in which IT should be used in the education context (Livingstone, 2012), and the pedagogical reasoning of IT use in teaching–learning activities in particular has been brought up as an important point of development (Holmberg et al., 2018; Webb & Cox, 2004). Nevertheless, the school environment is becoming increasingly digitalized, making it important to embrace IT use and create strategies to address current and future pitfalls.

IT use in teaching has evolved over the years, together with the development of IT. Additionally, the ability of schools to provide hardware, software, and related training to teachers has taken great steps forward. However, a greater number of available IT and constant technological changes can also

create problems for teachers. For example, it might be difficult to establish what IT is relevant for your own subject or how to use IT to support teaching in a meaningful manner. This can be connected with the teacher's IT-related perceptions (i.e., positive attitude or anxiety), especially in top-down IT adoption processes (see, e.g., Chiu, 2017). IT use can also become stressful for teachers (see, e.g., Estrada-Muñoz et al., 2020), even contributing to burnout (Califf & Brooks, 2020). IT use–related stress can affect the intention to use IT for educational purposes (Joo et al., 2016), and be influenced by attitudes toward educational IT use, perceptions of own IT skills, fit between IT and teaching style and the support received from school (Syvänen et al., 2016). It can also relate to high-intensity situations, such as the migration to online education because of the COVID-19 crisis (Chou & Chou, 2021). Thus, it is important to consider the topic of teacher well-being together with any discussions regarding IT use practices in daily school life.

Although pupils' school-related IT use can be restricted by the rules and activities set by their teachers, there is a need to consider IT use from young people's perspective. For example, considering the preferences of learners can be crucial for the design of new ITs, and the satisfaction of users might also affect their willingness to use the system for learning purposes (Kuzmanović et al., 2019). Because of the COVID-19 situation, great leaps in the digitalization of education were not only taken by teachers, but also by the pupils and their parents as well (Iivari et al., 2020). However, IT use in the classroom predominantly depends on teacher-, school-, and municipality-level issues, such as barriers to IT access or a lack of planning and preparation time (Francom, 2016). Additionally, the attitudes of teachers can affect their views and intentions regarding IT integration (Jimoyiannis & Komis, 2007; Scherer & Teo, 2019). Finally, teacher–pupil collaboration might become invaluable for building functional and meaningful teaching and learning experiences for the whole class.

Although the topic of IT use among young people has been extensively studied in past research, it is clear that there is a need to add depth to how IT use is understood in research. In particular, IS research has a lot to offer to this perspective because these topics are part of its research tradition. Thus, to understand the multidimensionality of young IT users and the online environments in which they engage in their everyday lives, future research needs to go beyond temporal and physical representations of IT use and shift the focus to the nature of IT use and the IT artifact itself.

2.2 Health and well-being outcomes in young people's IT use

Although IT use can bring many benefits at the organizational and individual levels, the literature discussing the relationship between IT use and the well-being of young people has often focused on negative well-being outcomes (e.g., because of excessive IT use). IT use can be connected with behaviors such as sedentariness (see, e.g., Vandelanotte et al., 2009), which has sparked debate

regarding the potential detrimental health effects of sedentary behavior affecting children and young people as well (e.g., Biddle et al., 2004; Pate et al., 2011). The use of specific types of online environments (e.g., social media) has also been connected with poor mental health outcomes among young people, such as mental distress and depressive symptoms (e.g., Abi-Jaoude et al., 2020; Kelly et al., 2018). However, IT use can be connected with a variety of physical and psychological health and well-being outcomes, all of which are not negative in nature. Thus, many different perspectives need to be considered to understand the complexity of the relationship between IT use and the well-being of young people.

Childhood and adolescence can be considered crucial time periods for an individual because the models formed in youth can affect life-long well-being (McDaid, 2016). Consequently, extensive IT use has often been viewed as a threat to the future health and well-being of young people. For example, excessive screen time has been connected with poor health outcomes in relation to sleep, metabolism, and mental health (Cao et al., 2011; Hale & Guan, 2015; Hardy et al., 2010), and it is suggested that some psychological or physiological outcomes associated with IT use might affect health and well-being in adulthood (e.g., Lissak, 2018).

Even though IT use might have a negative connotation in terms of well-being, more current research has questioned the strength of the connection between IT use among young people and poor well-being outcomes (Dienlin & Johannes, 2020; Orben & Przybylski, 2019). Consequently, current IT use recommendations considering young IT users might need a more solid research basis (Gottschalk, 2019). Especially during the COVID-19 crisis, IT-enabled social interaction and other positive experiences in online environments could foster the well-being of young people (Marciano et al., 2022). Because of this, there is a need to consider the shifting IT use trends and dimensionality of IT use from a well-being perspective. However, the negative states and outcomes related to IT use can also have different layers, making it important to pay attention to those phenomena affecting the health and well-being of young people that might be more implicit in nature.

2.2.1 Stress, coping, and IT use

Stress is a natural part of human life and can be defined as a situation where an individual views their relationship to the environment as somehow taxing or overwhelming, putting their well-being at risk (Lazarus & Folkman, 1984, p. 19). According to the transactional theory of stress, the relationship between an individual and their environment can be viewed as reciprocal (Lazarus & Folkman, 1984, p. 325). The individual's evaluation of the situation is also important for how the stress experience is framed and can be affected by their primary (i.e., assessment of stressors) and secondary appraisals (i.e., assessment of coping options) (Lazarus & Folkman, 1984, p. 53). In the organizational stress literature, the person–environment (P–E) fit approach to stress has also received a lot of research attention (see, e.g., Edwards, 1996; Yang et al., 2008). According

to the P–E fit approach, the interplay between various personal and environmental factors is viewed as significant regarding the occurrence of negative stress-related outcomes (i.e., strains) (see, e.g., Edwards & Cooper, 1990; Edwards et al., 1998). Thus, although stress experiences can be ultimately viewed as being shaped by individual perceptions and appraisals, outside conditions play a role in the process. In addition, even though stress can be defined in many different ways and can also be associated with positive emotions (Folkman, 2008), the aforementioned views guide the perceptions of stress that are used in the present research.

People's responses to stress can be understood in the form of coping. The methods of coping can be categorized differently, and a common division includes problem-focused (e.g., active coping, planning) and emotion-focused coping strategies (e.g., acceptance, seeking of emotional social support; see, e.g., Carver & Scheier, 1989), depending on which aspects of the stress experience the chosen strategy aims to address. Thus, although a person can aim to identify and solve the underlying cause of stress, feelings of stress can also be reduced by focusing on the stress experience itself. The developmental stage of adolescence can be viewed as a particularly significant period in human life in terms of the stress faced and ability to form and practice individual coping skills (Frydenberg, 2019). Additionally, the coping strategies used by young people can vary depending on the degree of the stress experience (e.g., daily hassles or major life events) and the age of the person in question (e.g., older adolescents can have a wider repertoire of coping strategies; Williams & McGillicuddy-De Lisi, 1999). Even though the word stress can signal a strong emotional experience, it is important to note that daily stress experiences often relate to mundane occurrences as opposed to major life events (DeLongis et al., 1982). However, everyday stressors have importance in the daily life of individuals and require specific coping strategies (Seery & Quinton, 2016). Adolescents can also experience everyday stress, and their experiences can be similar, regardless of other factors, such as academic performance (Baker, 1996). Adolescents can also use similar coping strategies, despite cultural and geographical differences (Gelhaar et al., 2007), but situational factors are partially influential in choosing the coping strategy (Cicognani, 2011).

IT use–related behavior can also be framed in different ways. In both leisure and work environments, the adaptation strategies (i.e., cognitive and behavioral coping efforts) of IT users can be affected by appraisals, such as how they view their ability to control the situation (Beaudry & Pinsonneault, 2005; Salo et al., 2020). Similarly, although emotional factors have received less attention in the literature on IT adoption and use, emotions are an important topic to consider in this context (e.g., the effect of mixed emotions on coping strategies used; see, e.g., Stein et al., 2015). Because IT use has become an integral part of individuals' lives, stress experiences related to IT use have also started to be studied. The term "technostress" started to gain attention in the 1980s, when Craig Brod defined it as "a condition resulting from the inability of an individual or organization to adapt to the introduction and operation of new technology" (1982, p.754). Since

then, the understanding of technostress has been built further to emphasize the role of individual experience (Tarafdar et al., 2019) and IT characteristics (Ayyagari et al., 2011). Today, technostress is studied in both organizational and leisure contexts, making it a noteworthy topic for IS research. In the present dissertation, technostress is viewed as stress experienced by individuals because of their use of IT (Tarafdar et al., 2019).

Technostress can be portrayed through technostressors (i.e., the creators of technostress), strains (i.e., the outcomes of technostress that are viewed negatively by an individual), and coping strategies (i.e., the actions used by individuals to address technostress) (Fischer & Riedl, 2017; Tarafdar et al., 2019). Because the characteristics of situations and individuals vary, even seemingly similar conditions might lead to different responses and outcomes. However, previous research has identified the common forms of technostress that emerge in different contexts. For the work context, this includes techno-invasion (e.g., IT use disrupts other life domains), techno-overload (e.g., IT is used excessively), techno-complexity (e.g., IT artifact viewed as too difficult to use), techno-uncertainty (e.g., inability to keep up with changes in IT), and techno-insecurity (e.g., other people have better IT knowledge) (Fischer & Riedl, 2017; Tarafdar et al., 2007). Thus, work-related technostress can be associated with the user's confidence, pace, or nature of work, the social environment, and work–life balance. For the leisure context, technostress has been studied in relation to social media use. In these environments, the stressful experiences of IT users can relate to life or social comparison (e.g., contrasting one's own life with social media content), social overload (e.g., engaging with an online community exceeds one's social resources), and online conflicts (e.g., arguments with other users) (Fox & Moreland, 2015; Maier et al., 2015b; Salo et al., 2019; Salo et al., 2022). Although technostress rising in the work context can be different from technostress experienced in leisure contexts, they are both inherently connected with individual perceptions and valuations of the IT artifact and the situation itself.

Although technostress and their related coping strategies have received research attention during the past decade, the stream of research tends to focus on the adult population, especially the work context (see, e.g., Tarafdar et al., 2019). There is a growing interest in the topic of technostress from the perspective of leisure-related IT use (see, e.g., Maier et al., 2015a; Salo et al., 2019; Salo et al., 2022), but research focusing on the adolescent perspective has remained scarce (see, e.g., Schmidt et al., 2021). However, previous research has established that compulsive smartphone use can be connected with poor health outcomes (Panda & Jain, 2008) and that the inability to access the internet can be stressful for young people (Díaz-López et al., 2020). Additionally, coming across harmful content can even be a source of posttraumatic stress symptoms for young people (McHugh et al., 2018). However, young people can use different coping strategies to address technostress, depending on the characteristics of the individual and situation in question (Schmidt et al., 2021). Even though the technostress perspective has not received much attention among this population, developmental perspectives, such as transitions and societal change, have been

discussed in the stress and coping literature (Lazarus & Folkman, 1984, p. 10). Because different transitions and developmental tasks, such as identity formation, can be seen as characterizing adolescence as an age period (see, e.g., Baumrind, 1991), there is room to discuss adolescents' stressful IT use experiences against this backdrop as well.

2.2.2 Designing mental health and well-being ITs

Although the experiences of individuals and their abilities to address different situations are crucial for IT use, the characteristics of an IT artifact should also be considered. ITs can be designed for the explicit purposes of promoting health and well-being, and there are different ways to pursue this outcome. However, ITs can also have more implicit features that might foster health or well-being, hence emphasizing the role of good design. For example, previous research has shown that IT environments can be used to deliver mental health interventions to young people (see, e.g., Huen et al., 2016; Li et al., 2013). However, the perspective of well-being promotion has been less prominent in health research. For example, the need for more studies with long-term follow-ups has been identified in research (Baños et al., 2017). In general, there seem to be many websites and applications available that aim to foster the mental health of young people, but there might not be enough research evidence to support these claims (Grist et al., 2017).

The success of digital environments in delivering mental health-related content is often evaluated in terms of whether positive changes can be observed among participants after engaging with the content for a period of time (i.e., an intervention setting is used). Although it is crucial for intervention studies to focus on the effectiveness of the intervention itself, the use of IT environments creates specific requirements for the delivery process. For example, child mental models should be followed in design endeavors aiming to create content for children (Masood & Thigambaram, 2015). Because young people are active IT users, it can be expected that they might hold certain perceptions of what IT artifacts, such as websites, applications, and mobile games, should look like. In the case of mental health resources (e.g., websites providing mental health information), it has been acknowledged that the existing resources might not meet these expectations (Wetterlin et al., 2014). Thus, more attention should be placed on the design process of the IT artifact (Baumel & Muench, 2016; Scholten & Granic, 2019).

Because the experiences of IT users are individualistic, it might be difficult to establish straightforward connections between IT characteristics and specific health or well-being outcomes. However, it would also be incorrect to say that the designers of IT artifacts have no power over what the experiences of the users end up being because the affordances of technologies create some boundaries for IT use itself. Thus, both IT design and use perspectives need to be kept in mind when trying to build a more profound understanding of this complex topic.

The research underlying the present dissertation shows that IT use among young people can include numerous layers and crucial perspectives. Although

individual experiences seem to be a key element for understanding the fundamental aspects of IT use, the significance of IT artifact design cannot be overlooked. Similarly, because some characteristic qualities are associated with IT use among young people (e.g., school context and leisure-related IT use trends), it can be expected that the specific features related to the use process can be identified for this population. However, age is not the only determinant of IT use, and the results of the present dissertation should not be reduced to this level. Instead, there is a need to emphasize young people as young IT users, whose interactions with IT can be affected by the complex social, technological, and individual affordances that shape their daily IT use routines.

3 RESEARCH METHODOLOGY

This chapter presents the research methodology underlying the current dissertation, including the methods used for data collection and analysis. The present dissertation predominantly follows a qualitative research approach. In particular, the semi-structured interview (SSI) is discussed in depth because it has been the primary method of inquiry used in the majority of the articles. Similarly, other prominent topics include the processes for participant selection and coding of data, as well as thematic analysis. The heuristic evaluation used in the last article of the present dissertation is discussed at the end of this chapter.

3.1 Approach to data collection and analysis

Qualitative research methods have constituted an important part of IS research for decades, and numerous relevant research guidelines have been developed over the years (Monteiro et al., 2022). This includes the qualitative interview, which is a widely used data collection technique that can fit various research paradigms (Myers & Newman, 2007). Although approaches to qualitative research and their consequent contributions can vary for numerous reasons (e.g., the research setting and the nature of the studied phenomenon), qualitative research has the ability to build an understanding of and explain the often complex and multidimensional IS phenomena. Naturally, qualitative IS research also has its limitations (Monteiro et al., 2022). Thus, regardless of the data collection and analysis methods chosen, it is important that any research following a qualitative tradition go beyond the practical steps taken and try to rationalize the choices made in relation to the nature of the studied phenomenon.

The qualitative research approach fits the purposes of the present dissertation because many of the topics of interest relate to people's personal views and experiences. For example, individuals' stress experiences can relate to numerous situational and personal factors, the understanding of which requires a method of inquiry that allows for reasonable depth. Additionally, the current

dissertation presents topics that have not been extensively studied in previous research (e.g., stressful IT use experiences of young people) or that otherwise represent emerging practices and contexts (e.g., online education in a comprehensive school environment). Through qualitative methods (e.g., SSIs), it was possible to give the interview participants the opportunity to talk about their experiences using their own words and explain what is meaningful or important to them on a personal level. The researcher could also pose additional questions to the participants and proceed to new areas that seem interesting in light of the research topic. However, it is important to note that there are also limitations to qualitative research. For example, acquiring generalizable results requires specific attention to the research design, and generalizability can be very different for qualitative research than how it is viewed in the quantitative tradition (see, e.g., Carminati, 2018).

The data underlying the results consist of three types. First, 31 interviews with young people on the topics of IT use–related stress and strategies to address this stress were carried out at two time points: in the spring of 2018 and in the fall of 2020. Second, 26 interviews with comprehensive school teachers occurred between January and July 2022. It should be noted that the latter part of the interviews with young people and all the interviews with teachers occurred during different stages of the COVID-19 pandemic, which had significant effects on using IT as part of school and home life. Third, 49 mental health and well-being websites and applications targeted at young people were identified and assessed in relation to user interface (UI) design in the spring of 2018. The results associated with the data were divided into separate articles according to thematic entities, resulting in five research articles (three published, one accepted for publication in a conference, one under review for a journal). Information about the dissertation data and related articles is provided in Table 2.

The interviews with pupils and teachers were conducted by two interviewers each (a master's student and the author of the present dissertation). Altogether, 21 interviews were carried out by two master's students and the remaining 36 interviews by the author of this dissertation. The analysis of all the data sets that were collected was mainly done by the author of the current dissertation, including discussions of the different stages of the analysis together with other researchers participating in the article writing processes.

TABLE 2 Research data and related articles in the dissertation

Data Set	Data Collection Method	Time of Data Collection	Subsequent Articles
31 interviews with young people aged 9–15	Semi-structured Interview	Spring of 2018 Fall of 2020	Exploring Early Adolescents' Stressful IT Use Experiences (a*rticle I*) Exploring Early Adolescents' Problem-Focused Strategies for Coping with Stressful IT Use Experiences (a*rticle II*)
26 interviews with comprehensive school teachers	Semi-structured Interview	January–July 2022	Comprehensive School Teachers' Experiences of the Challenges Associated with Information Technology Use in Traditional and Online Education (a*rticle III*) Teachers' Perceptions of Challenges with Pupils' Online Interactions (a*rticle IV, subset of the interviews, n=15*)
49 existing mental health and well-being websites and applications targeted at young people	Heuristic Evaluation	Spring of 2018	Digital Mental Health Resources for Children and Youth - Evaluation of Strengths in User Interface Design (a*rticle V*)

3.2 Semi-structured interview and qualitative data analysis

Semi-structured interview is a frequently used method to collect data in qualitative research, with benefits such as versatility and flexibility (Kallio et al., 2016). Because the aim of studies with young people and teachers was to build a deeper understanding of their experiences regarding the inherently multidimensional and evolving phenomenon of IT use, SSI was viewed as a method of inquiry capable of capturing experiences that can be complex in nature and relate to emerging IT use practices. From a practical point of view, SSIs would also provide flexibility to the interview process that might be especially relevant when interviewing younger participants, whose linguistic capabilities might be on a different level compared with adults. Thus, SSI would make it possible to center interview questions around predefined themes without losing

the ability to steer the conversations to topics that are easier for the participants to understand and verbalize.

SSIs have been used extensively in IS research as well (Myers & Newman, 2007). In an SSI, generally, the setting allows new insights to arise from the interview dialogue (DiCicco-Bloom & Crabtree, 2006). However, because the literature can be helpful for building an understanding of the subject matter in SSIs (Rabionett, 2011), the interview scheme itself and its basis constitute an important part of the process. Consequently, the interview scheme used in the present research was informed by previous research, and the interview practices were further developed based on the experiences gained (e.g., interviewees' reactions to questions). Customarily to SSIs, the focus point of the interview could change depending on the participant in question (Myers & Newman, 2007).

In the participant selection process for teachers, specific municipalities, schools, or rectors in Finland were approached to find participants for the interviews. The teachers were also encouraged to recommend new interviewees who might have something to say about the study topic (i.e., snowball sampling was used; see, e.g., Parker et al., 2019). For the interviews with both pupils and teachers, existing connections with schools were also leveraged to find participants. The interviewed pupils resided in the area of Central Finland, including municipalities and schools of different sizes. Although the first part of the teacher interviews was acquired from the same school (n=11), the teachers were also from different municipalities and schools across Finland. For the younger participants, it was ensured that they had permission from their parents/guardian to participate in the interview. Additionally, it was emphasized to all of the interview participants (including minors) that the participation in the study was voluntary. Finally, the school or municipality was contacted, and appropriate steps were taken to receive permission for the pupils, teachers, classes, or schools to participate in the study, whenever this was deemed necessary. However, the teachers could also participate in the study during their free time.

The interviews followed the ethical principles and instructions of the university, and the university's ethical board was contacted on a low threshold with questions regarding the study design (see original articles for more information). The final set of interviews used in the present dissertation includes 31 interviews with young people of 9–15 years of age (data collected in the spring of 2018 and fall of 2020) and 26 interviews with comprehensive school teachers (data collected in 2022 from January to July). Out of the young people (61% male), 20 were fourth–sixth grade (9–12 years) primary school students and 11 were seventh–ninth grade (13–15 years) lower secondary school students. This age group was chosen because they were viewed as old enough to have and describe their IT use–related experiences in an interview form. However, it was also viewed as a possibility that the experiences of young people might differ based on their age (e.g., purposes and degree of IT use), making it important that different kinds of experiences could be captured in the research. All the teachers were class or subject teachers who had teaching experience in primary and/or

lower secondary education. One rector was also included because of their simultaneous role as a subject teacher. More than half of the interviewees had more than 15 years of teaching experience. Because the views of teachers can vary based on their skills and experiences related to IT use, reaching teachers with different backgrounds (e.g., in terms of age, education level, or experience) was viewed as an important aspect. Finally, all the participants were Finnish speaking and resided in Finland.

The interviews carried out by the master's students followed the interview schemes created for the purposes of their master's theses. Similarly, the initial interview scheme used by the author of the present dissertation was based on the initial interview scheme developed by one of the master's students and their supervisor for the interviews with the adolescents. For the purposes of the teacher interviews, this scheme was adapted and extended to fit the teaching context and adult population. Upon creating the interview schemes, it was noted that placing more sensitive questions at the end of the interview can be advantageous in SSIs because it allows the interviewees to become more familiar with the researcher (see, e.g., Adams, 2015). Thus, an effort was made to structure the interviews in a manner that allowed for moving from simpler questions (e.g., own IT use habits) to more complex ones (e.g., views on online learning with young people and online education with teachers). The age level of the participants was considered by paying special attention to the wording of the questions in a way that would feel as natural as possible for the younger participants. The main contribution of both interview sets was based on open-ended questions (see Appendix 1 for further illustrations). However, the questions presented in the appendix are merely examples characterizing the ideas that were central to the interviews. For example, if the participant described a situation where they were bothered by IT use-related stimuli, the interviewer could then proceed to ask more specific questions regarding that particular experience. Thus, the actual questions presented in the interview situation could change depending on the situation and the interviewer-interviewee interaction. Closed questions could also be used to help the participants become comfortable with talking to the interviewer or to gain additional information regarding the situations described by the participants. Finally, all the interviews were transcribed, which was followed by coding using NVivo qualitative data analysis software. The interviews with primary school students typically lasted half an hour. With lower secondary school students, the interviews could range from half an hour to one hour. In the case of the teachers, the interviews lasted 49.5 minutes on average.

The data analysis processes for both the teacher and pupil interview data followed a similar approach, in which the codes describing the underlying data were used to enable meaningful categorization that would later support the interpretation and analysis. This is customary for qualitative content analysis (see, e.g., Blair, 2015). The qualitative approach was viewed as fitting for the goals of the studies because of its ability to bring forth units of interest that might exist at different levels of the data. Thus, specific nuances of data and the depth of the

results might have been lost if a quantitative approach had been used instead. At the beginning of each process, one interview was first coded to establish the initial categorizations. This was followed by the coding of another interview using the codes that were created and by expanding the categorizations and the depth of the codes whenever this was deemed necessary. Over the course of the coding process (consequent coding of interviews), the categorizations quickly became quite established. However, the categories created could be combined and rearranged based on the prominent perspectives in the interview data.

For example, the teacher interview data included higher categories such as *IT use in classroom* and *online education and IT use.* These were further labelled into challenges identified by teachers (e.g., *notifications disturb classwork* and *too much IT-mediated communication*) or other notions made of the class (e.g., *differences between pupils in how they view online education),* and included other layers based on the IT used or the situation in question. The data related to the interviews with early adolescents were also categorized in a hierarchical fashion (e.g., *notifications – feelings and events related to notifications – notifications are viewed as disruptive – the light from the device when sleeping/going to sleep)*. Similarly, these data included layers that take into account the technical (e.g., *noises from the tablet can disrupt eating)* and other noteworthy aspects of the experience (e.g., *feeling of using too much IT during the isolation period*). However, with both data sets it is important to keep in mind that the categorizations included various levels depending on the topic and the actual content that the codes were assigned to. Thus, the actual quotes from the interviewees that can be found in the original articles form an important part of the qualitative research process.

In the thematic analysis of the interview content, the coding and analysis processes were viewed as being interlinked (see, e.g., Weston et al., 2001), meaning that coding can inform analysis and vice versa. Codes and code categories were created by identifying the relevant content and joint themes across the interviews (see, e.g., Williams & Moser, 2019). The results focus on the insights of teachers and young people of themes that are informed by previous research (top-down), categorized according to the interview content (bottom-up). Thus, although the information gained through interviews is somewhat limited by the questions proposed by the researcher, an effort was made to capture the depth of the narratives provided by the participants, as they might include dimensionality that was not accounted for prior to the interviews.

3.3 Heuristic approach to the evaluation of mental health and well-being ITs targeted to children and young people

Traditionally, heuristic evaluation has been viewed as a method that uses specific usability principles to find problems in the user interface design of a system (Nielsen, 1995), and it is typical for a heuristic evaluation that the design of an interface is contrasted to a specific set of design criteria (Shneiderman & Plaisant, 2005). Because the insights and experiences of people can vary, it is often

suggested that a heuristic evaluation is carried out by multiple people (Nielsen & Molich, 1990). Because the aim of the final study in the dissertation was to build understanding of the design features of existing mental health and well-being websites and applications for young people, the heuristic approach was viewed as a path to place the themes of mental health, well-being and young people as IT users in the design context. Thus, the heuristics are used to synthesize different aspects that are crucial to consider during the design process but seem to be disconnected in the literature. A set of heuristic dimensions based on the literature was created to ensure that important themes pertaining to the complex topic would be considered in the evaluations (i.e., UI design, mental health and well-being, and young people as a target group; for more information, see Mehtälä et al., 2018). This is in line with the notion that different level factors can affect the willingness of young people to use mental health resources (Wetterlin et al., 2014). To diminish the effect of the evaluator on the results, specific heuristics representing the dimensions were formulated to leave less room for interpretation. Additionally, although in the case of the present study the assessment of the websites and applications was carried out by one person (the author of the dissertation), the heuristics and the underlying literature were discussed in close collaboration with other members of the research group.

Overall, the research methodology of the present dissertation is centered around semi-structured interviews because individual experience is best captured through a flexible, qualitative approach to inquiry. The information provided using this method can be extended by focusing on multiple perspectives, which have been done in the current research by including both the insights of young people and teachers. However, all research methods have their limitations, and other methods could have been used to achieve results not restricted by the shortcomings of this method (e.g., the effect of the interviewer on the results). Nevertheless, the SSI was viewed as the best fit for achieving the aims of this research because it made it possible to gain a deep understanding of the studied phenomena. Finally, IT characteristics cannot be overlooked in this context because they create some boundaries for IT use (e.g., because of the features available). Thus, a heuristic evaluation of existing websites and applications was viewed as a method that could supplement the understanding of IT use from a design point of view.

4 RESULTS OF THE ARTICLES

This chapter presents the five studies that were carried out to answer the research questions. Because the original articles are included as part of the dissertation, the aim of this section is to present the articles in a concise form, focusing on the overall nature and contributions of the articles. The articles and their publication channels (if available) are presented at the beginning of each subchapter.

4.1 Article I

Mehtälä, S., Salo, M., Tikka, S., & Pirkkalainen, H. (2022a) Exploring early adolescents' stressful IT use experiences, Behaviour & Information Technology.

The first article built an understanding of the stressful IT use experiences faced by early adolescents (aged 9–15) in different situations. The aim was to explore how the strength and type of experiences might vary among young IT users. An effort was also made to clearly connect the experiences to different ways of using IT (e.g., through categorizations), hence making it possible to explore the experiences in relation to the IT context. In the study, semi-structured interviews were used as the method of inquiry.

The results show that stressful IT experiences are related to the dimensions of 1) online social (media) behavior, 2) notification-driven behavior, 3) social distancing and online education behavior, or 4) gameplay and other aspects of IT use behavior. Thus, experiences tend to relate to pastimes that are popular among young people (i.e., playing games and social media use; Gray, 2018; Kinnunen et al., 2022). It was common that the interviewees could feel pressure associated with reacting to messages or that notifications in general could feel disruptive to other activities. The main results of the study are presented in Table 3.

TABLE 3 Early adolescents' stressful IT use experiences (from article I)

Online social (media) behavior	**64**
The pressure associated with reacting to messages and being	27
Own reaction time and presence 22	
Friends' reaction time 5	
A negative disposition toward specific content and communications	20
Received by others 10	
Received by oneself 10	
The pressure associated with content published by oneself	14
Doubts about information privacy	3
Notification-driven behavior	**56**
Disturbance to other activities	34
The feeling of receiving too many notifications	19
Disturbance to family members	3
Social distancing and online education behavior	**28**
The feeling of using too much IT	19
Difficulties with participating in online education	8
Disturbance to family members	1
Gameplay and other aspects of IT use behavior	**13**
A mismatch between one's own skills and level required by the game	6
Missing a deleted game	2
Game feels annoying or addictive	1
Too many advertisements	2
Negative feelings associated with device use in general	2
Total references	**161**

The results suggest that stressful IT use–related experiences among young people relate to different levels of device, application, and game use and include both individual and social IT use contexts. Although most of the experiences were associated with leisure use, the COVID-19 pandemic also revealed connections to school-related IT use (e.g., difficulties participating in online education). It was common for the experiences that IT use or IT characteristics to be viewed as negative or overwhelming. The qualities of young people's experiences can be compared with phenomena identified in the technostress research (e.g., technostressors, strains, and IT characteristics) (Taradar et al., 2019).

The literature has discussed social media–related experiences in adults and has identified stressors such as SNS (social networking service) overdependence, information overload, life comparison discrepancy, online discussion conflict, and privacy/security uncontrollability (Fox & Moreland, 2015; Maier et al., 2015b; Salo et al., 2019). These have also been found in the adolescents' stressful experiences. For example, the feeling of using too much social media were found to include characteristics of SNS overdependence or overload. In relation to the social aspects of IT use, life comparison discrepancy and online discussion conflict can be identified in the experiences of social media-related pressure (e.g., comparing oneself to others) and the participants' negative feelings evoked by messages received by them or other IT users, respectively.

The participants also viewed notifications as disturbing other activities or their family members. In general, the daily number of notifications was also seen as a problem. The literature shows that IT characteristics (e.g., presenteeism and mobility) can create a demand for the user (Tarafdar et al., 2019). Because many notifications, especially on mobile devices, tend to be turned on by default, it is important to pay attention to IT design practices and their role in creating the conditions for stressful experiences. The participants also discussed excessive IT use, especially in relation to online education or the time when they were isolated from others during the COVID-19 pandemic. This could include characteristics of techno-overload and include physical symptoms (e.g., headache and fatigue), which are labeled as strains in the technostress literature. Stress could also be linked with online education practices, such as lesson structure, teacher reachability, or technical IT aspects. Difficulties with technology, student engagement, and teacher–student communication can be viewed as noteworthy barriers in a sudden move from onsite to online education (Dhawan, 2020). The stressful gaming experiences often relate to losing a game, which can be characterized by a combination of frustration and feelings of failure. Because games are a common pastime among young people (Kinnunen et al., 2022), it is important to explore the different levels of IT use that might contribute to stressful experiences on a daily basis.

Based on the present study, it can be stated that early adolescents' stressful IT use experiences can relate to the different dimensions of IT use and vary in the degree of stress. Even though the stressful experiences of young people in the study ranged from potentially to highly stressful, it is noteworthy that the majority of the experiences in our data could be categorized mildly or moderately stressful. However, one-fifth of the mentions could be categorized as highly stressful. Thus, it is essential that all kinds of experiences related to IT use are discussed in the context in which they occur, which requires exploring the views and feelings of young people themselves.

4.2 Article II

Mehtälä, S., Salo, M., Tikka, S., & Pirkkalainen, H. (2022). Exploring Early Adolescents' Problem-Focused Strategies for Coping With Stressful IT Use Experiences. In Proceedings of the 30th European Conference on Information Systems (Article 6). European Conference on Information Systems.

The focus of the present article was on the problem-focused coping strategies used by early adolescents to resolve stressful IT use experiences. The aim was to identify coping strategies that young people might use in different IT use-related situations. The coping strategies were categorized based on the pervasiveness of the actions (i.e., how final they are) and the level of IT use (i.e., the layer on which the action occurs), making it possible to examine more closely the nature of the

strategies and their relation to the IT artifact. Semi-structured interviews were used as the research method.

The results of the study indicate that young people can use a variety of problem-focused strategies to cope with stressful IT use experiences. Even though coping strategies aiming for complete elimination of the stimuli from the device can be used by the participants, situational elimination and modification strategies (i.e., controlling stimuli in some situations) seem to be more popular. For example, it was common that the participants would mute their phones in specific situations or that they would, at times, restrict the use of certain devices. The main results of the study are presented in Table 4.

TABLE 4 Early adolescents' problem-focused coping strategies related to IT use (from article II)

Coping Strategy	Level of IT Use	Number of Mentions
Complete elimination		**8**
Discontinuing use	External behavior change	5
Deleting a game/app	IT artifact change	3
Situational elimination		**78**
Muting the device	IT artifact settings	33
Muting or turning off notifications, turning the internet connection off	IT artifact settings	13
Flipping over or covering the device	Physical distance to IT artifact	12
Placing the device further away or leaving it at home	Physical distance to IT artifact	10
Turning the device off	IT artifact settings	6
Putting the device on airplane mode	IT artifact settings	2
Using the "do not disturb" mode on the device	IT artifact settings	2
Situational modification		**31**
Restricting own use	External behavior change	22
Limiting the number of accounts being followed	Action within the IT artifact	2
Decreasing the number of notifications	IT artifact settings	2
Deleting messages	Action within the IT artifact	2
Adjusting the screen brightness	IT artifact settings	1
Switching between communication apps	IT artifact change	1
Turning the activity status off	IT artifact settings	1
Others		**5**
Succeeding in a game	Action within the IT artifact	3
Writing positive or encouraging comments	Action within the IT artifact	2
Total		**122**

The strategies were associated with different IT use situations related to school and leisure that also intersected between these two contexts. Although strategies aiming for complete elimination can be viewed as effective for controlling stimuli, they can also be connected with avoidance behavior (see, e.g., Billings & Moos, 1981), and might inadvertently lead to losing some beneficial aspects of IT use (Salo et al., 2022). Situational elimination strategies, in turn, can be successfully used to reduce technostress, and the process can benefit from valuating meaningful stimuli on a personal level (Salo et al., 2017). Physical barriers could also be used as coping strategies, for example, by flipping over the device or by making sure that it is not easily accessible (e.g., leaving it to another room). Some of the situational elimination strategies used by young people have also been identified in prior technostress literature (e.g., muting messaging groups, adding physical distance to the device, using airplane mode; Schmidt et al., 2021).

The situational modification strategies used by the participants (i.e., modifying stimuli in specific situations) could be connected to social media use. For example, the participants might limit the followed accounts or delete irrelevant messages. In prior literature, connections have been found between stress experiences and social media use (Lim & Choi, 2017; Maier et al., 2012; Salo et al., 2019). Restricting one's own IT use was also a noteworthy situational modification strategy used by the participants. They viewed the ability to personally restrict IT use as a skill that would reduce the need for control from parents, but also as something that would have positive effects on their well-being (e.g., reducing IT use in the evening could improve quality of sleep). Thus, concepts such as control, self-regulation, and self-efficacy (see, e.g., Lazarus & Folkman, 1984, pp. 170–171) can be viewed as important topics upon discussing the IT use-related stress and coping strategies used by young people.

A few mentions in the data also related to other coping strategies (i.e., succeeding in a game, writing positive or encouraging comments). Succeeding in a game can be connected with challenge and a sense of achievement, which can work as motives for participating in certain activities, including digital gaming (e.g., Olson, 2010; Yee, 2006). Thus, these kinds of strategies could relate to the meaningfulness of the activity on a personal level. Writing positive or encouraging comments can be used as a strategy to spread positivity within online communities. In general, negative tones seem to be quite prevalent in the content produced by users in different online environments (e.g., Allison, 2020; Mihailova, 2020). As a whole, the study shows that early adolescents can use a multitude of problem-focused strategies to address stressful experiences related to IT use. They can perform actions on different layers of IT use and choose the pervasiveness of the chosen action based on the situation. Thus, the strategies used by young people seem to focus on both the situation itself and individual tendencies. Similar notions have also been made in prior research (Schmidt et al., 2021). Although the participants came across as skillful IT users and could describe situations where IT use-related stimuli was successfully controlled, it is important to note that generations that have grown up with IT do not inherently possess exceptionally good information processing skills (see Kirschner & De

Bruyckere, 2017). Thus, young people might still need support (e.g., from parents and teachers) to understand their relationship with IT use and how it might contribute to well-being.

4.3 Article III

Mehtälä, S., Salo, M., Rinne, A., Koskelainen, T., & Pirkkalainen, H. (2023). Schoolteachers' experiences of the challenges associated with information technology use in traditional and online education. Article accepted to the 14th Scandinavian Conference on Information Systems (SCIS2023).

This study was carried out to explore comprehensive school teachers' experiences regarding IT use in traditional and online education contexts. It was assumed that different challenges might be associated with IT use, depending on the educational context. With the forced migration to online education because of the COVID-19 crisis, a large majority of teachers would also have gained experience with IT use in various settings. The challenges identified by teachers in traditional and online education were categorized according to the dimensions that they relate to (e.g., planning of education activities, technical challenges) and discussed in relation to the challenges identified in the literature (e.g., work from home, online education, technostress). The study used semi-structured interviews with teachers.

The results show that teachers can find similar challenges related to IT use in both onsite and online education settings. In traditional education, these would often relate to directing focus to schoolwork, the teacher's well-being, pupils' IT use capabilities, or technical difficulties. The most often mentioned challenges of online education included interaction with pupils/reachability, teacher's well-being, technical difficulties, and the planning of educational activities. However, the teachers could also find ways to overcome the challenges, for example, through support networks. The main results of the study are presented in Table 5.

TABLE 5 IT use–related challenges in the context of onsite and online education (from article III)

IT use–related challenges in traditional (onsite) education	**Total n of mentions**	**N of teachers**
Directing focus to schoolwork	91	15
Detrimental effects on the 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
IT use–related challenges in online education	**Total 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 workdays	13	7
Differences in the pupils' IT use capabilities	12	5

Although IT use can be different among people of different ages, technostress can be experienced by both adults and children alike (see, e.g., Schmidt et al., 2021). Similarly, technostress experiences can differ in work and leisure contexts (Salo et al., 2019), and the characteristics of remote work can be connected with stress experiences (Galanti et al., 2021). Thus, it is important to consider the challenges identified in the present study in relation to the context in which they occur (online education/remote work, IT use in education), the people affected (teachers/employees, pupils/young people), and the outcomes (technostress, work well-being). Although technical challenges are often associated with

techno-complexity, the technical challenges brought up by the teachers in both settings could also be connected with techno-overload, in which IT is used to an increasing degree to carry out work activities with the simultaneous perception that IT use is a source of additional work (e.g., because of its complexity; Tarafdar et al., 2007). Similarly, technical difficulties can be viewed as barriers to online education (Mäkelä et al., 2020).

IT use itself could also be viewed as straining the lives of teachers or pupils. This could include negative perceptions toward the blending of work and leisure, continuous reachability, or long workdays. These kinds of experiences can include the characteristics of techno-invasion (i.e., IT use–related connectivity blurring work and leisure boundaries; Tarafdar et al., 2007). The physical and psychological well-being outcomes experienced by teachers or their pupils can also be framed as strains (i.e., adverse effects associated with technostress experiences; Tarafdar et al., 2015), emphasizing the multidimensionality of the identified challenges. Additionally, prior research has noted that the lifestyle and rhythm of children can be negatively affected by online education (Wang et al., 2020).

Although similar challenges have been brought up in both onsite and online education contexts, it is interesting to see that there are also differences in how the challenges have been portrayed. Although IT use can create problems for concentration in a traditional classroom setting, the invisibility of the educational setting becomes a problem in online education. For example, it is sometimes impossible for the teacher to know whether the pupils are actually following the education activities, and it might be more difficult to identify pupils who are struggling with topics in real time. This can create problems in the long run, and the teacher might have to allocate additional time or specific sessions for tutoring. Similar challenges related to online education have also been identified in the literature (Bray et al., 2021). Because implicit but significant interaction practices that are found in onsite classrooms can be lost in online education, more attention is needed to establishing social contacts and fostering online collaboration (Mäkelä et al., 2020). As a whole, the study suggests that, although IT might be used to a different degree in online education, the same elements that are crucial for the successful use of IT to deliver teaching and learning can be found in both settings. Thus, it is important to consider the nature of the teaching–learning activities, technical and individual aspects (e.g., availability of high-quality networks, IT skills), and their implications, regardless of the educational setting in question.

4.4 Article IV

Mehtälä, S., Salo, M., & Pirkkalainen, H. (2023). Teachers' perceptions of the challenges with pupils' online social interaction. Article under review in a journal.

The fourth study discusses challenges with pupils' online social interactions and their visibility in the school context as perceived by teachers. Although online environments can add new layers to the social contexts faced by pupils and teachers in their daily lives, they also have the potential to blur the lines between school and leisure contexts. Because pupils' online interactions might expand and be intertwined with the interactions occurring in the school environment, it is important that teachers have an understanding of the online environments, as well as the ability to use different strategies to address problematic situations. For the purposes of this study, comprehensive school teachers were interviewed using a semi-structured interview scheme.

The results indicate that pupils' online social interactions are a visible part of the everyday life in schools. The teachers can identify different challenges associated with the pupils' interactions, such as unfavorable behavior in instant messaging groups or social media (e.g., sending or receiving messages of unpleasant content, spamming), online interaction–related pressure/comparing oneself to others, or online conflicts between one or more pupils. For the teachers, perhaps the biggest challenge is the obscurity and boundaries of the role of the teacher in addressing different situations because there might not be clear instructions or practices that would define the responsibilities of different actors in situations crossing the online/offline and school/leisure boundaries. However, the teachers came up with their own ways of addressing problematic situations, including, for example, situation-specific strategies (case-by-case), general discussions at a class level (e.g., online communication and rules), and communication to parents. The teachers also noted that online interactions can be very meaningful to pupils and even have the potential for education activities, making it a phenomenon to be embraced in a modern society. The challenges and strategies to address them are presented in Table 6.

TABLE 6 Challenges associated with pupils' online interactions, strategies to prevent or address problems, and possibilities of online interaction (from Article IV)

Challenge	**Manifestation**	**Level**	**Mentions 99**
Online conflicts	Unpleasant messages or content in online environments Conflicts between classmates	Pupil	33
The obscurity and boundaries of the role of the teacher	Difficulty to balance between the feeling of responsibility and the limitations of own role Limited resources to address different situations	Teacher	29
Exclusion and other unfavourable behaviour in instant messaging groups	Certain pupils are left outside or kicked out of messaging groups Spamming messages to class messaging group	Pupil	15
Online interaction and IT use-related pressure	Pressure to follow and/or react to messages Pressure regarding own appearance in social media	Pupil	13
The nature and the affordances of the online interaction	There might be a lower threshold for conflicts and bullying in online environments (e.g., due to anonymity) The interactions between pupils can be layered and difficult to follow	Pupil/ general	9
Strategy	**Manifestations**	**Level**	**64**
Situation-specific strategies	Teacher collaborates with parents or other school personnel to address a situation with specific pupil(s) Parents communicate a (resolved) situation between pupils to the teacher Teacher redirects problem-solving to parents (e.g., leisure-related conflicts)	Teacher/ parent	29

Discussions with class about online communication and rules	Teacher discusses with class why specific online behaviour (e.g., spamming) can be a problem Teacher and class create shared rules for online environments (e.g., instant messaging groups)	Teacher	14
General communication to parents	Online interaction can be the topic of parent-teacher conferences	Teacher	7
The skills or attitudes of the pupils	The pupils have good social skills and/or know how to react to different situations	Pupil	7
Support from adults	Parents and/or teachers can support the development of social skills	Teacher/ parent	4
Teacher as a member of class discussion group	The (presence of) teacher moderates class discussions	Teacher	3
Possibility	**Manifestations**	**Level**	**16**
Meaningfulness for pupils	Online environments (e.g., games) are an important part of pupils' everyday life	Pupil	12
Opportunities for school purposes	Pupils are more easily reached through instant messaging	Teacher	4

In particular, the younger generations seem to prefer online channels as a medium for daily communication (Venter, 2017), and these environments can be used by young people to support their real-world relationships (Subrahmanyam & Greenfield, 2008). Thus, it seems likely that conflicts can also arise in the interaction between young people who know each other, such as classmates. On a similar note, the teachers brought up that online conflicts can resemble the conflicts that occur between their pupils in the real world, making it possible to question the relevance of the online environment that is used as a platform for interaction. However, the absence of some implicit cues that are present in interactions in the physical world might affect how messages and tones are conveyed in online environments. Additionally, young people's social skills are still developing (Brown & Larson, 2009), which may create problems for interaction in both environments. It is important that teachers understand the history of their pupils and that teachers and parents aim to guide and support young people in this process. The strategies used by teachers can address online interactions at different levels (e.g., individual, class). Solving the situations on a case-by-case basis seems to be effective in producing an outcome but has the

potential to consume the teacher's resources. However, the effects of more general discussions with the class might not have long-lasting effects, or the effectiveness of the discussions might be more difficult to evaluate. Thus, there might be a need to create school, municipality, or nation-wide recommendations to provide informed support for practices that are already a part of the everyday life of the teachers.

Because the obscurity and boundaries of the role of the teacher was discussed comprehensively by the participants and included differing views (e.g., regarding what kind of situations should be addressed by the teacher), this topic is highly relevant when discussing pupils' online interactions from the teacher's perspective. On many occasions, the responsibility of the teacher regarding their pupils is bound to the school environment. This can include legislative reasoning (e.g., liability), but also traditional views of the roles of different actors (e.g., teachers and parents). In light of this, it might seem reasonable that events occurring in leisure time are solved by parents and that school events are addressed by the teachers (with help from parents). However, the boundaries between leisure- and school-related activities have become blurred, partly because of IT use. For example, pupils' social media use can include both leisure and school purposes (Luo et al., 2020). Although the participants in this study could have taken an active role in solving problems with pupils' online interactions, it was also brought up that the teachers' resources are limited. Thus, there might be a need to find new ways of collaboration among teachers, parents, and pupils to effectively address problematic situations using the expertise that the parties might have regarding different dimensions of IT use.

The results show that teachers can identify a variety of problems with pupils' online interactions, which can affect daily life in schools. Because the obscurity and the boundaries of the role of the teacher was a topic frequently brought up in the interviews, there is a clear need to discuss the rights and responsibilities of teachers in relation to online behavior that might cross the traditional division between school and home life. However, teachers have also formed strategies to address the challenges and have the professional skills to find solutions to different situations they might face in daily school life. The collaboration among teachers, parents, and students is a key element for the social well-being of students in physical and online environments.

4.5 Article V

Mehtälä, S., Kankaanranta, M., Rousi, R., & Clements, K. (2019). Digital mental health resources for children and youth - evaluation of strengths in user interface design. In J. T. Bastiaens (Ed.), Proceedings of EdMedia + Innovate Learning (pp. 1863–1871). Association for the Advancement of Computing in Education (AACE).

Both the IT use and design dimensions are important for understanding the multifaceted processes that might contribute to the well-being of young IT users. In the fifth article, the design dimension was placed under scrutiny by exploring ITs designed to promote mental health and well-being of children and young people. Although mental health ITs have been studied in the adolescent population, ITs designed to promote mental well-being have received less research attention (see e.g., Baños et al., 2017). However, both mental health and well-being ITs targeting children and young people exist, some of which are freely accessible online. Thus, the digital mental health and well-being resources form a tangible entity that seamlessly connects the topics of young people's well-being and IT design, making it possible to scrutinize specific design dimensions. The aim of the current study was to find out what kind of strengths and points of development can be linked to existing IT artifacts. Based on previous research, it was established that important dimensions to consider include are 1) visual design, 2) content provided, 3) functional design, 4) opportunities for social interaction, 5) engagement of the user, 6) codesign with target group, 7) reliability of the app, and 8) information privacy (for more information, see Mehtälä, 2018). For example, it is important that the ITs be visually pleasing and logically functioning so that they are more approachable to young IT users. However, ITs developed for children tend to follow adult mental models (Masood & Thigambaram, 2015), making it important to find ways for age-appropriate design. The mental health and well-being context also requires a specific kind of design because the information covered or collected by the app might be sensitive in nature. Additionally, digital mental health resources (e.g., websites) might not meet the expectations of young people (Wetterlin et al., 2014).

In the study, the identified dimensions were formatted into specific heuristics against which each app could be assessed. Heuristic evaluation was chosen as a method, to which it is characteristic that the design of an interface is evaluated against a set of criteria (Shneiderman & Plaisant, 2005). The design dimensions and formatting of the heuristics were discussed together with the other authors of the article, and the evaluation itself was carried out by the author of the dissertation. The final number of eligible resources (49) was obtained through a process where the content and the degree to which it was targeted to children and/or young people was taken into closer scrutiny (e.g., an app could be excluded because most of the content present was targeted to adults). Additionally, only resources that could be reached at the time of the analysis

were included. The results show that there is variation among websites and applications in how different design dimensions are met. Although most of the existing websites and applications follow essential design principles (i.e., visual and functional design), there is still some room for improvement, especially in the domains that are relevant for the mental health and well-being context. For example, the reliability of websites and applications could be improved by presenting sources for the content provided. In a similar manner, having a defined and narrow target group could make the content more approachable to its intended audience. The main results are summarized in Table 7.

TABLE 7 Design strengths of mental health and well-being ITs targeted at young people (from article V)

Heuristic Dimension	Mean Percentage	Percentage of Resources Meeting the Design Heuristics
Visual Design	78%	Visual design is consistent (90%) Colorful pictures and animations are used (65%)
Functional Design	73%	Navigation is effortless (73%)
Engagement	56%	Narrative elements are used (76%) Gamification/game elements are used (33%) Interactivity between user and UI promotes engagement (61%)
Content	56%	Target group age range is defined and narrow enough (22%) Provided content is light (90%)
Reliability	56%	The owner is trustworthy (90%) Sources are presented for the content provided (22%)
Codesign	41%	There are mentions of target group inclusion (41%)
Information Privacy	33%	Privacy policies are thorough (33%)
Social Interaction	28%	Ways for social interaction are provided (35%) Ways for social interaction experience are provided (20%)

The study suggests that developers of mental health and well-being ITs should pay specific attention to the dimensions of information privacy, codesign, and social interaction. This is in line with previous research (Kenny et al., 2016; Wetterlin et al., 2014), which also emphasizes the dimensionality of IT design. In addition, the design process should be in line with the specific aims of the IT artifact in question, making it possible that not all dimensions presented are equally relevant to achieve. For example, social media might not be the most suitable channel for mental health information (Rasmussen-Pennington et al.,

2013). However, the dimensions presented shed light on different elements of design and the variations that can be observed across existing mental health and well-being ITs.

Although the characteristics of IT do not determine the nature of IT use alone, they can create some boundaries that may shape the experiences of individual users. Upon addressing a sensitive topic, such as the mental health and well-being of young people, specific attention should be given to the design dimension to ensure that the websites and applications work in this context and remain ethical. However, the practical question of how to create websites and applications that are not only relevant from a therapeutic perspective but also engaging and approachable to young people remains for future endeavors to solve.

5 DISCUSSION

The present dissertation has aimed to build an understanding of how IT use relates to the well-being of young people. This has included perspectives from teachers and pupils as IT users, as well as insights regarding IT artifact design. This chapter aims to answer the research questions presented in the current dissertation (Table 8), including considerations of theoretical and practical contributions. Finally, the main implications are summarized, the limitations of this research are discussed, and recommendations are made for the future.

5.1 Research contributions

The present dissertation has discussed the well-being effects of IT use for young people, including considerations of IT design. Both leisure and school contexts were taken into account, and the experiences of young people were supplemented with the views and observations from teachers. The present dissertation aims to pay special attention to the different layers of IT use, going beyond notions of general IT use (e.g., time spent). The findings of the dissertation by research question are summarized in Table 8.

TABLE 8 Contributions to the dissertation

Research Question	Results and Contributions
What kind of stressful experiences do young people have in relation to IT use? (article I)	Young people can experience varying degrees of stress related to IT use, but many of the experiences in the study can be characterized as mild or moderate. In order of frequency, the experiences of young people tend to focus on online social (media) interaction, notifications, social distancing, and online education or gameplay, followed by other aspects of IT use. For example, it is common that notifications are viewed as disturbing other activities or that there is pressure related to reacting to messages and being present online. (Mehtälä et al., 2022a) The study extends the research by focusing on young people's own experiences in school and home contexts and discussing them in relation to the different aspects of IT use.
What kind of coping strategies can young people use to address stressful experiences related to IT use? (article II)	Young people can use different problem-focused coping strategies to address stress related to IT use depending on the situation at hand. Even though strategies aiming for the complete elimination of stimuli from the device can be used, most of the strategies relate to eliminating or modifying stimuli in specific situations. In relation to the IT artifact, the actions performed often relate to the settings, changes to IT use behaviors, or physical distance between the user and IT artifact (Mehtälä et al., 2022b). The study contributes to research by providing detailed accounts of young people's IT use–related coping strategies and aligning them with the level of IT use.
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? (article III)	Teachers can identify a variety of challenges associated with IT use in onsite and online education. Even though the ways and extent of using IT can be different in these two contexts, similar challenges can be identified. In onsite education, teachers in the study frequently discussed challenges related to directing focus to school work, detrimental effects on the teacher's well-being, differences between pupil's IT use capabilities, and technical difficulties. In a similar manner, challenges identified in online education included detrimental effects on teacher's well-being and technical difficulties, as well as interaction with pupils and reachability, as well as the planning of education activities. (Mehtälä, Salo, Rinne, et al., 2023). The study has relevance, especially because of its ability to compare and align comprehensive school teachers' experiences of the challenges related to IT use in onsite and online education.

What kind of challenges affecting daily school life relate to pupils' online social interactions and how can they be addressed? (article IV)	Pupils' online social interactions can be connected with daily school life on different levels. The study shows that unpleasant messages, unfavorable behavior, pressure, and conflicts can arise in online environments, which especially affects pupils. However, the teachers also emphasized the problems with the obscurity and the boundaries of the role of the teacher in addressing different situations. Even though teachers can use specific strategies to resolve situations on a case-by-case basis, they can also use more general strategies, such as discussions with the class about online communication and rules. Additionally, online social interaction can be viewed as a possibility and meaningful social environment for pupils. Collaboration between teachers, parents, and pupils, as well as making the roles of different actors clearer, can be viewed as fostering the fluency of daily life in schools (Mehtälä, Salo & Pirkkalainen, 2023). The study extends existing knowledge by shedding light on a topic related to IT use that is a part of the everyday life of teachers and students but might be more implicit because of the ability of online social interactions to cross school and home contexts.
What are mental health and well-being apps designed for young people like in terms of design? (article V)	Many existing mental health and well-being websites and applications are successful in following the heuristics for visual and functional design (i.e., basics of UI design). However, there is a need to pay more attention to design features that take into consideration the intended target group, as well as the mental health and well-being context (e.g., sources presented for content, defined, and sufficiently narrow target group) (Mehtälä et al., 2019). The study contributes to research by providing heuristics for design in the context of young people's mental health and well-being and by identifying strengths and weaknesses in the design of existing ITs.

The present dissertation aimed to produce knowledge at the explanation and analysis levels (see Gregor, 2006). The experiences of young people themselves are seen as invaluable for the studied phenomena because the feelings, perceptions, and interpretations that individuals have are unique in many ways and might not be understood correctly using an outside perspective. Similarly, the insights provided by teachers are something that can only be acquired through lived experiences, including observations of phenomena that might go unnoticed outside the research setting (e.g., pupils' online social interaction). Finally, the study regarding existing mental health and well-being websites and applications provides more straightforward information about the affordances of ITs designed to promote the mental health and/or the well-being of young people. Thus, as a whole, the current dissertation contributes to different levels of IT use, including considerations of IT characteristics.

The experiences of young people show that IT use can become stressful for a variety of reasons, including considerations of technology characteristics (e.g., notifications) or the nature of activities performed within online environments (e.g., social interaction). The experiences can also be compared with phenomena previously identified in technostress research (i.e., technostressors, strains, and IT characteristics) (Tarafdar et al., 2019). Although the stressful experiences faced by the participants were often mild or moderate in terms of the stress level, it is important to note that IT use is integrated into the daily lives of young people. Because IT characteristics (e.g., presenteeism and mobility) can create demands for users (Tarafdar et al., 2019), it is important for young people and their parents to reflect on their relationship with IT use to understand how their experiences are shaped. Additionally, because the skills of young people to cope with different situations are still developing (see, e.g., Brown & Larson, 2009), they might need support and guidance from adults to identify and deal with the emotions associated with IT use. For example, both teachers and parents can help young people build their emotional skills, which can be used in everyday life situations. However, young people can effectively use strategies to address IT-related stress, making it important not to underestimate their own agency and expertise. For example, their ability to choose modification or elimination strategies for managing IT-related stimuli depending on the context shows that they can execute actions on different levels of IT use based on their own skills and perceptions of the situation. The strategies for modifying IT features or use routines have been identified as successful in reducing technostress, and the benefits of personally evaluating meaningful stimuli have also been recognized (Salo et al., 2017). However, given the contradiction between the simultaneous need for support and active agency as IT users, it seems reasonable to discuss young people in the IT use context as young IT users. This gives room for the individual qualities that can be associated with an individual user, but it includes a notion of the characteristics of the age group that might not be automatically associated with the definition of an IT user (e.g., the school environment and trends in leisure-related IT use).

The experiences of teachers regarding online and onsite education provide crucial information on how IT use is viewed in different educational settings. Before the COVID-19 crisis, the IT skills of teachers and degree of IT use in a classroom could be very different depending on the country, municipality, school, or teacher in question. For example, IT use in educational settings could be affected by a multitude of factors, such as the attitudes of teachers (see, e.g., Jimoyiannis & Komis, 2007; Scherer & Teo, 2019;). However, the sudden shift to online education has created two settings (online and onsite IT use) that might require a different approach toward IT use. Additionally, learning to use (new) ITs in different situations could still be considered a separate undertaking of its own. Regardless of the extent of IT use in the education practice, teachers' concerns regarding their own well-being and technical difficulties can be expected because of the variation in IT skills and the software and hardware available to schools. However, it is interesting to see that frequent challenges

associated with IT use relate to the qualities of the educational environment itself. Whereas IT use can disturb lessons in onsite education, the teacher cannot be certain about classroom engagement in online learning. Prior research has also identified technical difficulties, student engagement, and communication between teachers and students as barriers that might arise in an unexpected move to online education (Dhawan, 2020). The pedagogical process for planning online lessons can also be viewed as something greatly differing from the practices used in onsite education, emphasizing the multitude of layers that need to be considered when navigating the different modes of education. Finally, it will be interesting to see how the future practices for using IT to support education activities shape up to be after the dust has completely settled in the aftermath of COVID-19.

Although pupils' online interactions are a topic that could be further explored through interviews with young people themselves, teachers can provide an invaluable perspective on the social relationships between their pupils and the perhaps unexpected role of the teacher. Because young people can extend their real-world relationships to online environments (Subrahmanyam & Greenfield, 2008) and teachers interact with their pupils on a daily basis, they might have an even better understanding of the group dynamics than parents. Additionally, because online interactions can cross the traditional boundaries between school and home life, they are an essential part of understanding the continuity of challenges associated with social interaction. Furthermore, teachers can observe similar patterns among their pupils and even between different classes or age groups. In the present dissertation, it is shown that pupils can face various challenges related to online social interaction that might need to be addressed together with adults. However, because of the complex nature of online interactions, it is difficult for teachers to define the limits of their rights and responsibilities. This finding is especially relevant for IS research, as it emphasizes the diversity of IT users and the different ways in which various (social) contexts might overlap.

Solving leisure-related conflicts between pupils can also be seen as excess work that would take too much time because of the limited resources available. In general, the feeling of responsibility over pupils' social media use seems to be a topic that can divide teachers (Thunman et al., 2018). Thus, there is a need to create practices that consider the nature of modern school life. Additionally, teacher–parent–pupil collaboration is viewed as an important way to address different situations. Online interactions are an integral part of the lives of young people and can bring many benefits to individuals, making it important that the extensive opportunities provided by IT use are not forgotten in the discussions surrounding well-being.

The current dissertation argues that young people's IT use can be connected to both positive and negative outcomes that can be physical, psychological, or social in nature. Additionally, teachers can make observations of their classes or individual pupils that might otherwise go unnoticed, and identify relevant IT use-related challenges resurfacing in the school environment. Although the

school context is meaningful for both teachers and pupils, IT use in leisure time might differ from IT use in work or school. Thus, individuals' experiences can be invaluable in providing information about the explicit and implicit dimensions that underlie IT use. Finally, it is important for IT to be designed to meet the needs and preferences of its users. Because there are IT artifacts with a specific aim to promote the mental health and/or well-being of young people, their design features should support this purpose. The characteristics of IT can create some boundaries for the experiences that arise during IT use but should never be taken at face value when it comes to how individuals are expected to behave or feel. As a whole, the present dissertation furthers the understanding of the role of IT in the well-being of young people, placing specific attention on the multidimensionality of IT use and the IT artifact itself.

5.2 Practical implications

In addition to contributing to the literature, the results of the present dissertation have significance at the societal and practical levels. The discussions about the implications of IT use for the well-being of young people need to correspond to the modern IT habits and situations that arise in school and leisure contexts. Additionally, the IT artifact should be considered a more complex entity, with notions that go beyond the physical representations of devices and general time spent using (any) IT (e.g., screen time). Thus, the current dissertation provides a platform for discussion that takes into consideration both the positive and negative implications of IT use in settings that are relevant to young IT users.

On a practical level, the results can be used by many stakeholders who engage with young people or the contexts that are tied with their IT use. First, teachers can use the results of this dissertation to gain a more profound understanding of the challenges that they or their colleagues might face related to IT use in different educational settings. Strategies to address different situations can also be especially valuable to teachers, particularly if they are struggling with similar topics and are affected by the potentially hectic daily school environment. The experiences of young people can also help teachers view IT use in school and leisure contexts from the perspective of their pupils. This can also make it easier for teachers to plan their education practices in a way that is compatible with pupils' needs.

Second, parents can use the results of the present dissertation to build connections between worlds and see the behavior of their children in a different light. Although parents are often one of the closest relationships that young people might have, there are limits to what they can observe. The perspective of teachers can also provide new insights to parents, especially regarding the online education period, which would stir the traditional roles that are present in education. Teachers are also a noteworthy daily contact in the lives of the pupils, making it possible for their experiences to provide an approach that is unfamiliar to the parents (e.g., given the differences between school and home contexts).

Thus, the experiences of both adolescents and teachers can provide invaluable information to parents that might otherwise be unavailable to them.

Third, the present research can be used by other school personnel (e.g., school psychologists and guidance counselors) to build an understanding of young people's IT use–related experiences and the complex online interactions that are visible in daily school life. For example, some of the insights related to first-hand experiences might not come up in discussions with pupils. Additionally, the insights of teachers provide an intriguing perspective that other school personnel groups might not be familiar with, which might help shed light on some phenomena that are a part of their own work. Finally, the results can also be used by IT developers/providers to understand the complex topic of fostering well-being among young people. Both the experiences of young people and teachers can inform the design of ITs designed with these target groups in mind (e.g., educational technology). Additionally, the developed heuristics can be used to direct attention toward the crucial aspects of mental health and well-being design.

5.3 Limitations

Like all research, the present dissertation is not without its limitations. First, the research is limited by the chosen research methods. Although subjective interview data can be used to gain rich information about the study topic, other forms of data (e.g., physiological) could have also provided unique information about the topic. Similarly, the design of ITs can be evaluated in different ways, including techniques such as focus groups or the think-aloud method. Additionally, the heuristics used in this study were created for the purposes of synthesizing different dimensions of design and are not intended to work as an all-encompassing model for the evaluation of mental health and well-being ITs. Although the methods chosen for the current dissertation can be seen as complementing one another, other methods and their combinations could also be chosen to provide interesting data on the subject.

Second, the discussions with younger participants were more straightforward (e.g., because of the stage of linguistic development), making the overall length of the interviews shorter than with the older participants. However, the experiences of younger participants were viewed as valuable as those of others, and a conscious effort was made to present questions in a manner that could be as easily understood by the participants as possible. However, this could sometimes mean that more support questions were used and the interview situation became more interviewer-led. Third, the interviews were carried out among Finnish participants familiar with the national school system. Thus, the results might not apply to other countries or educational systems. However, the COVID-19 situation in particular has been associated with changes to IT use practices worldwide, making digitization of education an important and topical phenomenon to be studied in different cultures.

Fourth, the results mainly discuss school- and leisure-related IT use. However, these are not the only contexts in which IT use may occur. Thus, focusing on specific social contexts (e.g., hobbies) could yield interesting insights regarding the topic. Fifth, the main contributions revolve around the experiences of teachers and young people. Although they represent an important viewpoint on the dissertation topic, the experiences of other people could supplement the results (e.g., parents). Sixth, recall bias might be associated with the experiences that arose in the interviews (Folkman & Moskowitz, 2004).

5.4 Recommendations for future research

Because IT use, its trends, and habits are affected by a state of constant change, it is important that future research continue to explore the dimensionality of IT use. This is especially important for stressful IT use experiences that represent a complex phenomenon not straightforwardly affected by the features of IT but that include notions of individual perceptions and attributes, along with the various characteristics associated with the situation itself. However, many trends tend to resurface every now and then, making it relevant to understand and study past research that may or may not have lost its relevance over the years. That being said, IT users should be considered individuals with their own experiences and opinions; hence, this calls for research efforts that do not diminish versatile personal experiences into mere stereotypes of a specific demographic. Nevertheless, it is important to ensure that the experiences of different user groups are prominent in the literature. Potential topics for future research include:

- The characteristics of IT-use related stressful experiences of children and young people from different backgrounds (e.g., age, country of origin, culture, IT use tendencies – Are the experiences different from one another? Why?)
- Technostress and related coping strategies among young people that spend a noteworthy amount of time engaging with specific online communities (e.g., [semi-]competitive digital gaming – Are there characteristic challenges that relate to a specific IT use profile? How does the position of IT use in the everyday life of adolescents affect their experiences?)
- The differences and similarities between IT use practices in different countries and education systems in the post-COVID19 era (What does migration back to on-site education look like? What was the significance of the online learning period for current and future education practices?)
- The role of young people's online interaction habits for the dynamics between family and friends (What are the social networks of today's young people like? How do IT affordances limit or guide online interactions? What about the other way around?)

- The features of the design processes that successfully produce mental health and well-being ITs that are preferred by the intended target group and stand the test of time (What kind of mental health and well-being ITs are widely used by adolescents? Why? What should digital mental health/well-being promotion look like?)

IS research can help create stability for similar research endeavors because the underlying constructs (i.e., user, IT artifact, and IT use) are expected to maintain a role in the future. Thus, IS research has the potential to build understanding of the topic even at the most fundamental levels. At the same time, future research should not be restricted by mental models that do not correspond to the technological, social, and individual characteristics of modern IT use. Because of this, multidisciplinary research efforts can help build understanding of the complex and multidimensional entities that can be connected with the well-being of young IT users. Perhaps one of the greatest challenges for future research is how to create continuity and connections between a multidisciplinary topic that is being studied at an accelerating pace without losing sight of producing meaningful results.

YHTEENVETO (SUMMARY IN FINNISH)

Erilaiset informaatioteknologiset (IT) ratkaisut ovat pitkään olleet luonteva osa moderneissa yhteiskunnissa elävien ihmisten arkea. Työelämän lisäksi IT:n merkitys on korostunut myös vapaa-ajan vietossa, johtaen usein laitteiden ja sovellusten kokonaiskäytön määrän kasvuun. Vaikka IT:n käyttö voi tuoda mukanaan monia etuja, voidaan siihen liittää myös erinäisiä haasteita. Lasten ja nuorten kohdalla ruutuaika nousee usein puheenaiheeksi, mutta käytön ajallinen tai laitteiden fyysisiin ominaisuuksiin keskittyvä tarkastelu ei anna kovin laajaa kuva IT:n moninaisista käyttötavoista tai näihin liittyvistä hyvinvointivaikutuksista.

Tässä väitöskirjassa tarkastellaan IT:n käyttöön liittyviä haasteita ja mahdollisuuksia lasten ja nuorten hyvinvoinnin edistämisen näkökulmasta. Väitöskirja koostuu viidestä tutkimusartikkelista, joista artikkelit 1-4 keskittyivät nuorten ja opettajien IT:n käyttöön liittyvien näkemysten ja kokemusten selvittämiseen teemahaastattelun keinoin. Ensimmäisessä artikkelissa selvitettiin nuorten stressaavia IT käyttökokemuksia. Tutkimuksessa havaittiin, että nuoret voivat kokea eriasteista stressiä laitteiden ja sovellusten käyttöön liittyen. Suurin osa kokemuksista on kuitenkin luonteeltaan varsin lieviä. Väitöskirjan toisessa artikkelissa perehdyttiin puolestaan nuorten käyttämiin ongelmakeskeisiin selviytymiskeinoihin, joiden avulla he pyrkivät ratkaisemaan stressaavia käyttökokemuksia. Selviytymiskeinot luokiteltiin suhteessa toimintojen luonteeseen (esim. kokonaisvaltaisuus), mahdollistaen selviytymiskeinojen kiinteämmän tarkastelun teknologiakontekstissa. Tutkimuksen tulosten mukaan nuoret voivat käyttää erilaisia keinoja stressaavien tilanteiden ratkaisuun, kuten pysyviä tai tilannekohtaisia muutoksia IT:n käyttötapoihin.

Väitöskirjan kolmannessa artikkelissa tarkasteltiin opettajien näkemyksiä IT:n käyttöön liittyvistä haasteista luokkahuone- ja verkko-opetuksessa. Tutkimuksessa saatiin selville, että samankaltaisia haasteita (esim. tekniset haasteet ja opettajan työhyvinvointi) voidaan havaita molemmissa ympäristöissä. Opetusympäristöjen erilaisuus vaikuttaa kuitenkin myös näkemyksiin haasteista, sillä siinä missä IT:n käyttö saattoi häiritä oppituntia luokkahuoneessa, opettajilla oli haasteita saada tietoa oppilaiden todellisesta osallistumisasteesta opetustilanteeseen etäopetuksen aikana. Opettajat toivat myös esillä, että verkkovälitteinen opetus vaatii erilaista lähestymistapaa opetuksen suunnitteluun.

Väitöskirjan neljäs artikkeli keskittyi oppilaiden verkkovälitteisen sosiaalisen vuorovaikutuksen haasteisiin kouluarjessa. Opettajien mukaan sosiaalisen vuorovaikutuksen haasteet, kuten keskusteluryhmissä ilmenevät konfliktit, ovat varsin yleisiä luokan oppilaiden keskuudessa. Opettajan näkökulmasta haasteeksi muodostuu erityisesti opettajan rooliin liittyvien oikeuksien ja velvollisuuksien määrittäminen tilanteiden selvittelyssä. Opettajat ovat kuitenkin kehittäneet keinoja tilanteiden selvittämiseen ja ennaltaehkäisyyn (esim. tietyistä teemoista keskustelu luokan kanssa). Toimiva keskusteluyhteys opettajan, oppilaiden ja vanhempien kesken sekä koulun käytäntöjen nykyaikaistaminen saattaisivat olla hyödyksi haasteiden ratkaisemisessa.

Väitöskirjan viimeisessä artikkelissa tarkasteltiin mielenterveyden ja -hyvinvoinnin sovelluksia suhteessa näille olennaisiin suunnitteluelementteihin. Tutkimuksen tavoitteena oli selvittää, millaisia vahvuuksia ja kehityskohteita olemassa oleviin ratkaisuihin liittyy. Menetelmänä käytettiin tutkijan suorittamaa asiantuntija-arviointia, jossa aikaisemmin tunnistetut hyvän suunnittelun osa-alueet muotoiltiin arvioitaviksi heuristiikoiksi, joita vasten sovellukset arvioitiin. Tutkimuksen tulokset osoittavat, että olemassa olevat mielenterveyden- ja hyvinvoinnin sovellukset noudattavat hyvin perustason suunnitteluperiaatteita (esim. visuaalinen ja funktionaalinen suunnittelu). Olisi kuitenkin toivottavaa, että sovellusten suunnittelussa kiinnitettäisiin enemmän huomiota kontekstiin sekä kohderyhmään (esim. tarjotun tiedon luotettavuus sekä sisällön kohdentaminen selkeästi rajatulle ikäryhmälle).

Tämän väitöskirjan tutkimustulokset ovat tärkeitä monille eri sidosryhmille. Väitöskirja tarkastelee hyvinvoinnin edistämisen haasteita ja mahdollisuuksia IT:n käytön ja suunnittelun näkökulmasta. IT:n käyttöön liittyen on selvitetty sekä opettajien että nuorten näkemyksiä. Tutkimuksen kannalta tulokset ovat hyödyllisiä IT:n käyttöön liittyvien hyvinvointivaikutusten kytkemisessä selkeämmin teknologiakontekstiin. Pelkän ajallisen tarkastelun sijaan IT:n käyttö saadaan jaettua toiminnoiksi, jotka voidaan puolestaan liittää tiettyihin tilanteisiin ja hyvinvointivaikutuksiin. Väitöskirjan tuloksia voivat hyödyntää muun muassa kunnat, koulut, opettajat, vanhemmat ja hyvinvointiratkaisuiden suunnittelijat. Väitöskirjan tuloksia voidaan hyödyntää muun muassa koulun teknologiakäytänteiden päivittämisessä tai luokan kanssa käytettyjen toimintatapojen kehittämiseen. Vanhemmille tutkimustulokset tarjoavat olennaista tietoa nuorille tärkeistä IT-ympäristöistä. Kaiken kaikkiaan väitöskirja kontribuoi yhteiskunnallisesti merkittävään aiheeseen, jonka syvempi ymmärtäminen tulee olemaan tärkeässä roolissa teknologiaympäristön kehittymisen ja monipuolistumisen myötä.

REFERENCES

Abi-Jaoude, E., Naylor, K. T., & Pignatiello, A. (2020). Smartphones, social media use and youth mental health. *CMAJ*, *192*(6), E136–E141.

Adams, W. C. (2015). Conducting semi-structured interviews. In K E.. Newcomer, H. P. Hatry, & J. S. Wholey (Eds.), *Handbook of practical program evaluation* (pp. 492–505). John Wiley & Sons, Inc.

Adams, S. K., Daly, J. F., & Williford, D. N. (2013). Article commentary: Adolescent sleep and cellular phone use: Recent trends and implications for research. *Health Services Insights, 6*, HSIS11083.

Ahn, J. (2011). The effect of social network sites on adolescents' social and academic development: Current theories and controversies. *Journal of the American Society for Information Science and Technology, 62*(8), 1435–1445.

Allaby, M., & Shannon, C. S. (2019). I just want to keep in touch: Adolescents' experiences with leisure-related smartphone use. *Journal of Leisure Research 51*(3), 245–263.

Allison, K. R. (2020, June). Navigating negativity in research: methodological and ethical considerations in the study of antisocial, subversive and toxic online communities and behaviours. In S. Chancellor, K. Garimella, & K. Weller (Eds.), *Workshop proceedings of the 14th international AAAI conference on web and social media* (Vol. 8, pp. 1–8). Association for the Advancement of Artificial Intelligence.

Aral, S., Brynjolfsson, E., & Van Alstyne, M. (2012). Information, technology, and information worker productivity. *Information Systems Research, 23*(3-part-2), 849–867.

Ayyagari, R., Grover, V., & Purvis, R. (2011). Technostress: Technological antecedents and implications. *MIS Quarterly*, 831–858.

Baker, J. A. (1996). Everyday stressors of academically gifted adolescents. *Journal of Secondary Gifted Education, 7*(2), 356–368.

Baños, R. M., Etchemendy, E., Mira, A., Riva, G., Gaggioli, A., & Botella, C. (2017). Online positive interventions to promote well-being and resilience in the adolescent population: A narrative review. *Frontiers in Psychiatry, 8.*

Baumel, A., & Muench, F. (2016). Heuristic evaluation of eHealth interventions: Establishing standards that relate to the therapeutic process perspective. *JMIR Mental Health, 3*(1), e4563.

Baumrind, D. (1991). Effective parenting during the early adolescent transition. In P. A. Cowan & M. Hetherington (Eds.), *Family transitions* (pp. 111–164). Lawrence Erlbaum Associates.

Beaudry, A., & Pinsonneault, A. (2005). Understanding user responses to information technology: A coping model of user adaptation. *MIS Quarterly*, 493–524.

Biddle, S. J., Gorely, T., Marshall, S. J., Murdey, I., & Cameron, N. (2004). Physical activity and sedentary behaviours in youth: Issues and controversies. *The Journal of the Royal Society for the Promotion of Health, 124*(1), 29–33.

Billings, A. G., & Moos, R. H. (1981). The role of coping responses and social resources in attenuating the stress of life events. *Journal of Behavioral Medicine, 4*(2), 139–157.

Blair, E. (2015). A reflexive exploration of two qualitative data coding techniques. *Journal of Methods and Measurement in the Social Sciences, 6*(1), 14–29.

Bray, A., Banks, J., Devitt, A., & Ní Chorcora, E. (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

Brod, C. (1982). Managing technostress: Optimizing the use of computer technology. *Personnel Journal, 61*(10), 753–57.

Brown, B. B., & Larson, J. (2009). Peer relationships in adolescence. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology: Contextual influences on adolescent development* (pp. 74–103). John Wiley & Sons, Inc.

Brynjolfsson, E., & Yang, S. (1996). Information technology and productivity: A review of the literature. *Advances in Computers, 43*, 179–214.

Burton-Jones, A., Stein, M. K., & Mishra, A. (2017). MISQ research curation on IS use. *MIS Quarterly Research Curations*, *1*(1), 1–24.

Califf, C. B., & Brooks, S. (2020). An empirical study of techno-stressors, literacy facilitation, burnout, and turnover intention as experienced by K—12 teachers. *Computers & Education, 157*, 103971.

Cao, H., Qian, Q., Weng, T., Yuan, C., Sun, Y., Wang, H., & Tao, F. (2011). Screen time, physical activity and mental health among urban adolescents in China. *Preventive Medicine, 53*(4–5), 316–320.

Carminati, L. (2018). Generalizability in qualitative research: A tale of two traditions. *Qualitative Health Research, 28*(13), 2094–2101.

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56*(2), 267.

Chiu, T. K. (2017). Introducing electronic textbooks as daily-use technology in schools: A top-down adoption process. *British Journal of Educational Technology, 48*(2), 524–537.

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

Cicognani, E. (2011). Coping strategies with minor stressors in adolescence: Relationships with social support, self-efficacy, and psychological well-being. *Journal of Applied Social Psychology, 41*(3), 559–578.

Córdoba, J. R., Pilkington, A., & Bernroider, E. W. (2012). Information systems as a discipline in the making: Comparing EJIS and MISQ between 1995 and 2008. *European Journal of Information Systems, 21*(5), 479–495.

Dede, C. (2008). Theoretical perspectives influencing the use of information technology in teaching and learning. In *International handbook of information technology in primary and secondary education* (pp. 43–62). Springer.

DeLongis, A., Coyne, J. C., Dakof, G., Folkman, S., & Lazarus, R. S. (1982). Relationship of daily hassles, uplifts, and major life events to health status. *Health Psychology, 1*(2), 119.

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems, 49*(1), 5–22.

Díaz-López, A., Maquilón-Sánchez, J., & Mirete-Ruiz, A. (2020). Maladaptive use of ICT in adolescence: Profiles, supervision and technological stress. *Comunicar, 64,* 29–38.

DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical Education, 40*(4), 314–321.

Dienlin, T., & Johannes, N. (2020). The impact of digital technology use on adolescent well-being. *Dialogues in Clinical Neuroscience, 22*(2), 135.

Drehlich, M., Naraine, M., Rowe, K., Lai, S. K., Salmon, J., Brown, H., Koorts, H., Macfarlane, S., & Ridgers, N. D. (2020). Using the technology acceptance model to explore adolescents' perspectives on combining technologies for physical activity promotion within an intervention: Usability study. *Journal of Medical Internet Research, 22*(3), e15552.

Edwards, J. R. (1996). An examination of competing versions of the person-environment fit approach to stress. *Academy of management journal, 39*(2), 292-339.

Edwards, J. R., Caplan, R. D., & Harrison, R. V. (1998). Person-environment fit theory: Conceptual foundations, empirical evidence, and directions for future research. In C. L. Cooper (Ed.), Theories of organizational stress (pp. 28–67). Oxford University Press.

Edwards, J. R., & Cooper, C. L. (1990). The person-environment fit approach to stress: Recurring problems and some suggested solutions. *Journal of Organizational Behavior, 11*(4), 293–307.

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

Fischer, T., & Riedl, R. (2017). Technostress research: A nurturing ground for measurement pluralism? *Communications of the Association for Information Systems, 40*(1), 17.

Fox, J., & Moreland, J. J. (2015). The dark side of social networking sites: An exploration of the relational and psychological stressors associated with Facebook use and affordances. *Computers in Human Behavior, 45*, 168–176.

Folkman, S. (2008). The case for positive emotions in the stress process. *Anxiety, Stress, and Coping, 21*(1), 3-14.

Folkman, S., & Moskowitz, J. T. (2004). Coping: Pitfalls and promise. *Annual Review of Psychology, 55*, 745–774.

Francom, G. M. (2016). Barriers to technology use in large and small school districts. *Journal of Information Technology Education Research, 15,* 577.

Frydenberg, E. (2019). *Adolescent coping: Promoting resilience and well-being*. Routledge.

Galanti, T., Guidetti, G., Mazzei, E., Zappalà, S., & Toscano, F. (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.

Gelhaar, T., Seiffge-Krenke, I., Borge, A., Cicognani, E., Cunha, M., Loncaric, D., Macek, P., Steinhausen H.-C., & Metzke, C. W. (2007). Adolescent coping with everyday stressors: A seven-nation study of youth from central, eastern, southern, and northern Europe. *European Journal of Developmental Psychology, 4*(2), 129–156.

Gottschalk, F. (2019). *Impacts of technology use on children: Exploring literature on the brain, cognition, and wellbeing* (OECD Education Working Papers, No. 195). OECD Publishing.

Gray, L. (2018). Exploring how and why young people use social networking sites. *Educational Psychology in Practice, 34*(2), 175–194.

Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly*, 611–642.

Grist, R., Porter, J., & Stallard, P. (2017). Mental health mobile apps for preadolescents and adolescents: A systematic review. *Journal of Medical Internet Research, 19*(5), e176.

Hale, L., & Guan, S. (2015). Screen time and sleep among school-aged children and adolescents: A systematic literature review. *Sleep Medicine Reviews, 21*, 50–58.

Hardy, L. L., Denney-Wilson, E., Thrift, A. P., Okely, A. D., & Baur, L. A. (2010). Screen time and metabolic risk factors among adolescents. *Archives of Pediatrics and Adolescent Medicine, 164*(7), 643–649.

Hartikainen, H., Iivari, N., & Kinnula, M. (2016, June). Should we design for control, trust or involvement? A discourses survey about children's online safety. In *Proceedings of the 15th International Conference on Interaction Design and Children* (pp. 367–378). ACM.

Haßler, B., Major, L., & Hennessy, S. (2016). Tablet use in schools: A critical review of the evidence for learning outcomes. *Journal of Computer Assisted Learning, 32*(2), 139–156.

Holmberg, J., Fransson, G., & Fors, U. (2018). Teachers' pedagogical reasoning and reframing of practice in digital contexts. *The International Journal of Information and Learning Technology*, *35*(2), 130–142.

Huen, J. M., Lai, E. S., Shum, A. K., So, S. W., Chan, M. K., Wong, P. W., Law, Y. W., & Yip, P. S. (2016). Evaluation of a digital game-based learning program for enhancing youth mental health: A structural equation modeling of the program effectiveness. *JMIR Mental Health, 3*(4), e46.

Hung, H. T., Yang, J. C., Hwang, G. J., Chu, H. C., & Wang, C. C. (2018). A scoping review of research on digital game-based language learning. *Computers & Education, 126*, 89–104.

Iivari, N., Sharma, S., & Ventä-Olkkonen, L. (2020). Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education

of the young generation and why information management research should care? *International Journal of Information Management, 55*, 102183.

Jackson, L. A., Zhao, Y., Kolenic III, A., Fitzgerald, H. E., Harold, R., & Von Eye, A. (2008). Race, gender, and information technology use: The new digital divide. *CyberPsychology and Behavior, 11*(4), 437–442

Jimoyiannis, A., & Komis, V. (2007). Examining teachers' beliefs about ICT in education: Implications of a teacher preparation programme. *Teacher Development, 11*(2), 149–173.

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

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

Kelly, Y., Zilanawala, A., Booker, C., & Sacker, A. (2018). Social media use and adolescent mental health: Findings from the UK Millennium Cohort Study. *EClinicalMedicine*, 6, 59–68.

Kenny, R., Dooley, B., & Fitzgerald, A. (2016). Developing mental health mobile apps: Exploring adolescents' perspectives. *Health Informatics Journal, 22*(2), 265-275.

Kinnunen, J., Tuomela, M., & Mäyrä, F. (2022). *Pelaajabarometri 2022: Kohti uutta normaalia* [The Finnish Player Barometer 2022: Towards the New Normal]. TRIM Research Reports 31. Tampere University.

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education, 67*, 135–142.

Krause, H. V., Baum, K., Baumann, A., & Krasnova, H. (2021). Unifying the detrimental and beneficial effects of social network site use on self-esteem: A systematic literature review. *Media Psychology, 24*(1), 10–47.

Kuzmanović, M., Anđelković-Labrović, J., & Nikodijević, A. (2019). Designing e-learning environment based on student preferences: Conjoint analysis approach. *International Journal of Cognitive Research in Science, Engineering and Education, 7*(3), 37–47.

Lamb, R., & Kling, R. (2003). Reconceptualizing users as social actors in information systems research. *MIS Quarterly*, 197–236.

Lauricella, A. R., Cingel, D. P., Blackwell, C., Wartella, E., & Conway, A. (2014). The mobile generation: Youth and adolescent ownership and use of new media. *Communication Research Reports, 31*(4), 357–364.

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

Lenhart, A., Madden, M., Smith, A., Purcell, K., Zickuhr, K., & Rainie, L. (2011). *Teens, kindness and cruelty on social network sites: How American teens navigate the new world of digital citizenship.* Pew Internet and American Life Project.

Li, T. M., Chau, M., Wong, P. W., Lai, E. S., & Yip, P. S. (2013). Evaluation of a web-based social network electronic game in enhancing mental health literacy for young people. *Journal of Medical Internet Research, 15*(5), e80.

Lim, M. S., & Choi, S. B. (2017). Stress caused by social media network applications and user responses. *Multimedia Tools and Applications, 76*(17), 17685–17698.

Lissak, G. (2018). Adverse physiological and psychological effects of screen time on children and adolescents: Literature review and case study. *Environmental Research, 164,* 149–157.

Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. *Oxford Review of Education, 38*(1), 9–24.

Luo, J., Liang, L., & Li, H. (2020). The divergent roles of social media in adolescents' academic performance. *Journal of Research in Childhood Education, 34*(2), 167–182.

Maier, C., Laumer, S., Weinert, C., & Weitzel, T. (2015a). The effects of technostress and switching stress on discontinued use of social networking services: A study of Facebook use. *Information Systems Journal, 25*(3), 275–308.

Maier, C., Laumer, S., Eckhardt, A., & Weitzel, T. (2015b). Giving too much social support: Social overload on social networking sites. *European Journal of Information Systems, 24*(5), 447–464.

Maier, C., Laumer, S., Eckhardt, A., & Weitzel, T. (2012). Online social networks as a source and symbol of stress: An empirical analysis. In *Proceedings of Thirty-Third the International Conference on Information Systems* (ICIS). The International Conference on Information Systems.

Marciano, L., Ostroumova, M., Schulz, P. J., & Camerini, A. L. (2022). Digital media use and adolescents' mental health during the COVID-19 pandemic: A systematic review and meta-analysis. *Frontiers in Public Health, 9*, 2208.

Masood, M., & Thigambaram, M. (2015). The usability of mobile applications for pre-schoolers. *Procedia - Social and Behavioral Sciences, 197*, 1818–1826.

McDaid, D. (2016). *Investing in health literacy. What do we know about the co-benefits to the education sector of actions targeted at children and young people?* World Health Organization.

McHugh, B. C., Wisniewski, P., Rosson, M. B., & Carroll, J. M. (2018). When social media traumatizes teens: The roles of online risk exposure, coping, and post-traumatic stress. *Internet Research, 28*(5), 1169–1188.

Mehtälä, S. (2018). *User interface design for children and youth: Websites and applications to promote mental health and wellbeing* [Master's thesis]. https://jyx.jyu.fi/handle/123456789/58509.

Mehtälä, S., Kankaanranta, M., Rousi, R., & Clements, K. (2019). Digital mental health resources for children and youth - Evaluation of strengths in user interface design. In J. T. Bastiaens (Ed.), *Proceedings of EdMedia + Innovate Learning* (pp. 1863–1871). Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/210217/.

Mehtälä, S., Salo, M., & Pirkkalainen, H. (2023). Teachers' perceptions of the challenges with pupils' online social interaction. Article under review in a journal.

Mehtälä, S., Salo, M., Rinne, A., Koskelainen, T., & Pirkkalainen, H. (2023). Schoolteachers' Experiences of the Challenges Associated With Information Technology Use in Traditional and Online Education. Article accepted to the *14th Scandinavian Conference on Information Systems (SCIS2023)*.

Mehtälä, S., Salo, M., Tikka, S., & Pirkkalainen, H. (2022a) Exploring early adolescents' stressful IT use experiences, B*ehaviour & Information Technology*.

Mehtälä, S., Salo, M., Tikka, S., & Pirkkalainen, H. (2022b). Exploring Early Adolescents' Problem-Focused Strategies for Coping With Stressful IT Use Experiences. In *Proceedings of the 30th European Conference on Information Systems* (Article 6). European Conference on Information Systems.

Meriläinen, M. (2023). Young people's engagement with digital gaming cultures–Validating and developing the digital gaming relationship theory. *Entertainment Computing*, *44*.

Meriläinen, M. (2021). Crooked views and relaxed rules: How teenage boys experience parents' handling of digital gaming. *Media and Communication*, *9*(1), 62–72.

Mihailova, T. (2020). Navigating ambiguous negativity: A case study of Twitch.tv live chats. *New Media & Society, 24*(8), 1830–1851.

Monteiro, E., Constantinides, P., Scott, S., Shaikh, M., & Burton-Jones, A. (2022). Editor's Comments: Qualitative research methods in information systems: a call for phenomenon-focused problematization. *MIS Quarterly, 46*(4), iii-xix.

Myers, M. D., and Newman, M. (2007). The Qualitative Interview in IS Research: Examining the Craft. *Information and Organization, 17*(1): 2–26.

Mäkelä, T., Mehtälä, S., Clements, K., and Seppä, J. (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). Association for the Advancement of Computing in Education (AACE).

Mäntymäki, M., Merikivi, J., Verhagen, T., Feldberg, F., & Rajala, R. (2014). Does a contextualized theory of planned behavior explain why teenagers stay in virtual worlds?. *International Journal of Information Management*, *34*(5), 567–576.

Mäntymäki, M., & Salo, J. (2011). Teenagers in social virtual worlds: Continuous use and purchasing behavior in Habbo Hotel. *Computers in Human Behavior, 27*(6), 2088-2097.

Nielsen, J. (1995). How to conduct a heuristic evaluation. *Nielsen Norman Group, 1*(1), 8.

Nielsen, J., & Molich, R. (1990, March). Heuristic evaluation of user interfaces. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 249–256). ACM.

O'Keeffe, G. S., Clarke-Pearson, K., & Council on Communications and Media (2011). The Impact of Social Media on Children, Adolescents, and Families. *Pediatrics, 127*(4), 800–804.

Olson, C. K. (2010). Children's motivations for video game play in the context of normal development. *Review of general Psychology*, *14*(2), 180-187.

Orben, A., and Przybylski, A. K. (2019). The Association Between Adolescent Well-Being and Digital Technology Use. *Nature Human Behaviour,* 3(2), 173–182.

Panda, A., and Jain, N. K. (2018). Compulsive Smartphone Usage and Users' Ill-Being among Young Indians: Does Personality Matter? *Telematics and Informatics,* 35, 1355–1372.

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

Pate, R. R., Mitchell, J. A., Byun, W., & Dowda, M. (2011). Sedentary behaviour in youth. B*ritish journal of sports medicine, 45*(11), 906–913.

Pienimäki, M., Kinnula, M., & Iivari, N. (2021). Finding fun in non-formal technology education. *International Journal of Child-Computer Interaction*, *29*, 100283.

Pujazon-Zazik, M., and Park, M. J. (2010). To Tweet, or not to Tweet: Gender Differences and Potential Positive and Negative Health Outcomes of Adolescents' Social Internet Use. *American Journal of Men's Health, 4*(1), 77–85.

Rasmussen-Pennington, D. M., Richardson, G., Garinger, C. & Contursi, M. L. (2013). "I Could Be on Facebook by Now": Insights from Canadian Youth on Online Mental Health Information Resources/«Je pourrais déjà être sur Facebook»: points de vue de la jeunesse canadienne sur les sources d'information en ligne concernant la santé mentale. *Canadian Journal of Information and Library Science, 37*(3), 183–200.

Salo, M., Makkonen, M., & Hekkala, R. (2020). The interplay of IT users' coping strategies: Uncovering momentary emotional load, routes, and sequences. *MIS Quarterly, 44*(3), 1143–1175

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

Salo, M., Pirkkalainen, H., Chua, C., and Koskelainen, T. (2017). Explaining information technology users' ways of mitigating technostress. In *Proceedings of the 25th European Conference on Information Systems* (pp. 2460-2467). European Conference on Information Systems.

Salo, M., Pirkkalainen, H., & Koskelainen, T. (2019). Technostress and social networking services: Explaining users' concentration, sleep, identity, and social relation problems. *Information Systems Journal, 29*(2), 408–435.

Sawyer, S. M., Azzopardi, P. S., Wickremarathne, D., & Patton, G. C. (2018). The age of adolescence. *The Lancet Child & Adolescent Health, 2*(3), 223-228.

Scherer, R., & Teo, T. (2019). Unpacking teachers' intentions to integrate technology: A meta-analysis. *Educational Research Review, 27,* 90–109.

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

Scholten, H., & Granic, I. (2019). Use of the principles of design thinking to address limitations of digital mental health interventions for youth. *Journal of Medical Internet Research, 21*(1), e11528.

Seery, M. D., & Quinton, W. J. (2016). Understanding resilience: From negative life events to everyday stressors. In A*dvances in experimental social psychology* (Vol. 54, pp. 181–245). Academic Press.

Seufert, S., Guggemos, J., & Sailer, M. (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.

Shneiderman, S. B. & Plaisant, C. (2005). *Designing the user interface*. The United States of America: Pearson Education, Inc.

Stein, M. K., Newell, S., Wagner, E., & Galliers, R. (2015). Coping with information technology: mixed emotions, vacillation, and nonconforming use patterns. *MIS Quarterly, 39*(2), 367–392.

Straub, D., & del Giudice, M. (2012). Editor's comments: Use. *MIS quarterly*, *36*(4), iii–vii.

Swist, T., Collin, P., McCormack, J. & Third, A. (2015). Social media and the wellbeing of children and young people: A literature review. Perth, WA: Prepared for the Commissioner for Children and Young People, Western Australia.

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

Tarafdar, M., Cooper, C. L., & Stich, J. F. (2019). The technostress trifecta-techno eustress, techno distress and design: Theoretical directions and an agenda for research. *Information Systems Journal, 29*(1), 6–42.

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

Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., & Ragu-Nathan, T. S. (2007). The impact of technostress on role stress and productivity. *Journal of management information systems, 24*(1), 301-328.

Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS quarterly*, *28*(4), 695–704.

Vandelanotte, C., Sugiyama, T., Gardiner, P., & Owen, N. (2009). Associations of leisure-time internet and computer use with overweight and obesity, physical activity and sedentary behaviors: cross-sectional study. *Journal of medical Internet research, 11*(3), e1084.

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

Webb, M., & Cox, M. (2004). A review of pedagogy related to information and communications technology. *Technology, pedagogy and education, 13*(3), 235–286.

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

Wetterlin, F. M., Mar, M. Y., Neilson, E. K., Werker, G. R. & Krausz, M. (2014). eMental health experiences and expectations: a survey of youths' Web-based resource preferences in Canada. *Journal of Medical Internet Research, 16*(12), e293.

Williams, K., & McGillicuddy-De Lisi, A. (1999). Coping strategies in adolescents. *Journal of applied developmental psychology, 20*(4), 537–549.

Williams, M., and Moser, T. (2019). The art of Coding and Thematic Exploration in Qualitative Research. *International Management Review, 15* (1), 45–55.

Yang, L. Q., Che, H., & Spector, P. E. (2008). Job stress and well-being: An examination from the view of person-environment fit. J*ournal of Occupational and Organizational Psychology, 81*(3), 567-587.

Yee, N. (2006). Motivations for play in online games. *CyberPsychology & Behavior 9* (6), 772–775.

Zheng, L. R., Oberle, C. M., Hawkes-Robinson, W. A., & Daniau, S. (2021). Serious games as a complementary tool for social skill development in young people: A systematic review of the literature. *Simulation & Gaming, 52*(6), 686–714.

APPENDIX 1 – ILLUSTRATIONS OF THE INTERVIEW QUESTIONS FOR EARLY ADOLESCENTS AND TEACHERS

Interviews with Early Adolescents

Background information
Questions about the age, grade and IT use tendencies of the interviewee

Examples
- What devices do you use?
- What applications do you use? You can also take a look at your own phone, if it helps you remember.
- How would you describe your own use of devices?
- Do you follow other people than your friends on Instagram/Snapchat?
- Do you like to spend time with devices, games and applications, or would you rather do something else?

Theme 1: Information overload (when you get many notifications or messages on your phone)
Questions about notifications and how they are perceived

Examples
- What notifications do you get on your phone?
- How many notifications do you get per day?
- Do you feel that notifications can be bothersome in some situations?
- Do you ever forget to answer important messages or notifications because you would receive so many notifications/messages (i.e., can an important message get lost in the message flow)?

Theme 2: Multitasking (when you do two or multiple tasks at the same time)
Questions about IT use-related multitasking and its effects

Examples
- What kind of things do you do at the same time, when you are using a device (e.g., console, laptop, phone, computer)?
- Do you browse your phone for fun during class?
- Can you think of a specific situation where you have been multitasking and it has somehow felt bothersome? What were you doing?

Theme 3: Social relationships and social pressure (connecting with others and the expectations related to that)
Questions about the ways in which IT is used to connect with family/friends and other people

Examples

- What applications do you use to connect with friends/family? Does the application that you use depend on the person that you are sending messages to?
- What is your communication with friends/family like?
- Do you feel that you should respond to messages as quickly as possible? Why/why not?
- How do you react if your friend does not answer at all?
- Do you feel that you can miss out on something, if you are not quickly reachable?
- Do you ever feel pressure related to participating in things like message groups?

Theme 4: Alleviating negative feelings related to IT use (Unpleasant feelings can be associated with the use of devices, applications and games. When feelings like this arise, people can do different things to make them go away or decrease them)
Questions about how negative feelings related to IT use can be managed

Examples

- Have you somehow changed the way in which you are using applications or devices, so that their use would not cause feelings like this/they would decrease? Have the changes been temporary or permanent?
- If you have carried out any actions, how would you describe their effects? Have they been helpful?

Theme 5: Social conflicts (arguments between IT users / when someone has sent another IT user unpleasant messages. The researcher emphasizes that the interviewee does not have to share experiences targeting themselves, unless they want to)
Questions about how the conflicts between people or unpleasant messages in online environments are viewed by the interviewee

Examples

- Have you come across conflicts between [IT] users (e.g., in social media/games)?
- Have you noticed unpleasant messages sent to other users?
- How does it make you feel, when you see that there is a conflict online / someone has received an unpleasant message?
- Can you think of a situation where it has felt bothersome to you when you have come across unpleasant interaction between users? What was the situation like?

Theme 6: The Coronavirus situation and the use of IT
Questions about participating to online education and the isolation period during the coronavirus pandemic

Examples

- When the coronavirus restrictions hit during the spring, how did everything go in the school? I understand that you spent a part of the semester online?
- Did you use more devices during online education than what you would normally use? Do you normally use any/ a lot of devices in school?
- How did the online education feel like to you? Was it more fun than regular school?
- What about the free time - do you feel that you used other applications and devices more than usual?
- Do you feel that you spent too much time on your phone/computer during the coronavirus situation?

Interviews with Teachers

Background information
Questions about work experience (e.g., subject, current class), IT use in free time, IT skills and ways of using IT as part of teaching and learning practices.

Examples

- In brief, how would you describe yourself as an IT user in your free time?
- Would you describe yourself as someone who can fluently use devices and applications?
- Which devices do you use as a teacher to support teaching?
- Which devices do the pupils use during class?
- Has your way of using devices to support education somehow changed over the years?

Theme 1: Information overload in school
Questions about class rules and how IT use is visible in the classroom

Examples

- Are the pupils' own phones ever collected away during class?
- Are the pupils allowed to use their phones during recess?
- If there are restrictions to the use of own phones, how well are these followed?
- Over the years, has there been a change in how much the devices can bother lessons?
- Can you think of a specific situation where you would have noticed or a pupil would have brought up themselves that notifications feel bothersome for carrying out school assignments or in other contexts? What happened? Why did the situation feel bothersome?

Theme 2: IT use-related multitasking in school
Questions about IT use-related multitasking (i.e., the use of devices while doing something else) and focusing to school work

Examples

- Have you noticed the pupils using their phone or another device at the same time as they try to do something else (multitasking)?
- Has multitasking interfered with the completion of the task? In what way?
- Do you think that using devices for schoolwork requires multitasking skills?
- Should pupils be separately taught "solo-tasking" (i.e., the ability to focus on one thing?
- Over the years, do you think that there has been a change in how difficult it is for pupils to focus on schoolwork?

Theme 3: The role of IT use in school-related social relationships
Questions about class messaging groups and online discussions

Examples

- Do you have a class WhatsApp group or another messaging group for the class?
- Have there been any conflict situations in the class messaging group (e.g., unpleasant messages, ways of using the group)
- Do you know if the pupils have their own messaging group for the class without a teacher?
- Do you ever think that pupils feel pressure related to participation in online discussions or their social media posts (e.g. comparison with others)?
- Can you think of a particular situation where you would have noticed or a pupil would have brought up unpleasant feelings related to messaging? What happened? Why did the situation feel bothersome?

Theme 4: Interaction between pupils in online environments and the role of the school/teacher
Questions about the online interactions between pupils and their visibility in the school environment

Examples

- Are there differences between pupils in how they react to social media and communication in online environments?
- Have the conflict situations in social media or other applications somehow changed over the years?
- Can you think of a specific situation where you would have noticed or a pupil would have brought up unpleasant feelings related to online environments? What happened? Why did the situation feel bothersome?

Theme 5: Alleviating negative feelings related to IT use in school
Questions about how the teacher and pupils can manage with different situations related to IT use

Examples

- How have disturbances from devices/other unpleasant feelings related to IT use been resolved in your classroom?
- Are there any school level common rules for the use of devices/applications?
- Do you think that there has been a change over the years in how well children can deal with negative feelings related to IT use and do something about them? Are there differences among pupils?

Theme 6: IT use among teachers and pupils during the online education period (due to the coronavirus situation)
Questions about familiarity with online education, practices used during online education period, support received for organizing education and how the online education period was viewed by the teacher and their pupils

Examples

- What did online education feel like for you during different times?
- What application did you use for delivering lessons? How was the lesson structured in practice?
- If you contrast the time before online education with the time after it, do you think that the ways of using devices and applications has somehow changed in on-site education?

ORIGINAL PAPERS

I

EXPLORING EARLY ADOLESCENTS' STRESSFUL IT USE EXPERIENCES

by

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RESEARCH ARTICLE

Exploring early adolescents' stressful IT use experiences

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ABSTRACT

Early adolescents are accustomed to using information technology (IT) for different purposes as a part of their everyday life. While IT use can provide many benefits, it can also include negative experiences, such as feelings of stress (i.e. technostress). Considering that young IT users' technostress perspectives have remained limited in the literature, this paper attempts to contrast their experiences with aspects from earlier research. A qualitative content analysis of semi-structured interviews with 31 primary and secondary school students reveals that early adolescents have encountered stressful IT use experiences that vary based on the degree of stress. The experiences relate to different dimensions of IT use, namely 1) online social (media) behaviour, 2) notification-driven behaviour, 3) social distancing and online education behaviour, and 4) gameplay and other aspects of IT use behaviour. Common denominators for these experiences include the attention or time required by IT use and coming across unwanted content or communications. In addition to reporting negative feelings and emotions, the participants mentioned physical strains, including headache and exhaustion. Although early adolescents can face experiences that can be contrasted with similar stressors and strains as adults, the distinct characteristics of their IT use should be considered in future research.

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Early adolescents; stressful experiences; IT use; technostress

1. Introduction

Information technology (IT) has become an integral part of the activities that people engage in as part of their daily life. IT users consist of people who operate in various roles in different contexts (Lamb and Kling 2003); these include children and young people who tend to grow up with the latest IT and learn to use it for specific school and leisure purposes. There are various outcomes associated with IT use, including adverse and beneficial effects on well-being. One of these is technostress, which is a term used to characterise the stress associated with IT use (Tarafdar, Cooper, and Stich 2019).

Previous research has largely focused on technostress experienced by adults, especially in the work context (see, e.g. Tarafdar, Cooper, and Stich 2019). Even though IT use among adolescents has been widely studied from various perspectives, there is a lack of research focusing on their technostress experiences. This is a valuable perspective because IT use can be quite different for adolescent and adult users. In addition to the obvious developmental differences, adolescents' IT use can be guided by the characteristics and boundaries set by their typical IT use environments (e.g. home, school and hobbies). Additionally, the role of certain actors (e.g. parents and teachers) that might not have as much influence on IT use among adults, should not be overlooked.

The current article inspects the different stress-initiating situations that can be present in the everyday IT use of adolescents in home and school settings. Perspectives from the technostress literature (e.g. stressors, strains, and IT characteristics) and the literature on adolescents' IT use (e.g. uses of IT and health and well-being outcomes) are combined to build understanding of the different dimensions in adolescents' IT use context that could be relevant for the emergence of stressful experiences. As a whole, the study addresses a combination of influencing factors related to IT use behaviour and user activities, IT characteristics and perceptions of stress. The underlying data consist of 31 semi-structured interviews with Finnish primary and secondary school students.

The paper is structured as follows: First, we describe the prior literature on IT use among adolescents and technostress, which forms the theoretical background of the paper. Then, we describe in detail how the interview data was collected and analyzed. The results section presents an overview of the stressful experiences

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associated with IT use as reported by the participants, including the identification of significant themes and factors introduced together with examples from the data. The study contributes to research by discussing the characteristics of the early adolescents' stressful IT use experiences, as well as by contrasting the experiences with concepts identified in the technostress literature. Additionally, it is argued that the findings of the study may be relevant to various stakeholders seeking to gain a more profound understanding of early adolescents' IT use behaviour, including designers, health professionals, teachers, and parents. Finally, the limitations of this research and topics for future research are described and are accompanied by concluding remarks.

1.1. Research on IT use among adolescents

Since young people have long been a significant user group of IT, previous research has explored IT use among adolescents. This includes identifying relevant demographics associated with IT use (see, e.g. Jackson et al. 2008), as well as the type and prevalence of IT use. In 2011, it was established that 95% of American children aged 12–17 use the internet, while up to 80% of them also used social media websites (Lenhart et al. 2011). Smartphones, in particular, are often used to alleviate feelings of boredom, but also to intentionally relax and connect with friends (Allaby and Shannon 2019). According to a recent Finnish survey (Kinnunen, Taskinen, and Mäyrä 2020), in the age group of 10–19-year-olds, nearly half of the participants claimed to play a digital entertainment game daily, while as many as 79% did this on a weekly basis or more often. In contrast, merely a bit less than 1% of the participants did not play these kinds of games at all (Kinnunen, Taskinen, and Mäyrä 2020). Thus, it can be stated that different online environments seem to form an important domain in the lives of adolescent users.

A considerable amount of research exists within various disciplines inspecting the duration (i.e. screen time), type, timing (time of the day), and variety of IT use in connection to adverse physical, psychological, and physiological health and well-being outcomes (Lissak 2018). Screen time, in particular, has been linked with problems in the domains of sleep, metabolism, and mental health (Hale and Guan 2015; Hardy et al. 2010; Cao et al. 2011), including poor outcomes associated with compulsive smartphone use (Panda and Jain 2008). It has also been established that adolescents can experience stress when they cannot access the internet (Díaz-López, Maquilón-Sánchez, and Mirete-Ruiz 2020), while encountering harmful content and communications can even lead to symptoms of post-traumatic stress (McHugh et al. 2018). This shows that stress related to IT use is an existing phenomenon among adolescents. However, gaining a more profound understanding of the topic requires placing more attention towards the various IT use cases in which stress might occur.

Although it is evident that the prior literature has traditionally focused on the adverse effects of IT use, more recent reviews undermine the perception of a strong connection between IT use among adolescents and negative wellbeing outcomes (Orben and Przybylski 2019; Dienlin and Johannes 2020). For example, more research might be needed to find support for the current IT use recommendations (Gottschalk 2019). It might be true that a fixated focus on poor well-being outcomes can be viewed as a quite narrow perspective when contrasted with the diversity of interactions and elements present in IT environments, such as the potential positive effects for socialisation (see, e.g. O'Keeffe and Clarke-Pearson 2011; Pujazon-Zazik and Park 2010). Thus, the benefits of IT use for young people should not be overlooked. However, because adolescence is portrayed by different physical, cognitive, and psychosocial developments, careful attention must be placed on the role of IT use in this process.

2. Research on technostress

The concept of technostress refers to the stress that a person experiences because of their use of IT (Tarafdar, Cooper, and Stich 2019). Here, stress is viewed as a 'relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being' (Lazarus and Folkman 1984, 19). Altogether, the literature on stress highlights the complicated, dynamic interactions between a person and their environment (e.g. technological environment). For example, the characteristics and features of IT enable use situations that create various kinds of demands, which can result in technostress (Ayyagari, Grover, and Purvis 2011). Although (techno)stress can also be positive (e.g. Benlian 2020), we mainly focus on negative (techno)stress because of its harmful consequences.

Technostress research has focused on concepts such as technostressors (i.e. the creators or creating conditions of technostress), strains (i.e. users' negative responses to stressors), and coping mechanisms (i.e. users' attempts to manage stressful situations) (Fischer and Riedl 2017; Tarafdar, Cooper, and Stich 2019). Technostress can emerge in various forms. Much of the prior technostress research has examined

technostress in work-related contexts, such as knowledge work (Fischer and Riedl 2017; Tarafdar, Cooper, and Stich 2019). These studies have identified common forms of technostress, including techno-invasion (e.g. constant overflow of IT use to other domains of life), techno-overload (e.g. too much IT), techno-complexity (e.g. IT feels too difficult to use), techno-uncertainty (e.g. IT changes are too quick), and techno-insecurity (e.g. other people know more about IT) (Tarafdar et al. 2007; Fischer and Riedl 2017). Strains and negative outcomes include poor work productivity, task performance, job dissatisfaction, decreased organisational commitment, turnover, and burnout (Califf et al. 2020; Maier, Laumer, and Eckhardt 2015a; Pawlowski et al. 2007; Pirkkalainen et al. 2019; Ragu-Nathan et al. 2008; Srivastava et al. 2015; Tams et al. 2018; Tarafdar et al. 2007).

Recently, researchers have started to pay more attention to technostress emerging in the personal, nonwork-related use of IT (Benlian 2020; Maier et al. 2015b; 2015c; 2020; Salo, Pirkkalainen, and Koskelainen 2019; 2022). In contexts such as social media use, researchers have identified new stressors, including life/social comparison (e.g. contrasting one's own life with content published by others), social overload (e.g. too many social requests online), and online conflicts (e.g. disputes and arguments on social networking services) (Fox and Moreland 2015; Maier et al. 2015b; Salo, Pirkkalainen, and Koskelainen 2019). With personal use, users often gradually create their own technostress as their use intensifies because of existing use schemes (i.e. influence/persuasion from the design of the IT and other users), as well as because of the fun and hedonic gratifications they experience (Salo et al. 2022). Intensified use creates increasing demands, which can then exceed one's abilities for dealing with them (Salo et al. 2022). For example, receiving constant personal notifications can at first be considered fun and exciting but can later introduce stress experiences or even turn out to be entirely stressful. Technostress (e.g. from notifications and interruptions) can occur in various contexts, as well as spill over from study/work contexts to personal/leisure contexts and vice versa (Benlian 2020; Galluch, Grover, and Thatcher 2015). Strains and negative outcomes in personal, non-work-related use include exhaustion, use discontinuance, concentration problems, sleep problems, identity issues, and interpersonal conflicts (Benlian 2020; Maier et al. 2015b; 2015c; Salo, Pirkkalainen, and Koskelainen 2019). Importantly, (techno)stress is subjective, and users have different responses to externally similar-looking events and situations based on their personal interpretations of the events and situations (Fox and Moreland 2015; Lazarus and Folkman 1984; Salo et al. 2018).

Although prior research about work-related and non-work-related technostress provides the initial foundation for investigating technostress in various contexts, it offers few insights into how children and young people experience technostress. Children lead manifold lives that often include the use of IT for various purposes, making it purposeful to examine the characteristics of their potential stress experiences. While the school context, in turn, can be contrasted with work, the obvious differences between these two environments should not remain unexplored. Understanding children's and young people's perspectives is important because IT is a natural part of their everyday lives. In addition, IT is an integral part of many societies, making it probable that adolescents will become more exposed to different forms of IT in the future through their increasingly active societal agency. This, in turn, calls for specific attention to the possible effects that IT use might have on the health and wellbeing of young users.

In conclusion, while technostress has been studied among the adult population and especially in the work context, research focusing on younger users is lacking. Additionally, studies exist on IT use among adolescents, with their focus more on aspects such as the duration and type of use, as well as their perceived effects on the physical, physiological, and psychological health and well-being of adolescents. However, as IT use can entail diverse types of interactions and various dimensions that might not always be intuitively identifiable from the outside, a focus on aspects such as the duration of use might not be successful in discovering the diversity of the actual stress experiences. In the following sections, the current research attempts to combine these two perspectives by exploring how the stressful IT use experiences faced by early adolescents can be contrasted with technostress.

3. Methodology

We chose to conduct a qualitative field study using semi-structured interviews (SSIs) to provide descriptions and explanations for early adolescents' stressful IT use experiences. Thus, the research design has taken a phenomenographic stance. The approach to inquiry can be viewed as interpretive, which allows for focusing on language as a conveyer of phenomena and ideas, here taking into account the complex nature of human experience (see, e.g. Myers 1997). We feel that interviews can help gain an understanding of early adolescents' stressful experiences, while providing early adolescents with the possibility to discuss their

experiences in their own words. In the present study, flexibility (Myers and Newman 2007) was seen as one of the greatest strengths of this data collection technique because of the emerging nature of the topic and the young age of the interviewees. As a whole, the data collection and analysis process could be described as a continuous interplay between the collected data and previous research. We present further details of this process below.

3.1. Data collection

SSIs are a common method for collecting data in qualitative research in general (Kallio et al. 2016) as well as in information systems (Myers and Newman 2007). These kinds of interviews characteristically fall between the unstructured and strictly structured interview forms. Although SSIs usually circle around a set of predetermined themes, new aspects arising from the dialogue are an important aspect of the interview process (DiCicco-Bloom and Crabtree 2006). The interview scheme that we used was inspired by previous research because it has been established that the literature and previous work are good sources for building a thorough understanding of the subject matter (Rabionett 2011). This included the identification of themes that could be relevant to the adolescent population (e.g. social pressure and multitasking), followed by more careful wording of questions. Although prior literature guided the process, an attempt was made to ensure that the questions were constructed using a language that would feel natural and easily understandable to the participants. Additionally, the initial scheme was further developed based on the results received from the interviews, such as through the identification of emerging themes. The interview included mostly open-ended questions (e.g. *Can you think of a situation where a notification has felt bothersome? What was the situation like? Do you feel that you should answer the messages that you receive as soon as possible? Why or why not?*) to ensure the richness and depth of the resulting data, but the dialogue could sometimes be supported with closed questions as well (e.g. *How often do you feel that those kinds of notifications can annoy you? Is it daily, weekly, or monthly? Do you feel that you spent more time using applications and devices in your leisure time as well during the online education period?*).

We conducted interviews with 31 students from primary (n = 20) and secondary schools (n = 11) in the spring of 2018 and fall of 2020. The age of the students ranged from 9–15 years, and 19 of the study participants were male (61%). While adolescence is often considered as the age period between 10 and 19 years of age, its definition can be extended to up to 24 years of age (Sawyer et al. 2018). Because of this, we feel that the age range of the participants is most fittingly described as *early adolescents*. However, the terms *young people* and *adolescents* are used interchangeably in the text to avoid tediousness. In addition, it should be noted that the ages of the students within the same class could differ from one another (e.g. students of a class consisted of 9- and 10-year-olds) due to the placement of their birthday during the calendar year. However, this was not seen as a reason to exclude the perceivably younger students from the study, as it seemed irrational to assume that their experiences would noteworthy differ from those of their classmates because of the slight age difference.

Even though the technostress experiences of different individuals can differ in intensity, it is important to note that the goal of the current study was to understand early adolescents' experiences through their customary, everyday IT use practices. We feel that this is a valuable perspective, especially because technostress research targeting early adolescents is still emerging. Purposive sampling was used in the sense that the sampling process was foremost guided by the age of the participants, as well as their willingness to participate in the study. Because the study attempted to capture the experiences of early adolescents, there was a need to choose a sufficient number of interviewees representing different age groups. Additionally, even though the participants were viewed as being old enough to express their views on the study topic, it was also true that older participants could often provide more detailed narratives. Thus, having a wider pool of participants was viewed as especially important for capturing the experiences of primary school children. The resulting set of interviews was seen as representing the different dimensions of IT use that can be relevant for early adolescents and, thus, fit the purposes of the current study. After conducting 31 interviews, we estimated that the benefit from conducting further interviews would be marginal. On average, an interview with a primary school student lasted half an hour. In the case of the secondary school students, in turn, the interviews ranged from half an hour to an hour. The interviews were transcribed for the relevant parts. Further information about the age and grade of the participants is provided in Table 1.

Table 1. Age and education level of the participants.

n	Educational Stage	Grade	Age Range
20	primary school	4–6th	9–12 years
11	secondary school	7–9th	13–15 years

The study was conducted following the university's ethical guidelines. Because the study involved minors, the permission to participate in the study was required from the children's guardians. The participants for the interviews were recruited by making enquiries to collaboration networks, including one primary and one secondary school. Initially, the rectors were approached about their willingness to let their school participate in the study. Following a positive answer, a similar inquiry was sent for the teachers regarding the participation of their students. Finally, permission from a parent/guardian was required for the children to participate in the research activities. In addition, the interest of the adolescents themselves in participating was inquired through a permission slip because this was seen to support their agency in decisions affecting their own lives.

In the schools, participation was encouraged by stating that a small prize would be raffled among the interview participants. In addition, every participant would receive a small, sweet treat as a token of gratitude for their participation. Because of the COVID-19 situation, permission to conduct the interviews in the fall of 2020 was applied for and received from the university management. Additionally, the COVID-19 situation was continuously monitored and discussed with the rector of the affiliated school, as well as the class teachers. During the interviews, precautionary measures, such as the use of face masks, thorough hand hygiene, and the use of an interview space with sufficient ventilation were taken to minimise the risks of the interview situation itself.

3.2. Data analysis

The data analysis process included creating codes that would describe the underlying data and allow a meaningful categorisation for interpretation and analysis, which is customary for qualitative content analysis (see, e.g. Blair 2015). This approach was viewed to fit the data collected through SSIs, especially because children's technostress experiences are still an emerging topic. Furthermore, a qualitative approach for analysis could help identify the various units of interest that might emerge and be visible on different levels of the data. The coding process was carried out using the NVivo qualitative data analysis software (version 1.0) by a member of the research team. The coding process was jointly designed and reviewed throughout the process among the different team members from various academic positions (e.g. associate professor, post-doc, PhD student). Even though qualitative research is rarely—and does not need to be—free of the interpretations made by the researcher, this was viewed as an important step to increase the quality of the inferences made from the data. The creation of codes and categories followed the identification of relevant topics and themes arising from the interviews (see, e.g. Williams and Moser 2019), here with a focus on capturing the different levels of IT use as closely as possible. For example, the code *Notifications are annoying* was placed in the category *Feelings and events associated with notifications* and included subcodes *When you're doing something else* and *When you get many of a certain kind*. In this way, higher categories could be built based on the perceived similarities between the codes, without losing relevant specifications.

However, it should be kept in mind that the interview frame was in fact informed by prior research and did affect the themes discussed during the interviews (e.g. notifications). Using this kind of interview frame would connect the study to earlier research and treat the participants in a similar manner, diminishing the effect of the interviewer on the results. However, because the interviewer has an active role in the interview process, these effects cannot be fully eliminated. The data analysis process could be viewed as a dialogue consisting of initial research-driven perceptions, insights arising from the interviews, and how these, in turn, can be contrasted with the views from the literature. In the first phase, only one interview was coded to ensure that this approach fit the data. This was followed by the coding of one interview representing each grade in the data to see how well the logic of the emerging categories and codes worked with the interviewees of different ages. At this point, the main structure of the coding scheme became quite established. Finally, the rest of the interviews were coded, here accompanied by the creation of any necessary subcategories.

In the second phase, all the code categories (e.g. *Notifications*, *Messages and comments*) and related subcodes (e.g. *Notifications are disturbing*, *Unpleasant messages and comments*) were analyzed to identify potential areas of interest in the data that might indicate the presence of stressful experiences related to IT use. The code and underlying interview text were more closely scrutinised whenever the code seemed to portray a negative emotionally loaded experience (e.g. the wording used the phrases *stressful/annoying/annoys* or *disturbing/disturbs*) and was related to IT use. In this way, *neutral* captions characterising IT use (e.g. *applications and devices used)*, as well as the captions representing *positive* experiences, could be left out of the analysis for this particular study. This approach to analysis was discussed and agreed upon together by the research team.

In the third phase, these data were analyzed in relation to the perceived degree of stress associated with the event or experience. This analysis resulted in 161 quotations associated with some degree of stress. In addition, 29 quotations were identified as not stressful and, hence, were left out of further analyses. We sorted quotations into four categories: highly stressful, moderately stressful, mildly stressful, and potentially stressful. A quotation was categorised as highly stressful if it indicated a strong connection to stress (e.g. use of strongly negative words to describe the emotions at play during a certain event). A moderately stressful quotation, in turn, referred to stress that was clearly stated but included wordings that made the experience seem less stressful (e.g. occasional disturbance). Similarly, descriptions of a mildly stressful experience used words that referred to a very low degree of stress (e.g. slight annoyance). Finally, a quotation was characterised as potentially stressful when it did not include a clear relation to stress but, at the same time, could not be unambiguously categorized as not stressful because of more implicit properties (e.g. describing an event that can be viewed as negatively loaded but does not include explicit references to personal significance). The categorizations were reviewed multiple times together with the research team and refined accordingly. Furthermore, any quotations that could not be unambiguously categorised were discussed to find the most suitable category. Thus, the final data set consists of quotations arranged based on the perceived level of stress experienced by the participants. Additionally, the data were further categorised based on the aspects of IT use that seemed to be relevant to the stress-creating conditions.

4. Results

During the interviews, the participants were asked about their customary ways of using IT. The participants were accustomed to using IT for different purposes, in leisure and school contexts. All 31 adolescents were regular mobile phone users and a majority mentioned using a computer. They were also asked about the applications and services that they used on their devices. Communication, video, and streaming services and applications were widely used among the participants, which is not surprising because of their popularity among different user groups. Most of the participants also used their devices to access social media and communities, news and books, games, and music. A typical participant used their phone as the primary device to access different kinds of contents and applications depending on their own interests. Additionally, it was common especially for the boys to use computers or consoles for game playing and related communications. Social media (e.g. Lenhart et al. 2011) and games (e.g. Kinnunen, Taskinen, and Mäyrä 2020) are often used by these age groups, and prior research also suggests that parental models remain an important factor in relation to news consumption, even in the age of mobile devices (Edgerly et al. 2018). In addition, music has traditionally been an important area of interest for adolescents, trending toward an increasing significance in late adolescence (Miranda 2013; Roberts, Henriksen, and Foehr 2009).

During the interviews, the participants were asked about their different IT use experiences in diverse situations, such as in relation to interactions with friends, family members, or other internet users. A closer analysis revealed that up to 161 experiences identified in the data could be associated with a certain level of stress (see the data analysis for more information). The results suggest that all 31 participants had faced situations that could be characterised as stressful. Around one-third of the experiences (54) were related to mild stress. Additionally, nearly a fourth of the experiences could be categorised as potentially (37) or highly (37) stressful. The remaining experiences (33) could be characterised as indicating moderate amounts of stress.

> Highly stressful experience encountered by a secondary school student: *Maybe it's that when I think about social media and the kinds of pressures associated with [your] looks. You also notice it in your mind or, like, in your mental health. I feel this kind of hecticness, like the presence of social media. So it can add to the anxiety related to social media, or this very stressful state of mind. And it's precisely one of those [things] that interfere with daily life and stuff like that. That they're all the same.*

> Moderately stressful experience encountered by a secondary school student: *Sometimes [the notifications] do disturb me. If I'm, for example, doing something, and suddenly some message arrives, I always feel like checking or viewing it.*

> Mildly stressful experience encountered by a primary school student: *It is annoying when I'm in the middle of the game and someone, for example [a friend] calls and asks if I can play with them.*

> Potentially stressful experience encountered by a secondary school student: *I should take the sounds off of my games because when I keep them on, this one time, when I did not know how to take them off of my games, my mum had said that if you don't take those notifications off, I'm going to take your phone completely away from you—or you have to delete all the games because she lost her nerve, because of the constant sounds.*

Based on their predominant qualities, the stressful experiences encountered by the participants can be

further divided into four main categories: 1) online social (media) behaviour, 2) notification-driven behaviour, 3) social distancing and online education behaviour, and 4) gameplay and other aspects of IT use behaviour. Table 2 presents these categories together with the degree of stress identified among the mentions within each category.

In our data, the stressful experiences encountered by the participants most often related to social activities and social media or notifications. Similarly, highly stressful experiences were quite evenly distributed among online social activities and social media, notifications, and social distancing and online education. Moderately and mildly stressful experiences, in turn, were found to be most prevalent in the first two categories. This provides a connection to the technostress literature because prior research has identified stressors related to social networking services (SNSs) use (see, e.g. Maier et al. 2015b; Salo, Pirkkalainen, and Koskelainen 2019). Because notifications have a strong link with IT design itself, the stressful experiences related to these could be contrasted with the technology environmental conditions. These include the IT characteristics that can create a demand for the user (e.g. presenteeism and mobility, see, e.g. Tarafdar, Cooper, and Stich 2019). A more profound division of the categories is presented in Table 3.

It is visible that the stressful experiences encountered by adolescents relate to different dimensions of IT use. In relation to social distancing and online education, the negative experiences were most often associated with the feeling of using too much IT. Regarding the technostress literature, this can be connected to information/IT overload (see, e.g. Tarafdar et al. 2007; Fischer and Riedl 2017). The experiences regarding gameplay and other aspects of IT use had to do with negative feelings associated with gameplay, number of advertisements or device use in general. Much like with the notifications, many of these aspects could be connected to the IT characteristics dimension. However, a more careful analysis of the experiences is still needed to evaluate their nature as a whole, as described in the following sections.

Table 2. Stressful experiences with IT categorised by the perceived degree of stress.

Online social (media) behaviour	64
Highly stressful	*13*
Moderately stressful	*10*
Mildly stressful	*17*
Potentially stressful	*24*
Notification-driven behaviour	56
Highly stressful	*12*
Moderately stressful	*19*
Mildly stressful	*18*
Potentially stressful	*7*
Social distancing and online education behaviour	28
Highly stressful	*9*
Moderately stressful	*3*
Mildly stressful	*10*
Potentially stressful	*6*
Gameplay and other aspects of IT use behaviour	13
Highly stressful	*3*
Moderately stressful	*1*
Mildly stressful	*9*
Potentially stressful	*0*
Total references	**161**

Table 3. Factors affecting stressful IT use experiences.

Online social (media) behaviour	64
The pressure associated with reacting to messages and being present	27
Own reaction time and presence	*22*
Friends' reaction time	*5*
A negative disposition toward specific content and communications	20
Received by others	*10*
Received by oneself	*10*
The pressure associated with content published by oneself	14
Doubts about information privacy	3
Notification-driven behaviour	56
Disturbance to other activities	34
The feeling of receiving too many notifications	19
Disturbance to family members	3
Social distancing and online education behaviour	28
The feeling of using too much IT	19
Difficulties with participating in online education	8
Disturbance to family members	1
Gameplay and other aspects of IT use behaviour	13
A mismatch between own skills and level required by the game	6
Missing a deleted game	2
Game feels annoying or addictive	1
Too many advertisements	2
Negative feelings associated with device use in general	2
Total references	**161**

4.1. Online social (media) behavior

The participants' stressful experiences with online social activities and social media were most often associated with reaction time to messages. Many of the participants felt that there was some kind of pressure associated with how fast they reacted to the messages sent to them. Additionally, some of the participants associated different negative feelings, such as frustration, with a situation where a friend did not answer their message.

> *Maybe in the case of some people. Not with my closest friends, but with more distant friends because I seriously don't have the energy to open everything that I receive. Social media has a kind of this culture that if you don't react right away, people will immediately be like, 'Hey, why aren't you answering?' You sometimes feel like you have to 'announce that you're alive.' Because the lives of everyone, or many people, revolve around social media, so maybe in that sense. (Secondary school student)*

> This one time my friend had shared this funny, umm, video to a group, and then I felt like I commented it too late—that is when I felt that, am I too slow with these things or what—it's nothing more than that, but, I'm usually the person who puts in the last message. (Primary school student)

> Well then I kind of, maybe wonder a bit about that. When you've been [sending instant messages] a little more actively, and suddenly there is a longer pause, it kind of makes you wonder. (Secondary school student)

Prior research has noted that social pressure can be present in instant messaging situations, fostered by IT characteristics such as indicators of availability (Church and De Oliveira 2013; Pielot et al. 2014). The participants also referred to their disposition toward messages and comments that they encounter online. For example, the interviewees expressed sympathy toward the victims of bullying and users who received other unpleasant comments.

> Yeah, you see that [bullying] every single day. Umm, I have never been bullied, and I have [not] bullied anyone online because I see no sense in that. But you see it quite often. And people make all these completely stupid [online] questionnaires where people can anonymously say anything. It also counts as online bullying if someone calls you names anonymously. (Secondary school student)

> — For example, there can be pretty mean comments underneath a picture in [social networking service] or something. — In both services [social networking service and messaging service], there have been cases where an embarrassing or otherwise unfavorable picture could have been sent or published. So I think that it would at least be pretty unpleasant if that was done to me. (Secondary school student)

> I mean, there is no point to go and put comments like that to someone else. — It's pretty awful for the person who is getting the comments. (Primary school student)

> Well, I think it feels pretty bad when some people are arguing and the others have to just watch when they send these nasty messages to one another. (Primary school student)

Some of the participants also chose to share their own experiences, including disputes with other users. These often occurred with people that they knew in real life as well but in situations related to online game play or social media use.

> Well, maybe in a game, someone has a bit called you names or something – It's like, the players have become better and better [in playing the game], and they keep calling the worse players names and that is why I stopped [playing] it. It's like this, unnecessary, umm, criticizing of others. (Primary school student)

> And then, umm, sometimes I argue with [a friend]. (Primary school student)

> When I started this one user [in a social networking service] that I still use, in one video, I received like [tens of] hateful comments—I don't care about them —I might think about them for a moment, but it's like, they don't affect the things I do in any way. (Secondary school student)

While adolescents can experience different types of bullying online (see, e.g. Slonje, Smith, and Frisén 2013), the actual extent of this phenomenon as contrasted with *traditional* modes of bullying has been questioned (Olweus 2012). However, IT environments can work as platforms for bullying, due to different characteristics such as anonymity and not being bound to certain time and place (Slonje, Smith, and Frisén 2013), making cyberbullying a potential threat to adolescents' online social activity (Pujazon-Zazik and Park 2010) as well. The participants were also asked whether they felt pressure in relation to the content that they published. They mentioned spending time thinking about what they published, comparing themselves to others, and feeling pressure in relation to their own appearance. The remaining few mentions were related to the information security of the services. One of the participants, for example, discussed a data breach in a widely used social networking service.

> — I think about it very carefully, like is it a picture that I want, for example, my grandma to see. If the picture is not something that I would voluntarily show to all of my relatives for example, then I wouldn't publish anything like that. I want to publish pictures that I don't have to regret afterwards. (Secondary school student)

> Well yeah—like, I wouldn't publish a picture, where you can see that I have just woken up and stuff like that. (Primary school student)

> Yeah, as I mentioned, I don't have [an instant messaging service], but I had it for like six months. The same goes with [a social networking service]. But then I deleted them because I want to be unreachable and also because it's so … How do you put it … Very superficial, like for example. you show in [the social networking service] the best aspects of your life and like that. And so, sometimes that has given me this [feeling] that geez, the life of that person is like a bed of roses, but on the other hand, that is not the reality. (Secondary school student)

> Well, it's like when you think about the fact that all the information is taken from a hundred thousand people, both visible and not visible. They see all your passwords, too, email passwords as well. That would surely be pretty unpleasant. (Secondary school student)

It has also been established in prior literature that adolescents can experience pressure associated with their own appearance (McCabe and Ricciardelli 2001) and that social networking services (SNSs) have the potential to provide an environment for social comparison (Yang 2016). Combined with the findings from this study, it can be stated that the characteristics of SNSs as well as other aspects of social IT use can contribute to the negative experiences encountered by adolescents online.

4.2. Notification-driven behavior

The participants' stressful experiences with notifications from devices and applications were associated with three subcategories: 1) disturbance to other activities, 2) a great number of notifications, and 3) disturbance to family members. Notifications, be they related to individual or social IT use, were often viewed as disturbing or annoying when the focus was on something else.

> Sometimes when, umm, the tablet is always charging and I go to eat and then there is this like, completely horrible sound when the updates or something keeps constantly coming to it. (Primary school student)

> — [Notifications] do disturb me. Almost always like in some group chat or other things that have any of the kind of things that you are not interested in, or if you'd like to do something else. And you usually can't turn them off, so they just keep coming all the time. (Secondary school student)

The evaluation of the notification relevance can affect negative feelings associated with the interruption (Aranda, Ali-Hasan, and Baig 2016). The great number of notifications was also viewed negatively by many of the participants. Much like in the first subcategory, the number of notifications was often viewed as disturbing or annoying, while the latter was also influenced by the notification type in question (i.e. certain kinds of notifications were viewed as more annoying than others). It was also noticed that an important message could get lost in the flow of notifications. Finally, some of the participants mentioned that notifications could be disturbing to their family members, such as parents or younger siblings.

> You [used to] get like, several hundred [notifications] a day—I guess I find it kind of disturbing because you hear the notification sound all the time. (Primary school student)

> — I have [stopped using] dad's tablet. It constantly tells you to remove files even though we have removed like half of the files, still it keeps like complaining so we decided to stop using it — It was [annoying]—we couldn't even watch this one movie because it was all the time like, remove files, and it was crazy disturbing. (Primary school student)

> Sometimes it has been like so that you have had something important in [a messaging service], and you haven't noticed that when there have been many messages coming from various groups. Or in [an instant messaging service], if there is some important subject, you just don't notice it. Sometimes this happens, but on the other hand, if I get something very important, I know to wait for it beforehand. But yeah, sometimes it is disturbing when you miss something. (Secondary school student)

> Sometimes when, well I … We have quite many family members and when my mom takes the youngest one to bed, it sometimes disturbs when my mom is getting [the sibling] to fall asleep—when someone calls, that is the most disturbing thing. (Primary school student)

The findings from this section suggest that adolescents' experiences of the disturbance or annoyance caused by notifications relate to different aspects of IT use context. Because notifications are an important part of the functionality of many devices and applications, they can fundamentally be viewed as an IT characteristic. Nevertheless, notifications can also be of social (e.g. messages from friends) or individual (e.g. system notifications) nature, and become problematic to a variety of online and real-world activities. In addition to disturbance to the adolescents themselves, notifications can also be disturbing to their family members. Thus, notifications can be connected to stressful experiences in various levels of interaction and individual activities.

4.3. Social distancing and online education behavior

The participants also brought up experiences related to social distancing and online education. Because only the later part of the interviews occurred after COVID-19, the information related to this category was primarily provided by primary school students. The participants reported feelings of using too much IT, difficulties with participating in online education, and, much like the previous category, disturbance to family members. In addition to mentioning general feelings of excessive IT use, the participants faced physical symptoms, such as headaches and eye fatigue.

> On the computer with homework, you could spend an hour or several hours, so you did use the computer quite a bit—maybe there was a bit too much [IT use]—you started doing homework in the morning and suddenly you noticed wow, it's already noon. (Primary school student)

> Sometimes, I did get a headache when I had stared [the screen] all-day. (Primary school student)

> It was like, you got a bit cross-eyed from having to stare and follow the lesson—from the screen. (Primary school student)

Previous research has associated IT use with physical symptoms, including a potential connection between smartphone use and headache (Demirci, Demirci, and Akgonul 2016). Additionally, there have been concerns in relation to some aspects associated with distance learning (e.g. screen use) that could potentially increase the headache burden among children and young people (Karvounides et al. 2021). In relation to lessons, the participants brought up a lack of motivation to participate and dissatisfaction with how the lessons were structured or how they required participation. Reaching the teacher was also viewed as a problem. Some discussions related to technical difficulties with IT and the required preparations emerged. Finally, in relation to disturbances to family members, one participant mentioned that the different schedules of family members participating in online education were sometimes problematic.

> You maybe didn't always have the energy to go to [a video conferencing platform] at a certain [time], because then if, you always like got scared that you were late from there because it had already started even though there was no one there, when you went to check. (Primary school student)

> If you didn't understand something, it was sometimes a bit hard to reach the teacher. (Primary school student)

> — But then like during the lessons you have like, for example, if you have something wrong with your mic or something like that it can be labeled as goofing around—even though it wouldn't be like that. (Primary school student)

The findings suggest that different levels of IT use can be relevant when evaluating adolescents' experiences of social distancing and online education. While IT characteristics can be viewed as an important aspect of successful lesson delivery, other dimensions such as the expertise of teachers, parents and students to use the selected IT as well as the accumulating nature of IT use, and its potential consequences, seem to be meaningful in this context. In this sense, both social and individual aspects of IT use might be relevant for understanding the stressful experiences related to social distancing and online education.

4.4. Gameplay and other aspects of IT use behavior

The remaining mentions consisted of stressful experiences associated with gameplay and other aspects of IT use, namely number of advertisements, and device use in general. The participants reported negative feelings toward gameplay, most often losing, as well as toward accidentally deleting a game.

> Hmm, I guess one time in this game when, umm, I was trying to, umm, go against this boss, in that situation I think I lost my nerve a couple of times. (Primary school student)

> Well … For example this one time, it happened that I downloaded this pretty good game to my, umm, phone, which I sometimes played with my computer – Well then, my phone did not have the capacity to run it, so I tried deleting these, all these games and these, so – that it would work a bit better, but then, it still wouldn't work so, I just thought how I lost everything just because of that (primary school student)

Some of the participants' stressful experiences were caused by games that were perceived as too difficult. As intrinsic motivation and appropriate level of challenge (i.e. not too easy but also not excessively difficult) are important aspects of enjoyable gameplay and a flow state (Csikszentmihalyi 1990), gaming can reflect negative experiences when the demands of a game substantially exceed a player's current skills. Gameplay and flow was also at times obstructed by notifications. Furthermore, some of the participants were annoyed by the number of advertisements within games or applications. Finally, negative experiences in regard to device use, in general, included encountering physical symptoms, namely headache, and fatigue, while using a device.

> [Interviewer: Have you ever faced a situation where an application has become annoying?] I have. For example, I have deleted some games when they constantly show you a commercial. (Secondary school student)

> I usually get a headache when I'm using my phone, so I spend quite a lot of time on the trampoline or do something else that is fun outside. (Primary school student)

> I do use [my phone] just before bed. But then I have also noticed that it affects the quality of sleep quite a bit. And then you get that like radiation from it, and it affects precisely the quality of sleep and the next day as well, you don't necessarily have as much energy or you feel tired, like that. (Secondary school student)

Stressful experiences associated with losing a game and encountering a disturbing amount of advertisements can both be considered to create a barrier for the immersive game or application use experience. The physical outcomes related to device use, in turn, are of similar nature to the ones mentioned in relation to social distancing and online education. In this sense, they seem to be more defined by the time spent looking at a screen rather than the activities themselves. As a whole, the mentions in relation to gameplay and other

aspects of IT use seem to consist of stressful experiences at the individual level.

5. Discussion

In the current study, it was established that adolescents' interactions with IT included experiences that varied in the degree of stress. Although nearly a fourth of the identified experiences could be described as highly stressful, the stress levels of the remaining situations varied from merely potentially stressful to moderately stressful. The experiences mentioned by the interviewees related to four categories: 1) online social (media) behaviour, 2) notification-driven behaviour, 3) social distancing and online education behaviour, and 4) gameplay and other aspects of IT use behaviour.

5.1. Research contributions

The adolescents' stressful experiences with IT use relate to diverse aspects of device, application, and game use, including both social and individual IT use contexts. While most of the experiences can be associated with leisure use, especially online education due to COVID19 has revealed some experiences related to IT use that are specific to the school context. The distinctive features of the experiences reported by adolescents can be contrasted with prior research on technostress (e.g. technostressors, strains, and technology characteristics) (Tarafdar, Cooper, and Stich 2019).

While the technostressors identified in the previous literature can be viewed to be present in the adolescents' experiences, different aspects related to individual and social IT use contexts should not be overlooked. In relation to online social interaction and social media, the participants brought up perspectives associated with reaction time and disposition toward messages, as well as pressure related to what they published. There were also some mentions of information privacy, graphical content, and the feeling of using too much social media. Experiences with SNSs have been discussed in the adult population and include stressors such as SNS overdependence, (information) overload, life comparison discrepancy, online discussion conflict, and the uncontrollability of privacy and security (Fox and Moreland 2015; Maier et al. 2015b; Salo, Pirkkalainen, and Koskelainen 2019). These are all visible, at least to some extent, in the aspects mentioned by the adolescents as well. For example, the pressure associated with providing timely answers to messages and the feeling of using too much social media can include the characteristics of SNS overdependence and overload. In relation to life comparison discrepancy, some of the participants mentioned feeling pressure regarding their own social media posts and messages and comparing their life to that of others. Stressors related to online discussion conflict, in turn, were discussed in the form of reactions to messages received by oneself or others. In addition, privacy and security uncontrollability were present in a few mentions in relation to SNS information security.

While the extent of cyberbullying has been questioned in the previous research (e.g. Olweus 2012), this study shows that adolescents do come across bullying and disputes while using IT, with a varying degree of personal involvement. However, it should be noted that the results might not completely reflect the extent of this phenomenon, as it is possible that the participants might not have felt comfortable sharing their personal experiences during the interview. Additionally, the participants were given the opportunity to discuss this sensitive topic on a more general level. Furthermore, and especially with the younger students, alternative terms (e.g. online disputes) were used to approach this theme, as it was assumed that the participants might have different ideas of what constitutes cyberbullying. This study notes that while the unpleasant messages and comments faced by the participants would not be targeted towards the adolescents themselves, they can feel sympathy towards their recipients or discomfort when acting in a spectator role. This shows that while bullying is an important phenomenon to study, understanding young IT users' daily experiences might call for more consideration towards the complex nature of online interactions and social media, as well as the diverse roles that their users have agency in.

In relation to notifications, the participants often referred to them as disturbing other activities or their family members (e.g. parents and siblings). On many occasions, the number of notifications was also viewed as problematic. For example, for mobile applications, it is common for notifications sent by the application to be turned on by default. Previous research has noted that certain IT characteristics, such as presenteeism and mobility, can create a demand for the user (Tarafdar, Cooper, and Stich 2019). The negative experiences associated with the overflowing and interrupting nature of notifications can also be contrasted with techno-overload and overdependence. In case of adolescents, it should also be noted that the notifications often relate to leisure contexts. Moreover, family dynamics seem to affect the experiences, as notifications from adolescents' devices can annoy or disturb family members and the other way around. Thus, negative experiences related to notifications should be contrasted with the context in which they occur.

Because a notable proportion of the interviews were conducted during the COVID-19 outbreak, experiences relating to social distancing and online education were also present in the data. The participants referred to feelings of using too much IT, having difficulties with participating in lessons, and as with the notifications, disturbance to family members. The feelings of excessive IT use can be linked with techno-overload because participating in online education often required the participants to increase their time spent using IT. In addition to participating in online lessons, participants also reported using the devices for their homework. The participants could view the IT use required by online education as excessive, or it could be the result of combined IT use during school and leisure time.

In relation to excessive IT use, the participants also reported the occurrence of physical symptoms, such as headache and fatigue. These can be viewed as strains that occur due to time spent using IT. Finally, the participants mentioned their feelings toward how the lessons were structured, reaching the teacher, and certain technical IT aspects. Technical challenges, a lack of student engagement, and obstacles in teacher–student communication can become problems in an abrupt move from traditional to online education (Dhawan 2020). Thus, many of these experiences can be associated with the teachers' and students' unfamiliarity with the new teaching and learning practices. However, the occurrence of diverse stressful experiences related to different dimensions of IT use call for attention towards how IT use is organised among children and young people during remote learning.

The participants also referred to gameplay and other aspects of IT use. Specifically, gaming seems to be a noteworthy area of interest in the light of the adolescents' experiences. It was customary that negative gaming experiences were related to losing in a game, which is often characterised by a sense of frustration associated with a feeling of failure. There was also a reference to a demand for long-term skill development among players making the game more challenging, which was viewed negatively by a casual player. These kinds of situations can be viewed as a mismatch between an individual's skills and the skill level required by the game. As different forms of game playing are common pastimes for young IT users, especially for boys and young men, these experiences form a relevant area of interest in IT use among adolescents.

Additionally, the interviewees noted that the advertisements encountered in games and applications could feel annoying. Game play and application use experiences can be contrasted with the states of flow and immersion identified in prior literature (see, e.g. Csikszentmihalyi 1990; Silic and Lowry 2020), the interruption of which can evoke negative feelings. Additionally, the participants mentioned that physical symptoms, namely headache, and fatigue, could be associated with using a certain device. These can be viewed as physical strains resulting from device use. In conclusion, while certain in-built qualities of IT can be associated with the negative experiences faced by adolescents, these experiences are also affected by the nature of the use process, as well as, different factors threatening its smooth flow.

5.1.1. Practical implications

The present study focuses on stressful experiences relevant to the adolescent population. In addition to helping researchers connect technostress with adolescents' multidimensional IT use context, the current research provides practical information for different professional groups interacting with adolescents, including teachers, youth workers, and health care professionals. These groups can use this information to build their understanding of the different dimensions of IT use that can be meaningful in the diverse situations faced by their students or clients. For example, the different dimensions of IT use, namely online social interaction and social media, notifications, social distancing and online education as well as gameplay and other aspects of IT use, can be used as a starting point for identifying potential areas of interest in a specific situation.

This information can also be relevant from a parental perspective because it can help parents and guardians get a better grasp of the IT use context that their children navigate through daily. This includes gaining a more profound understanding of the IT environments that are relevant for modern adolescents. Knowledge about the different characteristics of IT that are connected to stressful experiences among adolescents can also help practitioners in the domain of IT to better understand these processes and apply this information in the design and development of new IT artifacts.

5.1.2. Limitations and topics for future research

The current study comes with specific limitations. First, the results focus on the use of social media, games, and school-related applications because these were viewed as some of the most fundamental technologies present in the lives of the interviewed adolescents. However, adolescents' experiences may also derive from the use of other technologies. Second, although the content of the adolescents' stressful experiences can be applied when studying this topic, the frequencies of these experiences are not generalisable. Furthermore, because the present study focused on the experiences of Finnish

primary and secondary school students, there may be differences across countries and cultures. Third, the current study collected subjective data instead of physiological data. Although both kinds of data can provide insights into the topic, we deliberately wanted to focus on the adolescents' experiences and their descriptions. Fourth, the interviews about experiences may reflect recall bias (Folkman and Moskowitz 2004). Fifth, even though there was an effort to construct the interview questions in a way that felt natural and easy for the participants, it is possible that some of the younger participants, in particular, could have had difficulties in understanding the questions or verbalising their own experiences and thoughts. Finally, the present study has focused on the negative side of the adolescents' experiences, even though stress can also be positive (Benlian 2020; Salo et al. 2018).

It might be fruitful for future research endeavours to more specifically map the qualities of different IT use environments that may be significant in the lives of early adolescents. Additionally, it is important to study the phenomenon of technostress in various cultural and geographical contexts. Given the limitations of the methodological approach, there is also a need to expand the topic using other suitable research methods that might help address the shortcomings of the chosen methodology. Most importantly, it is essential that any future research takes into consideration the specific characteristics of the early adolescent population (e.g. gameplay and online social behaviour) and the contexts that might be meaningful to their IT use experiences (e.g. school, leisure). Even though some interviewees reported specific occasions that could be characterised as strongly stress-initiating situations, most of the experiences were associated with merely potential or moderate stress. Although the current study has focused particularly on adolescents' stressful experiences, it did not discuss the mitigation mechanisms used to limit or decrease these effects, which is a noteworthy phenomenon to be studied. However, at the same time, it should be kept in mind that the experiences, expectations, and preferences of adolescents are not only defined by their age, but also by their individual personas and the meaningful environments in which they engage in their daily lives.

6. Conclusions

In their daily interactions with IT, adolescents can encounter experiences that are characterised by diverse amounts of stress. Even though some of these can be described as highly stressful, most of the reported experiences ranged from potentially to moderately stressful. In addition, the experiences relate to different dimensions driving IT use behaviour, namely online social (media) interaction, notifications, social distancing and online education as well as gameplay and other aspects of IT use. However, it should be noted that these experiences are affected by the adolescents' individual perceptions of, or their reactions to, the faced situations.

Adolescents' experiences can be contrasted with concepts from adults' technostress experiences, namely IT characteristics, technostressors (i.e. technostress creators), and strains (technostress outcomes). However, it should be kept in mind that adolescents' IT use context includes distinct features, such as the school context, which is not entirely comparable to the adults' working life. Additionally, besides online education, adolescents' experiences are often associated with leisure use, including experiences with gameplay. Moreover, upon navigating online environments, adolescents do come across different kinds of unpleasant comments and messages that can make them uncomfortable and feel sympathy towards people receiving them. Thus, it should be noted that different level online communications can be distressing to adolescents. Finally, due to these differences, the experiences of adults and adolescents should be compared with care.

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References

Allaby, M., and C. S. Shannon. 2019. ""I Just Want to Keep in Touch": Adolescents' Experiences with Leisure-Related Smartphone use"." *Journal of Leisure Research* 51 (3): 245–263.

Aranda, J., N. Ali-Hasan, and S. Baig. 2016. "I'm Just Trying to Survive: An Ethnographic Look at Mobile Notifications and Attention Management". In *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct*, Florence, Italy, 6–9 September, pp. 564–574.

Ayyagari, R., V. Grover, and R. Purvis. 2011. "Technostress: Technological Antecedents and Implications." *MIS Quarterly* 35 (4): 831–858.

Benlian, A. 2020. "A Daily Field Investigation of Technology-Driven Spillovers from Work to Home." *MIS Quarterly* 44: 3.

Blair, E. 2015. "A Reflexive Exploration of two Qualitative Data Coding Techniques." *Journal of Methods and Measurement in the Social Sciences* 6 (1): 14–29.

Califf, C. B., S. Sarker, and S. Sarker. 2020. "The Bright and Dark Sides of Technostress: A Mixed-Methods Study Involving Healthcare IT." *MIS Quarterly* 44 (2): 809–856.

Cao, H., Q. Qian, T. Weng, C. Yuan, Y. Sun, H. Wang, and F. Tao. 2011. "Screen Time, Physical Activity and Mental Health among Urban Adolescents in China." *Preventive Medicine* 53 (4–5): 316–320.

Church, K., and R. De Oliveira. 2013. "What's up with WhatsApp? Comparing Mobile Instant Messaging Behaviors with Traditional SMS," In *Proceedings of the 15th international conference on Human computer interaction with mobile devices and services*, Munich, Germany, 27–30 August, pp. 352361.

Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*. New York: Harper & Row.

Demirci, S., K. Demirci, and M. Akgonul. 2016. "Headache in Smartphone Users: A Cross-Sectional Study." *Journal of Neurology and Psychology* 4 (1): 5.

Dhawan, S. 2020. "Online Learning: A Panacea in the Time of COVID-19 Crisis." *Journal of Educational Technology Systems* 49 (1): 5–22.

Díaz-López, A., J. Maquilón-Sánchez, and A. Mirete-Ruiz. 2020. "Maladaptive Use of ICT in Adolescence: Profiles, Supervision and Technological Stress." *Comunicar* 64: 29–38.

DiCicco-Bloom, B., and B. F. Crabtree. 2006. "The Qualitative Research Interview." *Medical Education* 40 (4): 314–321.

Dienlin, T., and N. Johannes. 2020. "The Impact of Digital Technology Use on Adolescent Well-Being." *Dialogues in Clinical Neuroscience* 22 (2): 135.

Edgerly, S., K. Thorson, E. Thorson, E. K. Vraga, and L. Bode. 2018. "Do Parents Still Model News Consumption? Socializing News Use Among Adolescents in a Multi-Device World." *New Media and Society* 20 (4): 1263–1281.

Fischer, T., and R. Riedl. 2017. "Technostress Research: A Nurturing Ground for Measurement Pluralism?" *Communications of the Association for Information Systems* 40 (1): 17.

Folkman, S., and J. T. Moskowitz. 2004. "Coping: Pitfalls and Promise." *Annual Review of Psychology* 55: 745–774.

Fox, J., and J. J. Moreland. 2015. "The Dark Side of Social Networking Sites: An Exploration of the Relational and Psychological Stressors Associated with Facebook Use and Affordances." *Computers in Human Behavior* 45: 168–176.

Galluch, P. S., V. Grover, and J. B. Thatcher. 2015. "Interrupting the Workplace: Examining Stressors in an Information Technology Context." *Journal of the Association for Information Systems* 16 (1): 2.

Gottschalk, F. 2019. Impacts of Technology Use on Children: Exploring Literature on the Brain, Cognition and Well-being, OECD Education Working Papers, No. 195, Paris: OECD Publishing.

Hale, L., and S. Guan. 2015. "Screen Time and Sleep among School-Aged Children and Adolescents: A Systematic Literature Review." *Sleep Medicine Reviews* 21: 50–58.

Hardy, L. L., E. Denney-Wilson, A. P. Thrift, A. D. Okely, and L. A. Baur. 2010. "Screen Time and Metabolic Risk Factors among Adolescents." *Archives of Pediatrics and Adolescent Medicine* 164 (7): 643–649.

Jackson, L. A., Y. Zhao, A. Kolenic III, H. E. Fitzgerald, R. Harold, and A. Von Eye. 2008. "Race, Gender, and Information Technology Use: The New Digital Divide." *CyberPsychology and Behavior* 11 (4): 437–442.

Kallio, H., A. M. Pietilä, M. Johnson, 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.

Karvounides, D., M. Marzouk, A. C. Ross, J. H. VanderPluym, C. Pettet, A. Ladak, … C. L. Szperka. 2021. "The Intersection of COVID-19, School, and Headaches: Problems and Solutions." *Headache: The Journal of Head and Face Pain* 61 (1): 190–201.

Kinnunen, J., K. Taskinen, and F. Mäyrä. 2020. Pelaajabarometri 2020: Pelaamista koronan aikaan. [Player Barometer 2020: Game Playing at the Time of COVID-19]. TRIM Research Reports 29. Tampere University. Tampere, Finland.

Lamb, R., and R. Kling. 2003. "Reconceptualizing Users as Social Actors in Information Systems Research." *MIS Quarterly* 27 (2): 197–236.

Lazarus, R. S., and S. Folkman. 1984. *Stress, Appraisal, and Coping*. New York: Springer Publishing Company.

Lenhart, A., M. Madden, A. Smith, K. Purcell, K. Zickuhr, and L. Rainie. 2011. *Teens, Kindness and Cruelty on Social Network Sites: How American Teens Navigate the New World of "Digital Citizenship"*. Washington, DC: Pew Internet and American Life Project.

Lissak, G. 2018. "Adverse Physiological and Psychological Effects of Screen Time on Children and Adolescents: Literature Review and Case Study." *Environmental Research* 164: 149–157.

Maier, C., S. Laumer, and A. Eckhardt. 2015a. "Information Technology as Daily Stressor: Pinning Down the Causes of Burnout." *Journal of Business Economics* 85 (4): 349–387.

Maier, C., S. Laumer, A. Eckhardt, and T. Weitzel. 2015b. "Giving Too Much Social Support: Social Overload on Social Networking Sites." *European Journal of Information Systems* 24 (5): 447–464.

Maier, C., S. Laumer, J. B. Thatcher, H. Sun, C. Weinert, and T. Weitzel. 2020. "Social Networking Site Use Resumption: A Model of Return Migration," Forthcoming in: *Journal of the Association for Information Systems*.

Maier, C., S. Laumer, C. Weinert, and T. Weitzel. 2015c. "The Effects of Technostress and Switching Stress on Discontinued Use of Social Networking Services: A Study of Facebook Use." *Information Systems Journal* 25 (3): 275–308.

McCabe, M., and L. Ricciardelli. 2001. "Parent, Peer and Media Influences on Body Image and Strategies to Both Increase and Decrease Body Size among Adolescent Boys and Girls." *Adolescence* 36 (142): 225–240.

McHugh, B. C., P. Wisniewski, M. B. Rosson, and J. M. Carroll. 2018. "When Social Media Traumatizes Teens: The Roles of Online Risk Exposure, Coping, and Post-Traumatic Stress." *Internet Research* 28 (5): 1169–1188.

Miranda, D. 2013. "The Role of Music in Adolescent Development: Much More Than the Same Old Song." *International Journal of Adolescence and Youth* 18 (1): 5–22.

Myers, M. D. 1997. "Qualitative Research in Information Systems." *MIS Quarterly* 21 (2): 241–242.

O'Keeffe, G. S., K. Clarke-Pearson, & Council on Communications and Media. 2011. "The Impact of Social Media on Children, Adolescents, and Families." *Pediatrics* 127 (4): 800–804.

Myers, M. D., and M. Newman. 2007. "The Qualitative Interview in IS Research: Examining the Craft." *Information and Organization* 17 (1): 2–26.

Olweus, D. 2012. "Cyberbullying: An Overrated Phenomenon?" *European Journal of Developmental Psychology* 9 (5): 520–538.

Orben, A., and A. K. Przybylski. 2019. "The Association Between Adolescent Well-Being and Digital Technology Use." *Nature Human Behaviour* 3 (2): 173–182.

Panda, A., and N. K. Jain. 2018. "Compulsive Smartphone Usage and Users' Ill-Being among Young Indians: Does Personality Matter?" *Telematics and Informatics* 35: 1355–1372.

Pawlowski, S. D., E. A. Kaganer, and J. J. Cater. 2007. "Focusing the Research Agenda on Burnout in IT: Social Representations of Burnout in the Profession." *European Journal of Information Systems* 16 (5): 612–627.

Pielot, M., R. De Oliveira, H. Kwak, and N. Oliver. 2014, April. "Didn't you see my Message? Predicting Attentiveness to Mobile Instant Messages," In *Proceedings of the SIGCHI conference on human factors in computing systems*, Toronto, CA, 26 April-1 May, pp. 3319–3328.

Pirkkalainen, H., M. Salo, M. Tarafdar, and M. Makkonen. 2019. "Deliberate or Instinctive? Proactive and Reactive Coping for Technostress." *Journal of Management Information Systems* 36 (4): 1179–1212.

Pujazon-Zazik, M., and M. J. Park. 2010. "To Tweet, or not to Tweet: Gender Differences and Potential Positive and Negative Health Outcomes of Adolescents' Social Internet Use." *American Journal of Men's Health* 4 (1): 77–85.

Rabionett, S. E. 2011. "How I Learned to Design and Conduct Semi-Structured Interviews: An Ongoing and Continuous Journey." *Qualitative Report* 16 (2): 563–566.

Ragu-Nathan, T. S., M. Tarafdar, B. S. Ragu-Nathan, and Q. Tu. 2008. "The Consequences of Technostress for End Users in Organizations: Conceptual Development and Validation." *Information Systems Research* 19 (4): 417–433.

Roberts, D. F., L. Henriksen, and U. G. Foehr. 2009. "Adolescence, Adolescents, and Media." In *Handbook of Adolescent Psychology: Contextual Influences on Adolescent Development*, edited by R. M. Lerner, and L. Steinberg, 314–344. New York: John Wiley & Sons, Inc.

Salo, M., H. Pirkkalainen, C. E. H. Chua, and T. Koskelainen. 2022. "Formation and Mitigation of Technostress in the Personal Use of IT." *MIS Quarterly, Available in Early View* 46 (2): 1073–1107.

Salo, M., H. Pirkkalainen, 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.

Salo, M., H. Pirkkalainen, M. Makkonen, and R. Hekkala. 2018. "Distress, Eustress, or No Stress?: Explaining Smartphone Users™ Different Technostress Responses," in *International Conference on Information Systems*, San Francisco, CA, 13–16 December.

Sawyer, S. M., P. S. Azzopardi, D. Wickremarathne, and G. C. Patton. 2018. "The age of Adolescence." *The Lancet Child & Adolescent Health* 2 (3): 223–228.

Silic, M., and P. B. Lowry. 2020. "Using Design-Science Based Gamification to Improve Organizational Security Training and Compliance." *Journal of Management Information Systems* 37 (1): 129–161.

Slonje, R., P. K. Smith, and A. Frisén. 2013. "The Nature of Cyberbullying, and Strategies for Prevention." *Computers in Human Behavior* 29 (1): 26–32.

Srivastava, S. C., S. Chandra, and A. Shirish. 2015. "Technostress Creators and Job Outcomes: Theorizing the Moderating Influence of Personality Traits." *Information Systems Journal* 25 (4): 355–401.

Tams, S., J. B. Thatcher, and V. Grover. 2018. "Concentration, Competence, Confidence, and Capture: An Experimental Study of Age, Interruption-Based Technostress, and Task Performance." *Journal of the Association for Information Systems* 19 (9): 857–908.

Tarafdar, M., C. L. Cooper, and J. F. Stich. 2019. "The Technostress Trifecta-Techno Eustress, Techno Distress and Design: Theoretical Directions and an Agenda for Research." *Information Systems Journal* 29 (1): 6–42.

Tarafdar, M., Q. Tu, B. S. Ragu-Nathan, and T. S. Ragu-Nathan. 2007. "The Impact of Technostress on Role Stress and Productivity." *Journal of Management Information Systems* 24 (1): 301328.

Williams, M., and T. Moser. 2019. "The art of Coding and Thematic Exploration in Qualitative Research." *International Management Review* 15 (1): 45–55.

Yang, C. C. 2016. "Instagram use, Loneliness, and Social Comparison Orientation: Interact and Browse on Social Media, but Don't Compare." *Cyberpsychology, Behavior, and Social Networking* 19 (12): 703–708.

II

EXPLORING EARLY ADOLESCENTS' PROBLEM-FOCUSED STRATEGIES FOR COPING WITH STRESSFUL IT USE EXPERIENCES

by

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Exploring Early Adolescents' Problem-Focused Strategies for Coping With Stressful IT Use Experiences

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Research Paper

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Abstract

In today's technology-oriented world, individuals' ability to cope with information technology (IT) has become increasingly important. This is especially relevant for early adolescents, who are expected to use IT from an early age on as part of their everyday lives. Although early adolescents' IT use and its outcomes have been studied, their related coping strategies have received less attention. The current study focuses on early adolescents' problem-focused strategies used to cope with stressful IT use experiences. The underlying data consist of semistructured interviews with 31 early adolescents. The results show that the strategies used by early adolescents differ in terms of their pervasiveness and level of IT use. Additionally, we reveal details about the connections of the strategies within different contexts, such as school and leisure. Although this study provides important insights for understanding early adolescents' coping strategies, more research is needed to assess the effectiveness of these strategies.

Keywords: early adolescents, IT use, coping, stressful experiences

1 Introduction

People use information technology (IT) in many domains of their lives. In addition to the work context, IT is used for different leisure purposes. Even though IT use can provide many benefits, it can also entail adverse effects to one's well-being. This includes the phenomenon of technostress, a form of stress associated with IT use (see, e.g., Tarafdar et al., 2015). Being born into the IT society, adolescents are especially affected by IT use. In this sense, IT has become a natural part of their everyday lives, including the different contexts in which they engage. This makes the ability to cope with stressful situations encountered upon navigating IT environments an essential skill for young IT users.

Although coping is a traditional and widely studied topic in the field of psychology and related research areas (see, e.g., Carver, 2011; Lazarus and Folkman, 1985; Pearlin and Schooler, 1978), coping with technostress has received less attention within the domain of IT use. Moreover, few studies have addressed IT-related coping from the adolescent perspective (Schmidt et al., 2021). Given this lack of research and the integral role of IT in the lives of early adolescents, there is a clear need for further studies on the topic. Because early adolescents are accustomed to using various types of IT within school and leisure contexts, it could be assumed that they have also developed strategies for dealing with the everyday stress experiences arising in different IT use situations. This includes the notion that early adolescents' IT-related coping processes are expected to be characteristic of their age group, as their developmental stage, IT use context and preferred ways of using IT might differ from those of

adults. Furthermore, it has been noticed that the IT use habits of early adolescents can be linked with various health and well-being outcomes (see, e.g., Vanucci and McCauley Ohannessian, 2019; Favotto, Michaelson and Davison, 2017). IT environments create an intriguing arena for studying coping because the IT artifacts set certain boundaries (or opportunities) to the performed actions. While there are various coping approaches, the current study focuses especially on problem-focused coping (i.e. addressing the problematic situation per se), because it (1) provides possibilities for finding concrete solutions to stressful IT use situations (e.g., see Beaudry, 2009; Love and Irani, 2007) and (2) enables a focus on the IT artifact. As such, our aim of focusing on problem-focused coping is to provide tangible insights that take into account the stress experience itself, as well as the role of IT in the process. Our study seeks to answer the following question: "*What kind of problem-focused coping strategies do early adolescents employ to address stressful experiences that relate to IT use?"*.

For the theoretical background, the current study employs literature on stress, coping and IT use, discussed together with the adolescent perspective, to form an understanding of the relevant dimensions characterizing the coping actions performed within the adolescents' age group. For the empirical qualitative study, the underlying data consists of 31 semistructured interviews with Finnish early adolescents, between the ages of 9 and 15. The present study provides information about the problem-focused coping strategies used by early adolescents to address IT-related stress. This expands the literature on problem-focused coping by specifically focusing on early adolescents' experiences and discussing them together with specific IT use perspectives (e.g., the level of IT use). In this way, the study can help researchers understand the characteristics of early adolescents' IT-oriented coping processes, as well as their position in early adolescents' everyday lives.

In the following section, stress and coping are discussed in light of the literature. This is accompanied by the adolescent perspective, including considerations of IT use. The third section discusses the data collection and analysis processes. The fourth section focuses on the results, presenting the early adolescents' problem-focused coping strategies categorized according to their pervasiveness and level of IT use and discussed with citations from the data. The fifth section is dedicated to the discussion of the results in relation to the literature, including considerations to practice. Finally, the limitations of the current study, suggestions for future research, and conclusions are presented.

2 Background

Psychological stress is a normative part of human life. It can be defined as an individual's negative appraisal of the person–environment relationship in relation to their resources and well-being (Lazarus and Folkman, 1984, p. 21). This definition allows for the contemplation of various contexts and situations that can be associated with stressful experiences. Additionally, it is important to note that not all stress occurs because of major life events. Instead, many stress experiences are more likely related to less dramatic, even mundane, occurrences in our daily lives (DeLongis et al., 1982). Because IT use has an established position in many modern societies, it constitutes an important domain for studying individuals' daily stress experiences.

Technostress can be defined as "stress that individuals experience due to their use of [IT]" (Tarafdar et al., 2019, p. 7). Technostress experiences can vary in intensity, and have adverse effects on the health and well-being of IT users. The concept can be further explored through the dimensions of 1) IT characteristics (i.e., an individual's perceptions of specific IT and its features), 2) stressors (i.e., stimuli that create stress to the individual), and 3) strains (i.e., stressor-initiated outcomes and responses in the individual's life) (e.g., see Salo et al., 2019; Ayyagari et al., 2011). Thus, an important component of technostress experiences is an individual's negatively loaded appraisal of IT-related stimuli. Because technostress arises in the continuum of IT use, it is intertwined with this context and should be studied accordingly, here also allowing for the identification of characteristic stress experiences.

Coping refers to one's "constantly changing cognitive and behavioral efforts exerted to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus and Folkman, 1984, p. 141). Previously, IS researchers have employed the concept of coping, for example, to understand and explain individuals' use of IT in general at work (Fadel and Brown, 2010), users' different reactions to IT-related events within both work and nonwork contexts (Beaudry

and Pinsonneault, 2005; Salo et al., 2020), ICT-related interruptions to tasks (Galluch et al., 2015), and users' management of stress deriving from the use of work-related IT (Pirkkalainen et al., 2019). In addition to empirical studies, the strategies for coping with the threats associated with IT, as well as the related outcomes to an individual's identity, have been discussed (Nach and Lejeune, 2010). Often, coping is associated with negative or stressful events/incidents that place demands on individuals (Folkman and Moskowitz, 2004). In the context of IT use, examples of such demanding events may include continuously receiving too many distracting notifications on one's smartphone or perceiving new software as overly challenging to learn and use.

Although coping reflects a multifaceted phenomenon, two key concepts of coping are cognitive appraisals and coping strategies. Appraisals refer to an individual's implicit or explicit evaluations of the situation and its different dimensions that shape one's emotional and behavioral reactions to the situation, whereas coping strategies refer to the ways an individual approaches and deals with such situations (Lazarus and Folkman, 1984; Folkman and Moskowitz, 2004). Regarding appraisals, individuals tend to assess the meaning and significance of the situation and their ability to control the situation at hand (Folkman and Moskowitz, 2004; Salo et al., 2020). Regarding coping strategies, a prominent way to categorize individuals' coping strategies reflects two categories: problem-focused and emotion-focused coping strategies. Problem-focused coping strategies refer to instrumental and concrete ways to address the cause of the situation, whereas emotion-focused coping strategies are directed at managing one's emotions regarding the situation (Lazarus and Folkman, 1984). Complementary approaches that have been discussed previously include, for example, social coping, reactive coping, and proactive coping (Folkman and Moskowitz, 2004; Pirkkalainen et al., 2019; Salo et al., 2022), which tend to overlap with the categorization of coping strategies into problem-focused and emotion-focused approaches. Furthermore, other related studies have examined the mitigation of technostress by individuals' various modifications to their IT use (Salo et al., 2022), as well as organizational support (Ragu-Nathan et al., 2008; Tarafdar et al., 2015).

There is a wide variety of studies discussing stress and coping in the adult population. However, these topics have also been inspected from the developmental perspective, including themes such as transitions and societal change (Lazarus and Folkman, 1984, p. 10). This leaves room for the inclusion of different age groups, allowing for the contemplation of stress as a normative part of human development. For example, early adolescence can be characterized by different transitions, including developmental tasks such as identity formation (see, e.g., Baumrind, 1991). The life-span perspective focuses on development as a lifelong process, making adolescence an important developmental stage that can be examined through different viewpoints such as the role of context, active agency of the individual, and social change (Frydenberg, 1997, p. 8).

Even though coping has been studied for decades within various disciplines, coping strategies related to users' technostress experiences have received less attention. Especially, there is very little literature on the topic from the adolescent perspective (see, e.g., Schmidt et al., 2021). Because technostress can be viewed as a threat to certain domains of IT users' health and well-being and early adolescents lead manifold lives that include IT use as an integral part of participating in different school and leisure activities, their IT-related coping strategies are an especially important topic to study. In fact, adolescents have long been an age group that seems to deploy IT at a rapid pace (e.g., see Adams et al., 2013), including the discontinuation of IT that is no longer preferred (Drehlich et al., 2020). The use habits of adolescents can also differ from other age groups (Pfeil et al., 2009), and they tend to identify more problem-focused than emotion-focused coping strategies in relation to their IT use (see Schmidt et al., 2021). On a related note, IT use as a process is fundamentally linked to the technological foundation because certain IT characteristics (e.g., constant reachability) can contribute to demands in an individual (e.g., see Galluch et al., 2015). Additionally, the nature of the technology-oriented actions is what differentiates coping with IT from coping emerging in other domains of life. Thus, IT characteristics are an important dimension to consider upon discussing early adolescents' problem-focused coping strategies related to IT use.

3 Data Collection and Analysis

The purpose of the current study is to identify early adolescents' problem-focused coping strategies associated with stressful IT use experiences. Semistructured interviews (SSIs) were chosen as the method because of their ability to produce rich data. In addition, qualitative interviews can be viewed as effective and extensively used data gathering techniques within the IS field (e.g., see Myers and Newman, 2007). SSIs, in particular, include advantages such as versatility and flexibility (Kallio et al., 2016). Although different approaches for measuring coping (e.g., retrospective and momentary accounts, narrative methods) are not without their limitations, they can all provide valuable information when applied in the appropriate situation (Folkman and Moskowitz, 2004). Because coping strategies are often personal and situational, a dialogical approach to data collection seemed to be appropriate here. The use of an interview scheme provided the structure of the interview, but the flexibility of the situation itself allowed for focusing on themes that were important to each interviewee, as well as the emergence of new topics.

The interview scheme applied in the study was built around important concepts identified in the previous technostress literature, including technostressors, strains and mitigation/coping strategies. The interview scheme included questions such as "*Can you think of a situation, where a notification arriving on your phone has felt bothersome? What were you doing, and why did it make you feel that way?"* and "*Are there ever times when you feel pressured by your social media posts? For example, do you compare yourself to others?*". The scheme was structured in a manner that enabled moving from simple themes (e.g., devices and applications used, ways of using IT) to more complicated ones (e.g., stressful experiences related to SNSs), allowing a gradual move to aspects that might require more time to think. Following this logic, questions related to coping were mainly placed to the latter section of the scheme. This can be an advantageous approach to SSIs because participants have the chance to become more familiar with the interviewer, making it easier to answer more sensitive questions (e.g., see Adams, 2015). Finally, while the interview scheme was built to enable the discussion of different types of IT use in various contexts (e.g. school, home, hobbies), we let the interviewees focus particularly on areas that were meaningful to them (e.g., games).

In the beginning, different schools were approached to find the participants for the study. This included the exploration of existing collaboration networks (e.g., rectors, teachers). The study followed the university's ethical guidelines, including ensuring permission from the parents for their children to participate. Additionally, the participants' own willingness to participate was asked for in the form of a permission slip. The incentive to participate was increased by stating that a small prize (a movie ticket or gift card) would be raffled among the participants. Additionally, every participant received a sweet treat at the end of the interview.

Altogether, 31 interviews were conducted with students from primary (n=20) and secondary (n=11) schools. The participants were from 9 to 15 years of age, and a little over half of the participants were male (n=19). Because the definitions of adolescence vary in research (e.g., see Sawyer et al., 2018), the term *early adolescents* was chosen to be used as the most fitting description characterizing the age of the study participants. Often, the interviews lasted from half an hour to an hour, the shorter length being typical especially for the younger primary school students. The first set of interviews took place in the spring of 2018, and this was followed by the second set of interviews in the fall of 2020. Because the second set of interviews took place during the COVID-19 pandemic, permission to conduct the on-site interviews was applied for and received from the university. The pandemic situation was also closely discussed and monitored together with staff from the affiliated schools. Finally, specific safety measures (e.g., the use of face masks and thorough hand hygiene) were applied to minimize the potential risks associated with the interview situation.

After the interviews, the recordings were transcribed and moved into qualitative data analysis software (NVivo) to allow further coding and analysis. Each interview transcription was individually coded by identifying pieces of information that would relate to adolescents' IT use, stress or combinations of these themes. Hierarchies were used to establish relations between codes and place similar codes into the same categories. In this sense, coding was viewed as a part of the analysis process, with an important role of increasing understanding of the studied phenomenon (Weston et al., 2001). Although the interview scheme was inspired by the previous research, an effort was made to ensure that the coding process was not too fixated on these conceptualizations. For example, the codes included layers from specific aspects brought up by the participants (e.g., *plays less on school nights*) to broader categories more closely representing the concepts identified in the literature (e.g., *restricting use*). However, it is advantageous for SSIs to use information from prior literature to aid scheme building (e.g., see Rabionet,2011).

Once the data were fully coded, the data were approached from the perspective of problem-focused coping in IT environments. First, all the codes and subcodes were scanned to identify mentions related to coping in stressful IT use situations, which resulted in 211 codes. Second, the interview citations associated with the codes were more carefully analyzed, including specifying the degree of stress (stressful/potentially stressful). An experience was categorized as stressful when it indicated moderate to high amounts of stress (e.g., through wordings such as *disturbs*, *too much*). Similarly, a mention was categorized as potentially stressful when there were less direct or implicit indications of stress (e.g., through wordings such as *might/could disturb*). This step resulted in a total of 122 mentions meeting the inclusion criteria (*potentially stressful/stressful experience* and *problem-focused, IT-oriented strategy*).

4 Results

All the early adolescent interviewees received notifications on their mobile phones. Additionally, as many as 18 of the 31 participants had modified their notification settings for one reason or another. In a related note, many of the participants' narrations about controlling their devices and applications were not associated with stressful experiences. However, as many as 30 participants interviewed had taken action to cope with experiences that could be characterized as stressful or potentially stressful. It was typical for a stressful experience that the stimuli from the IT artifact was described somehow as taxing (e.g., *a call disturbs, advertisements annoy, too many notifications*). Coping actions, in turn, often related to specific IT artifacts or situations (e.g., muting the notifications, flipping over the phone when going to sleep).

A total of 122 mentions related to problem-focused coping with stressful (99) or potentially stressful (23) experiences could be identified in the data. The coping strategies used by the participants could be divided into four categories (Table 1). First, eight mentions related to completely eliminating the stimuli from the IT artifact. Second, most (78) of the mentions could be characterized as situational elimination activities that aimed at eliminating stimuli from the IT artifact in certain situations. Third, a quarter of the mentions (31) related to more moderate modification activities that attempted to modify specific aspects of the IT use experience. Finally, a few of the mentions (5) discussed other activities performed within a game or app that could not be unambiguously placed in the other categories. While coping actions related to the elimination of stimuli, such as avoidance and distancing, can be viewed as emotion-focused strategies in the context of coping literature (see, e.g., Lazarus and Folkman, 1984, p.150), the strategies identified in this study are viewed primarily as problem-focused due to the concrete and instrumental nature of these actions when considered in the IT use context.

Coping Action	Level of IT Use	Number of Mentions
Complete elimination		**8**
Discontinuing use	External behavior change	5
Deleting a game/app	IT artifact change	3
Situational elimination		**78**
Muting the device	IT artifact settings	33
Muting or turning off notifications, turning the internet connection off	IT artifact settings	13
Flipping over or covering the device	Physical distance to IT artifact	12
Placing the device further away or leaving it at home	Physical distance to IT artifact	10
Turning the device off	IT artifact settings	6
Putting the device on airplane mode	IT artifact settings	2
Using the 'do not disturb' mode on the device	IT artifact settings	2
Situational modification		**31**
Restricting own use	External behavior change	22
Limiting the number of accounts being followed	Action within the IT artifact	2
Decreasing the number of notifications	IT artifact settings	2
Deleting messages	Action within the IT artifact	2
Adjusting the screen brightness	IT artifact settings	1
Switching between communication apps	IT artifact change	1
Turning the activity status off	IT artifact settings	1
Others		**5**
Succeeding in a game	Action within the IT artifact	3
Writing positive or encouraging comments	Action within the IT artifact	2
Total		**122**

Table 1. Coping strategies used by early adolescents, here categorized by the strategies' pervasiveness and the level of IT use

The strategies used by the participants could also be categorized according to the level of IT use in which they were carried out. *IT artifact* was used as an umbrella term to characterize different IT objects, namely devices, applications, games, and their bundles. The more granular levels of IT use can be observed in the phrasing of the individual coping actions. Even though it was common for the strategies to target the settings of an IT artifact, many of the mentions also related to external use behavior or adding physical distance away from the artifact. Additionally, some of the strategies consisted of specific actions performed within an IT artifact or IT artifact change. The identified strategies and their differentiating characteristics are discussed in more detail below.

4.1 Complete elimination

Some of the strategies resulted in complete elimination of interactions with the related IT artifact. In most cases, the strategies related to discontinuing the use of an app, game, or device. The discontinuation related to situations where the IT artifact or its use included unpleasant elements that exceeded the person's willingness to use the artifact.

> *Only with some games, when I used to play games—when you noticed that it started to annoy you or you would get hooked too much, then you'd just stop [using it]. (Secondary school student)*

> *Well, I haven't really stopped using some app altogether because of notifications, but if you get a terrible number of ads, then yeah. (Secondary school student)*

Additionally, some of the participants referred to deleting a game or an app altogether. Much like with discontinuation, these strategies were also related to unpleasant situations. However, there were also references to viewing the IT artifact as not useful.

> *I deleted [an instant messaging app] from my phone when I got too many of those notifications. So I, umm, don't like need it on my phone because I… When I go on the computer, then I will read [them] there. If there is something important, then I can answer there. (Primary school student)*

IS discontinuance has been explored by previous studies, especially in the context of SNS use (e.g., see Turel, 2016), including the technostress perspective (Maier et al., 2015). These actions can be seen as a definitive means to address perceived problems with specific IT artifacts. At the same time, it is possible that the artifact might not hold a significant position in the user's life, as illustrated by the above example. Thus, although we can evaluate the degree of the action from the point of view of the IT artifact use outcome, it might be more difficult to specify what potential advantages are lost in the process.

4.2 Situational elimination

Over half of the strategies used by the participants related to situational elimination. This category differs from complete elimination in the sense that although the actions performed aim to eliminate bothersome stimuli, they are performed only in certain situations or for a specific purpose. The strategies in this category could be divided into two subcategories according to the IT use level in which they are carried out.

The strategies in the first subcategory related to adjusting IT artifact settings; these included pervasive actions such as turning off the notifications or the device altogether or putting the device in airplane mode. Slightly milder elimination strategies were more specifically targeted at certain stimuli, such as muting the device or the notifications, using the *do not disturb* mode, or turning the internet connection off. Similar strategies to manage technostress are also used in the adult population (Salo et al., 2017).

> *And, for example, on some exam days or on days that you do schoolwork you try to, like, turn off the phone altogether. (Secondary school student)*

> *I have done this thing that I've turned off notifications for some groups and, for example, I've turned off the weather [notifications], or anything that disturbs you a lot or even a little bit. So, I've turned them off and to this day, they have not been of any harm. (Secondary school student)*

> *[I have taken notifications off] from like, [mobile game 1] and [mobile game 2], so that they wouldn't send too many notifications—Often you would get, well, a lot of notifications from them, and you don't have time to look at all the notifications—they are a bit bothersome. (Primary school student)*

> *For example, when I go to bed, I put the internet connection off so it does not matter if you keep the sounds on or not because you don't get them [the notifications] then. (Primary school student)*

In the second subcategory, the strategies related to adding physical distance to the IT artifact, which included actions such as placing the device further away or leaving it at home. In these instances, the physical distance to the device could become substantial. The remaining strategies related to more mechanical actions, such as flipping over or covering the device. Although the distance itself in the case of these strategies might not be a noteworthy one, they would eliminate seeing the screen activity itself.

> *A lot of the time, I give my phone completely to someone else. In those kinds of situations, when you're doing some other activities, then I would just give the phone to another person and say, "Give that back to me in like half an hour." So that I wouldn't focus on it too much. (Secondary school student)*

> *Usually, I keep my phone further [away], um, because often I do my homework in peace and quiet —so that the notifications wouldn't keep coming all the time—for example, the ones from groups. (Primary school student)*
>
> *Well, for example, when I go to sleep, I put it there so that the screen is face down—and, well, when I'm doing the homework. (Primary school student)*
>
> *Umm, I have sometimes [turned the device] when there has been a moment when everyone in a group is discussing about something a lot, and then I would like turn it away from the top, so that I wouldn't see the light [on the screen]. (Primary school student)*

Adolescents can view IT use as distracting for various activities, including leisure (Allaby and Shannon, 2019). The strategies in this category often related to situations when it was important to focus on another activity, such as schoolwork or going to sleep. There were also mentions of turning off notifications for IT artifacts not viewed as useful or important. These actions show that early adolescents can use diverse strategies to eliminate stimuli from IT artifacts in different situations, depending on their current needs.

4.3 Situational modification

The second most prevalent category of the strategies used was the situational modification of IT use. This category differs from situational elimination in the sense that the actions do not inherently aim to eliminate the stimuli completely but to instead moderate certain aspects of the experience. The strategies in this category targeted various levels of interaction with the IT artifact, from changing one's own behavior to performing specific actions within the artifact.

Most often, the strategies within this category related to restricting one's IT use. For example, the participants noted that it is important to acknowledge one's limits in using IT. Often, restriction was associated with the ability to focus on schoolwork, maintain sleep schedules, or keep the overall IT use during the COVID-19 situation at bay.

> *You realize by yourself that you have to stop, for example, if you have played long enough. (Primary school student)*
>
> *Yeah, so these days I try not to use the phone right before bed. At some point, I had quite a lot of all kinds of sleeping problems. Like, for example, going to bed really late. So I've noticed that when you go to bed early and you don't browse the phone, you fall asleep better. (Secondary school student)*
>
> *[During the COVID-19 situation] maybe there was even a little less [computer use] than [usual]—When you've been on the computer all day—you like tried to decrease it. (Primary school student)*

There were also some mentions of restricting IT use in social contexts. This could be a collective decision made with friends or personal decision that could help them focus on the task at hand. It was also brought up that certain apps might be more suitable in certain situations than others.

> *[Interviewer: If you are hanging out with your friends, is it common that at some point you take your phones out and start browsing them?] Well, yeah. Or I feel that it was more like that sometimes before. Maybe now you have somehow realized that it can be disturbing in that situation. I mean, this is the situation in my own friend circle—it has decreased quite a bit. I mean, the unnecessary browsing of social media. It sort of bores you already. (Secondary school student)*
>
> *[With my friends] I use [a messaging app] and then, if we are on the computer, I usually keep my phone on mute because I don't like it when I do something and it starts to make noise, so I have [another messaging app] on my computer. (Primary school student)*

This kind of modification of routines can be seen as a strategy to decrease the stress related to IT use (Salo et al., 2017). In terms of adjusting IT artifact settings, the participants referred to actions such as decreasing the number of notifications, turning the activity status off for a certain application, or

adjusting the screen's brightness. Additionally, there were some mentions of the specific actions performed within the IT artifact itself, namely limiting the number of accounts being followed within an app and deleting received messages.

> *Well, like maybe half a year ago, I got a lot of notifications from a game, so I set it so that it wouldn't be allowed to send a great amount of them. (Primary school student)*

> *I have shut it [the activity status] off [for a messaging app], so it does not display when I have been active—for example, because of homework, so that everyone would not beg me [to tell, what was for] homework. And also like, you try to be unreachable. (Secondary school student)*

The modification strategies brought up by the participants seem to relate to different aspects of their everyday lives. In many instances, the aim was to help focus on relevant activities (e.g., doing homework, spending time with friends), maintain a healthy relationship with IT use, or simply decrease everyday stimuli from IT artifacts. Although these coping actions can be motivated by the current situation, they can also suggest a future-oriented focus, making them include elements from proactive coping (see, e.g., Aspinwall and Taylor, 1997). Thus, early adolescents can use different modification strategies to adjust the IT artifact and their interactions with it to suit diverse current and future situations.

4.4 Others

Finally, a few of the strategies could not be unambiguously placed in the aforementioned categories. These were actions performed within the IT artifact, namely succeeding in a game and writing positive or encouraging comments.

> *This one time, I accidentally deleted [a mobile game]—and I couldn't get this previous user back. That is when I got a bit frustrated, but then, I got [a game character], and I was not frustrated anymore. (Primary school student)*

> *Well, sometimes when I've seen someone receive a lot of hate, then I've gone ahead and given [them] a nice comment. For example, if they have [a certain hobby], I compliment their [hobby-related achievement] or the video itself. (Secondary school student)*

Game playing is a popular pastime among people of different ages. In the Finnish population, it has been noted that adolescents tend to play digital entertainment games most frequently on a daily and weekly basis when compared with other age groups (Kinnunen et al., 2020). Engaging in online communities has also traditionally been popular among adolescents (Livingstone et al., 2011). Thus, these strategies seem to be specific to the leisure contexts that tend to be especially meaningful to this age group.

5 Discussion

Early adolescents can use problem-focused strategies to cope with stressful IT use experiences. We found that the strategies can be further categorized based on their pervasiveness and level at which they are carried out. Although the performed actions can aim for the complete elimination of stimuli from the IT artifact, the elimination activities were often more situational. Moreover, a part of the strategies aimed for mere situational modification of the stimuli. In addition to externally changing the use behavior or the IT artifact used, the strategies were commonly executed through IT artifact settings or by adding physical distance to the IT artifact. Finally, some strategies included the actions performed within a specific IT artifact.

5.1 Research contributions

This study contributes to research by identifying early adolescents' problem-focused coping strategies associated with IT use. While the focus on the pervasiveness of the strategies provides insights into the general nature of the stress-initiated responses, the characterizations of individual coping actions provide valuable information on specific use instances. The level of IT use, in turn, connects the strategies to their IT context, making the problem-focused approach a visible quality that is promoted

by the IT-oriented nature of the strategies. In terms of IT-related coping, this research provides insights by discussing the topic from the early adolescent perspective, in conjunction with essential aspects characteristical of different IT use situations.

The coping strategies identified in this study were often associated with different school and leisure-related situations. In addition, some of the experiences were connected to IT use on a more general level, crossing various contexts (e.g., habits). The most definitive coping actions performed by the participants aimed for complete elimination of stressful stimuli. Complete elimination of the IT artifact or its use can be a very effective approach for getting rid of the disturbance associated with it. Although removing apps or files that are no longer needed seems to be a common coping action among adolescents (Schmidt et al., 2021), these strategies were less frequent in our data. In a way, this kind of elimination of stimuli could even be viewed as including elements of avoidance (e.g., see Billings and Moos, 1981). Instead of confronting the actual problem, it might seem tempting to dispose of the arena in which it occurs. However, this strategy has the potential to dispose of the good (i.e., the positive side of IT use) along with the bad (Salo et al., 2022). Additionally, it has been noted that habits can be an important driver of continued use (Limayem et al., 2007), which could suggest that less habitual IT use is more prone to discontinuation. Because of this, it might be beneficial to inspect the significance and the position of the IT artifact as part of the individual's everyday life. At the same time, it is important to keep in mind that continuation and discontinuation processes might not be entirely comparable (Turel, 2015).

Elimination strategies can also be more situational, allowing for more flexibility in the process. It was common for these strategies to target the sounds of the device, either by muting the notifications or the device altogether. However, using different modes (e.g., airplane mode, do not disturb) and turning the device off could provide even more pervasive options. Situational elimination strategies can be helpful for reducing IT-related stress and can benefit from the personal valuation of different kinds of stimuli coming from the IT artifact (Salo et al., 2017). Many times, adding physical barriers to accessing or viewing the artifact (e.g., long distance, flipping over or covering the device) was also seen as appropriate for the situation. Similar coping strategies used by adolescents, such as muting chat groups, using silent or airplane mode and leaving the phone at home, have been identified in earlier technostress research as well (Schmidt et al., 2021). For the elimination strategies identified in this study, situational factors (e.g., doing homework, going to sleep) seemed to be especially relevant for choosing the appropriate action. Thus, early adolescents seem to have formed specific, IT-oriented practices for dealing with artifact-related stimuli in different contexts.

The situational modification strategies, in turn, included more nuances in terms of the specific actions performed and their level of IT use. The strategies were sometimes related to communication and social media applications where the participants referred to adjusting their settings or performing specific actions to reduce stimuli (e.g., limit followed accounts, delete messages). Social networking services, in particular, have been associated with stress experiences in prior literature (e.g., see Salo et al., 2019; Lim and Choi, 2017; Maier et al., 2012). However, because the situational modification strategies were often related to restricting their own use, the concepts of control, self-regulation and self-efficacy seem to be a characteristic of this category. Although control, self-regulation and self-efficacy can be viewed as a set of beliefs affecting the appraisal, they can also be viewed as a part of the coping process (e.g., see Lazarus and Folkman, 1984, p.170-171). Behavioral changes can include determined actions such as modifying IT use in different situations (Salo et al., 2017). In the data, restricting one's own IT use was seen to reflect a skill reducing the need for parental control but also including positive effects for one's overall well-being (e.g., sleep quality) or preventing future problems.

Finally, the data included a few mentions related to other coping strategies, namely succeeding in a game and writing positive or encouraging comments. Experiences of success are often important for goal-oriented IT activities that are engaged in as part of leisure time. For example, challenge and sense of achievement have been specifically connected with goal-oriented game play (e.g., see Olsen, 2010; Yee, 2006), suggesting that these coping strategies might be more connected with the perceived meaningfulness of the related activity (i.e., game playing). Writing positive or encouraging comments, in turn, can be viewed as a way to increase positivity in online communities, which can sometimes establish a negatively loaded atmosphere (e.g., see Mihailova, 2020; Allison, 2020). Thus, the strategies

in this category seem to be closely intertwined with the participants' aim to make their leisure-related use experience specific to a certain, preferred IT environment more pleasurable.

The early adolescents' problem-focused coping strategies associated with stressful IT use experiences seem to be connected with both individual and situational factors, which is supported by earlier research (Schmidt et al., 2021). However, the pervasiveness of the coping strategies as well as the level of IT use associated with each action are essential aspects to consider in order to establish a more profound understanding of the underlying coping processes. Early adolescents are active IT users and as such, they have the potential to encounter stressful IT use situations as a part of their everyday lives. Although the early adolescents' coping-related stress experiences often seemed to remain on a moderate level, a similar finding in earlier research suggests that adolescents' technostress experiences tend to be lower in intensity when compared to the adult population (Schmidt et al., 2021). Even though younger generations have often been viewed as skillful IT users, possibly diminishing some technical frustration with different devices, it is important to note that growing up in a digital world is not a guarantee of superior information processing skills (see, e.g., Kirschner and De Bruyckere, 2017). However, IT and related use habits do evolve over time, shaping the experiences of young people. Finally, even though early adolescents are increasingly using IT for learning purposes, there can be variation among different schools and classrooms on how established the position of IT use is as part of everyday school activities. Thus, the amount and nature of school-related IT use should be considered when evaluating the significance of the stress experiences rising from mandatory IT use. Additionally, comparisons to the adults' stress experiences arising from IT use in the work context should be done with care.

While most stress experiences in human life might not be dramatic, everyday encounters with stress can play a major role in terms of adaptation and health (DeLongis et al., 1982). This is an important aspect to consider, especially because early adolescents' capabilities to address stress are still developing. Because of this, the health and well-being outcomes of IT-related stress, however minor, might be difficult to predict. Thus, early adolescents' interactions with IT should be carefully studied to ensure that their IT use habits do not contradict their future health. Additionally, the stress-coping process is dynamic and changing, different factors, such as identity, health and social relationships can both precede and be shaped by the chosen coping actions. For example, a person might view oneself as a certain kind of IT user, guiding their responses to IT stimuli. Reciprocally, the formed IT use habit might steer future interactions with IT. In this sense, the meaning-making and appraisal processes carried out by a person are also essential aspects to consider in this context. Finally, it is important to note that early adolescents are at the beginning of their journey as IT users. Their skills to cope with IT-related stress are expected to develop over time, making their current strategies and habits a baseline for future development.

5.2 Practical contributions

The current study has practical implications for various stakeholders. Because the results comprise actual strategies used by early adolescents in school and leisure contexts, this information can be used by different practitioners to gain a better understanding of early adolescents' IT use and related well-being processes. This includes, for example, student teachers, primary and secondary school teachers, and health professionals working with this age group. Knowledge regarding coping strategies can be helpful for planning IT use practices in schools, and for understanding students' interactions with different IT artifacts. In terms of design, perspectives on young IT users' habits can also be used by designers and developers of IT artifacts because this information can help tailor their products to meet the needs of different age groups. In this sense, the results can prove to be especially fruitful for the designers of educational software companies. Finally, the results can be used by parents and early adolescents to build better practices for everyday IT use situations.

5.3 Limitations and future research

The current study has certain limitations. First, although the results can be useful for various research and practical endeavors, it should be noted that this study was carried out in a population of Finnish early adolescents between the ages of 9 and 15. Thus, careful consideration must be taken when the information is applied in other countries, cultures or age groups. Second, the current study focused specifically on problem-focused coping strategies. However, adolescents also use emotion-focused coping strategies (e.g., see Schmidt et al., 2021) that comprise an important research topic. Third, IT use situations can also be framed through the conceptualizations of threats and opportunities (see, e.g., Beaudry and Pinsonneault, 2005). Fourth, while early adolescents can use various problem-focused coping strategies to address IT-related stress, it should be noted that the problem is often intertwined with the functionality of the IT artifact. This makes it sometimes difficult to evaluate what would be the appropriate level of action to take. Fifth, IT use can be conceptualized in many different ways. In the future, it would be interesting to see how different coping strategies can relate to specific app characteristics or even user personalities. Sixth, our data was based on perceptions rather than physiological stress measurements, which comprise another valuable source for collecting stress-related information. Seventh, although the study participants were often asked whether or not they felt that the strategies they have used have been effective in reducing disturbances from the devices, the adolescents' answers tended to remain quite brief. Future research is needed to evaluate the effectiveness of these strategies. Eighth, the present study focused on the early adolescents' personal views, making the parental perspective relevant only when it related to stressful experiences and/or specific coping strategies. The role of parental models and rules applied in families should be further reviewed in future research. Finally, although the early adolescents' strategies were explored as resolving IT-related stress situations, coping strategies can also include disadvantages (e.g., see Salo et al., 2022), making this an important topic to be covered by upcoming research.

6 Conclusions

Early adolescents can use different problem-focused strategies to cope with adverse IT use experiences. The coping strategies can aim for the complete elimination of stimuli from the IT artifact in question but are more often associated with situational elimination or mere modification. In terms of specific actions, the strategies are commonly related to behavior change, adjusting IT artifact settings, or adding physical distance away from the artifact. The actions can also be performed within a certain IT artifact or on the level of IT artifact change. Although the early adolescents' strategies can be discussed together with concepts from technostress, coping, and IT use literature, the characteristics of the use contexts specific to this age group (e.g., school, leisure) should be considered in future research. Early adolescents are active IT users capable of performing diverse problem-solving actions in different situations. However, the important role of providing support, understanding, and education regarding IT use should not be overlooked.

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References

Adams, W. C. (2015). "Conducting semi-structured interviews," in: Newcomer, K. E., Hatry, H. P., Wholey, J. S. (eds.), *Handbook of practical program evaluation* (pp. 492–505). Hoboken, New Jersey: John Wiley & Sons, Inc.

Adams, S. K., Daly, J. F., and Williford, D. N. (2013). "Article commentary: Adolescent sleep and cellular phone use: Recent trends and implications for research," *Health Services Insights* 6, HSI-S11083.

Allaby, M., and Shannon, C. S. (2020). ""I just want to keep in touch": Adolescents' experiences with leisure-related smartphone use," *Journal of Leisure Research*, *51*(3), 245-263.

Allison, K. R. (2020, June). "Navigating negativity in research: methodological and ethical considerations in the study of antisocial, subversive and toxic online communities and behaviours," in: Chancellor, S., Garimella, K., & Weller, K. (eds.), *Workshop proceedings of the 14th international AAAI conference on web and social media*, Atlanta, GA (virtual) (Vol. 8, pp. 1-8).

Aspinwall, L. G., and Taylor, S. E. (1997). "A stitch in time: Self-regulation and proactive coping," *Psychological Bulletin* 121 (3), 417.

Ayyagari, R., Grover, V., and Purvis, R. (2011). "Technostress: Technological antecedents and implications," *MIS Quarterly*, 831-858.

Baumrind, D. (1991). "Effective parenting during the early adolescent transition," in: Cowan, P. A. & Hetherington, M. (eds.), *Family transitions* (p. 111-164). New Jersey: Lawrence Erlbaum Associates.

Beaudry, A. (2009). "Coping with information technology,". In: D Dwivedi, Y. K., Lal, B., Williams, M. D., Schneberger, S. L., and Wade, M. (eds.), *Handbook of research on contemporary theoretical models in information systems* (pp. 516-528). Hershey: IGI Global.

Beaudry, A., and Pinsonneault, A. (2005). "Understanding user responses to information technology: A coping model of user adaptation," *MIS Quarterly*, 493-524.

Billings, A. G., and Moos, R. H. (1981). "The role of coping responses and social resources in attenuating the stress of life events," *Journal of Behavioral Medicine* 4 (2), 139-157.

Carver, C. S. (2011). "Coping," in: R. J. Contrada & A. Baum (eds.), *The handbook of stress science: Biology, psychology, and health* (pp. 221–229). New York: Springer Publishing Company.

DeLongis, A., Coyne, J. C., Dakof, G., Folkman, S., and Lazarus, R. S. (1982). "Relationship of daily hassles, uplifts, and major life events to health status," *Health Psychology* 1 (2), 119.

Drehlich, M., Naraine, M., Rowe, K., Lai, S. K., Salmon, J., Brown, H., Koorts, H., Macfarlane, S., and Ridgers, N. D. (2020). "Using the technology acceptance model to explore adolescents' perspectives on combining technologies for physical activity promotion within an intervention: Usability study," *Journal of Medical Internet Research* 22 (3), e15552.

Fadel, K. J., and Brown, S. A. (2010). "Information systems appraisal and coping: The role of user perceptions," *Communications of the Association for Information Systems* 26 (1), 6.

Favotto, L., Michaelson, V., and Davison, C. (2017). Perceptions of the influence of computer-mediated communication on the health and well-being of early adolescents. *International journal of qualitative studies on health and well-being* 12(1), 1335575.

Folkman, S., and Moskowitz, J. T. (2004). Coping: Pitfalls and promise," *Annual Review of Psychology*. 55, 745-774.

Frydenberg, E. (1997). *Adolescent coping: Theoretical and research perspectives*. London: Routledge.

Galluch, P. S., Grover, V., and Thatcher, J. B. (2015). "Interrupting the workplace: Examining stressors in an information technology context," *Journal of the Association for Information Systems*, *16* (1), 2.

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

Kinnunen, J., Taskinen, K., and Mäyrä, F. (2020). *Pelaajabarometri 2020: Pelaamista koronan aikaan* [Player Barometer 2020: Game Playing at the Time of COVID-19]. Trim Research Reports 29. Tampere: Tampere University.

Kirschner, P. A., and De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education* 67, 135-142.

Lazarus, R. S., and Folkman, S. 1984. *Stress, appraisal and coping.* New York: Springer.
Lim, M. S., and Choi, S. B. (2017). "Stress caused by social media network applications and user responses," *Multimedia Tools and Applications* 76 (17), 17685-17698.
Limayem, M., Hirt, S. G., and Cheung, C. M. (2007). "How habit limits the predictive power of intention: The case of information systems continuance," *MIS Quarterly*, 705-737.
Livingstone, S., Ólafsson, K., and Staksrud, E. (2011). *Social networking, age and privacy*. London: EU Kids Online.
Love, P. E., & Irani, Z. (2007). "Coping and psychological adjustment among information technology personnel," *Industrial Management & Data Systems* 107 (6).
Maier, C., Laumer, S., Weinert, C., and Weitzel, T. (2015). "The effects of technostress and switching stress on discontinued use of social networking services: A study of Facebook use," *Information Systems Journal* 25 (3), 275-308.
Maier, C., Laumer, S., Eckhardt, A., and Weitzel, T. (2012). "Online social networks as a source and symbol of stress: An empirical analysis," in: *Proceedings of Thirty Third the International Conference on Information Systems* (ICIS).
Mihailova, T. (2020). "Navigating ambiguous negativity: A case study of Twitch.tv live chats," *New Media & Society*.
Myers, M. D., and Newman, M. 2007. "The qualitative interview in IS research: Examining the craft," *Information and Organization* 17 (1), 2-26.
Nach, H., and Lejeune, A. (2010). "Coping with information technology challenges to identity: A theoretical framework," *Computers in Human Behavior* 26 (4), 618-629.
Pearlin, L. I., and Schooler, C. (1978). "The structure of coping," *Journal of Health and Social Behavior*, 2-21.
Pfeil, U., Arjan, R., and Zaphiris, P. (2009). "Age differences in online social networking–A study of user profiles and the social capital divide among teenagers and older users in MySpace," *Computers in Human Behavior* 25 (3), 643-654.
Pirkkalainen, H., Salo, M., Tarafdar, M., and Makkonen, M. (2019). "Deliberate or instinctive? Proactive and reactive coping for technostress," *Journal of Management Information Systems* 36 (4), 1179-1212.
Rabionet, S. E. (2011). "How I learned to design and conduct semi-structured interviews: an ongoing and continuous journey," *Qualitative Report*, 16(2), 563-566.
Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., and Tu, Q. (2008). "The consequences of technostress for end users in organizations: Conceptual development and empirical validation," *Information Systems Research* 19 (4), 417-433.
Salo, M., Makkonen, M., and Hekkala, R. (2020). "The interplay of IT users' coping strategies: Uncovering momentary emotional load, routes, and sequences," *MIS Quarterly* 44 (3), 1143-1175.
Salo, M., Pirkkalainen, H., Chua, C. E. H., and Koskelainen, T. (2022). "Formation and mitigation of technostress in the personal use of IT," *MIS Quarterly*, available in early view.
Salo, M., Pirkkalainen, H., Chua, C., and Koskelainen, T. (2017). "Explaining information technology users' ways of mitigating technostress," in: *ECIS 2017: Proceedings of the 25th European Conference on Information Systems*, Guimarães, Portugal, June 5-10, 2017.
Salo, M., Pirkkalainen, H., and Koskelainen, T. (2019). "Technostress and social networking services: Explaining users' concentration, sleep, identity, and social relation problems," *Information Systems Journal* 29 (2), 408-435.
Sawyer, S. M., Azzopardi, P. S., Wickremarathne, D., and Patton, G. C. (2018). "The age of adolescence," *The Lancet Child & Adolescent Health*, 2(3), 223-228.
Schmidt, M., Frank, L., and Gimpel, H. (2021). "How adolescents cope with technostress: A mixed-methods approach," *International Journal of Electronic Commerce* 25 (2), 154-180.
Tarafdar, M., Cooper, C. L., and Stich, J. F. (2019). The technostress trifecta-techno eustress, techno distress and design: Theoretical directions and an agenda for research. *Information Systems Journal 29*(1), 6-42.
Tarafdar, M., Pullins, E. B., and Ragu-Nathan, T. S. (2015). "Technostress: Negative effect on performance and possible mitigations," *Information Systems Journal* 25 (2), 103-132.
Turel, O. (2016). "Untangling the complex role of guilt in rational decisions to discontinue the use of a hedonic information system," *European Journal of Information Systems* 25 (5), 432-447.

Turel, O. (2015). "Quitting the use of a habituated hedonic information system: A theoretical model and empirical examination of Facebook users," *European Journal of Information Systems* 24 (4), 431-446.

Vannucci, A., and McCauley Ohannessian, C. (2019). Social media use subgroups differentially predict psychosocial well-being during early adolescence. *Journal of youth and adolescence* 48(8), 1469-1493.

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

Yee, N. (2006). "Motivations for play in online games," *CyberPsychology & Behavior* 9 (6), 772-775.

III

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

by

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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.

IV

TEACHERS' PERCEPTIONS OF THE CHALLENGES WITH PUPILS' ONLINE SOCIAL INTERACTION

by

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V

DIGITAL MENTAL HEALTH RESOURCES FOR CHILDREN AND YOUTH: EVALUATION OF STRENGTHS IN USER INTERFACE DESIGN

by

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Digital Mental Health Resources for Children and Youth - Evaluation of Strengths in User Interface Design

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Abstract: The aim of this research is to explore the positive user interface (UI) design of digital mental health resources for children and youth. For this purpose, a heuristic model is introduced and heuristic evaluation is used as a method to systematically assess 49 digital mental health resources. In the assessment, the resources are evaluated by observing the prevalence of UI design strengths defined in the heuristic model. The results of the study indicate that the resources analyzed have strengths especially in the dimensions of visual design, content, reliability, engagement and functional design. Furthermore, all of the resources have at least four design strengths, creating a good basis for increasing positive design. However, further research is needed to establish how to incorporate positive design into digital mental health resources designed for children and youth.

Introduction

In today's world, children and youth spend an increasing amount of time in digital environments. Digital environments provide a channel through which children and youth are likely to be reached, since different obstacles such as acceptance of technology do not restrict this age group in a similar manner to other generations (Baños, Etchemendy, Mira, Riva, Gaggioli & Botella, 2017). In fact, with easy access to information technology (IT) and an environment that supports IT use, youth growing up with these technologies have a chance to benefit from the technological development in the best way possible (Shneiderman & Plaisant, 2005). In terms of health behavior, it has been established that models formed in youth may have a noteworthy effect on the formation of lifelong wellbeing (McDaid, 2016). Since children and youth can be reached through digital environments and childhood is crucial for future wellbeing, close attention should be paid towards inspecting the connections between IT use and health promotion.

There is recent research evidence supporting the notion that digital interventions promoting mental health can be effective among children and youth (e.g. Huen et al., 2016; Li, Chau, Wong, Lai & Yip, 2013). However, health research has traditionally focused on the prevention and intervention of problems instead of wellbeing promotion (Huebner, Gilman & Furlong, 2009). In the area of mental wellbeing, controlled studies with long-term follow-ups are still lacking (Baños et al., 2017). Additionally, despite the fact that studies exist on the effectiveness

of digital mental health resources, clinically trialed and validated interventions are not the only resources that are available through the Internet. A recent study indicates that there is a lack of research evidence to support the effectiveness of applications intended to instil the education of mental health for children and youth (Grist, Porter & Stallard, 2017). Thus, it is important for children and young people to build their competence in different domains such as critical literacy (e.g. Shor, 1999) to be better able to differentiate between trustworthy and questionable sources of information. At the same time, it should be made sure that valid resources are easily approachable by the intended target groups (see e.g. Edgerton et al., 2016).

Towards Positive UI Design Framework

When digital mental health resources are designed, one of the key aspects for success is the careful execution of the UI design. The central idea behind this thinking has been aptly summarized by Baumel and Muench (2016):

> "-- a product can be usable without exhibiting any therapeutic potential, but it cannot have therapeutic potential without being usable." (p. 3)

The researchers created heuristics for electronic health interventions relating to the therapeutic process perspective. The different domains identified in the study include usability, aesthetics, safety, content, engagement, persuasive design, research evidence and the application owner's credibility. Of particular interest is to design electronic health interventions in a way that serves the needs of the target group but does not compromise user privacy or the desired outcome of the intervention (Baumel & Muench, 2016). Similarly, the properties of digital resources designed for children and youth have been studied in the past (see e.g. Hourcade, 2008; Livingstone, 2007; Martens, 2012; Masood & Thigambaram, 2015; Naidu, 2008; Shneiderman & Plaisant, 2005). For example, Masood and Thigambaram (2015) have identified four components and relating guidelines for child UI design. The identified components include navigation, presentation, content and interaction. One key observation made by the researchers is that mobile applications tend to follow adult mental models. However, child mental models should be followed when designing resources for children (Masood & Thigambaram, 2015).

In the past, research targeting children and youth has concentrated on their competences in using digital devices (see e.g. Chang, Tsai, Chang & Chang, 2014; Shneiderman & Plaisant, 2005), as well as the effectiveness of digital mental health resources and interventions (see e.g. Baños et al., 2017; Manicavasagar et al., 2014). However, little attention has been placed on the design qualities of these resources. It is well known that children and youth are heavy users of digital resources featured on websites (Duggan & Brenner, 2013) and mobile games (Kinnunen, Linja & Mäyrä, 2018). However, it has been noticed that existing digital mental health resources might not meet the expectations of youth (Wetterlin, Neilson, Werker & Krausz, 2014). Thus, there might be a gap between what children and youth are used to and expect from digital resources and how the educational resources are currently being designed. This creates a need to re-evaluate the design process itself.

Traditionally, the design of information and organizations has been problem-centric (Avital, Boland & Lyytinen, 2009), which is common for technical domains (Carroll, Rosson, Farooq & Xiao, 2009). In the field of information systems (IS), for example, there seems to be a tendency to highlight issues and failures (Grover, Straub & Galluch, 2009). Following this tradition, the evaluation of UIs has long concentrated on finding the flaws in design (see e.g. Madan & Dubey, 2012; Nielsen, 1994). However, this seems to be a prominent way of approaching design. One could ask, do design processes have to focus on problems to function?

Once the focus of UI design starts to shift from problems to opportunities, we begin to approach the field of positive design. According to Desmet and Pohlmeyer (2013), positive design refers to a design process that aims to increase the subjective wellbeing of humans. In this sense, positive design is intertwined with positive psychology, which can be defined as the study of human flourishing or optimal functioning (Seligman & Csikszentmihalyi, 2000). Thus, positive design is not only a design method, but a different way of observing the design process itself.

One example of positive design thinking, appreciative inquiry, aims to change and develop organizations by replacing the traditional problem-solving mindset with finding the positives of a system (Asif & Klein, 2009). Appreciative inquiry can be seen as a part of positive scholarship, which is a term used to characterize research focusing on positive states, outcomes and generative mechanisms (Roberts, 2006). Accordingly, design principle research is closely linked to positive scholarship since it targets the same goals (Zhang, 2007). However, since design principle research has traditionally been problem-centric, the connection to positive scholarship is not entirely visible. Thus, employing similar positive design thinking that is present in appreciative inquiry to design principle research could potentially strengthen the link to positive scholarship and help shift the research focus from problems to opportunities.

A Framework for Designing Digital Mental Health Websites and Applications for Children and Youth

In order to outline the design of digital mental health resources for children and youth from UI design point of view, A Framework for Designing Digital Mental Health Websites and Applications for Children and Youth (Mehtälä, 2018) was created. The framework is based on digital mental health and UI design literature, and it comprises eight heuristic dimensions with relating heuristics for children and youth. The primary purpose of the framework is to combine the basic dimensions of UI design, such as visual and functional design, with dimensions that are especially relevant for children and youth in the context of mental health. By doing this, it is possible to consider the topic more comprehensively. The heuristic dimensions of the design framework, as well as the underlying literature, are presented in Table 1.

Heuristic Dimension	Objective	References
Visual Design	Ensure that the visual design of the resource is appropriate for its purpose	Baumel & Muench, 2016; Masood & Thigambaram, 2015; Shneiderman & Plaisant, 2005; Livingstone, 2007; Martens, 2012; Hourcade, 2008; Naidu, 2005; Chang et al., 2014; Baños et al., 2017
Content	Ensure that the content of the resource is appropriate for its purpose	Baños et al., 2017; Rasmussen-Pennington et al., 2013; Baumel & Muench, 2016; Shneiderman & Plaisant, 2005; Martens, 2012; Masood & Thigambaram, 2015
Functional Design	Ensure that the functionality of the resource is appropriate for its purpose	Kenny et al., 2016; Baumel & Muench, 2016; Shneiderman & Plaisant, 2005; Masood & Thigambaram, 2015; Hansen et al., 2003
Social Interaction	Acknowledge the role of social support and social networks	Mäntymäki et al., 2014; Kenny et al., 2016; Drost et al., 2017; Wetterlin et al., 2014; Rasmussen-Pennington et al., 2013; Fok & Wong, 2002
Engagement	Ensure that the design of the resource promotes engagement	Dondlinger, 2007; Amory et al., 1999; Naidu, 2005; Masood & Thigambaram, 2015; Hourcade, 2008; Huen et al., 2016; Kenny et al., 2016; Rasmussen-Pennington et al., 2013; Baumel & Muench, 2016
Co-Design	Ensure that co-design is utilized in the resource development process	Kenny et al., 2016; Kayser et al., 2015; King et al., 2015
Reliability	Verify the reliability of the resource and its contents	Grist et al., 2017; Baumel & Muench, 2016; Manicavasagar et al., 2014; Burckhardt et al., 2015
Information Privacy	Ensure that the system data is secured	Kenny et al., 2016; Wetterlin et al., 2014; Baumel & Muench, 2016

Table 1: A Framework for Designing Mental Health Websites and Applications for Children and Youth (adapted from Mehtälä, 2018)

In the study by Mehtälä (2018), the framework presented above was used to create design heuristics for evaluating digital mental health resources in terms of UI design. As a result, the essential components of the framework were carefully analyzed and divided into observable variables. However, in its current form, the heuristic model does not consider the area of positive design. In this study, the aim is to explore the positive UI design that is present in digital mental health resources designed for children and youth.

Research Design

The aim of the study was to evaluate the UI design quality of digital mental health resources from the view of designing for children and youth. The more specific research question was: *What strengths do resources for child and youth digital mental health education have in regards to positive design?*

Method: Heuristic Evaluation

This study attempts to characterize digital mental health resources for children and youth from the UI design perspective. Since the aim of the study relates to achieving a deeper understanding of the design strengths of existing digital mental health resources for children and youth, heuristic evaluation was chosen as a method for the evaluation process. In heuristic evaluation, an evaluator reviews the design of an interface by contrasting it to an existing set of design criteria (Shneiderman & Plaisant, 2005). This, in turn, increases the reliability of the study by diminishing the possibility for results that are evaluator dependent (see e.g. Carmines & Zeller, 1979). Motives for choosing heuristic evaluation as a method for the study include the fact that the method was not restricted by the design phase of the resources analyzed (Shneiderman & Plaisant, 2005). That being said, heuristic evaluation is appropriate for evaluations on design strengths, especially when the strength view is incorporated into the heuristics model used. Additionally, the high amount of resources analyzed (n=49) and the use of established heuristics in the evaluation process made heuristic evaluation seem like the most suitable option.

Design Heuristics

For the purposes of this study, the design heuristics proposed by Mehtälä (2018) were adjusted to create a heuristic model for evaluating design strengths of digital mental health resources for children and youth. Following the principles of positive design, the design heuristics were reformed to better reflect the strengths and possibilities that are present in the resources, disregarding the focus on flaws and limitations. For example, the original model included design heuristics focusing on the deficiencies on design consistency and problems with navigation, while the new model focuses on presence of consistent design and effortlessness of navigation. This, in turn, allows the focus to shift from design flaws and problems to design strengths, affecting the way in which the assessment process is seen. The adjusted model is presented in Table 2.

Heuristic Dimension	Design Heuristic(s)
Visual Design	Visual design is consistent Colorful pictures and animations are used
Content	Target group age range is defined and narrow enough Provided content is light
Functional Design	Navigation is effortless
Social Interaction	Ways for social interaction are provided Ways for social interaction experience are provided (e.g. interaction with content produced by other users)
Engagement	Narrative elements are used Gamification / game elements are used Interactivity between user and UI promotes engagement
Co-Design	Target group has participated in design processes
Reliability	The owner is trustworthy Sources are presented for the content provided
Information Privacy	Privacy policies are thorough

Table 2: A Heuristic Model for Evaluating the UI Design Strengths of Digital Mental Health Resources for Children and Youth (adapted from Mehtälä, 2018)

Since users, tasks and use context are essential components of ICT design (Te'eni, Carey & Zhang, 2007), the framework presented above provides a substantial basis for assessing digital mental health resources for children and youth. Additionally, the framework attempts to observe the resources from the perspective of UI design, adding another outline to the assessment process.

Data

The set of resources analyzed in the study was received from a systematic review conducted in an earlier phase of the project (see e.g. Hankala, Kankaanranta, Kepler-Uotinen, Rousi & Mehtälä, 2017). The review comprised 181 mental health resources that were systematically searched and screened out using the results provided by the Google search engine. The set of resources was reviewed to confirm the suitability of the resources for the analysis, which resulted in the exclusion of 132 resources. Thus, altogether 49 resources were deemed to be suitable for the purposes of this study. The suitability of the design heuristics proposed by the heuristic model, in turn, was confirmed by carrying out an initial test with only two of the resources. This step was critical in light of the validity of the results, since it allowed the contemplation of the relationship between the results of the analysis and the phenomenon studied (see e.g. Carmines & Zeller, 1979). The results of the initial test indicated that the design heuristics were suitable for the current study and the data collection could be carried out by contrasting the resources with the established design heuristics.

Data Analysis

Based on the information collected from the 49 resources, it can be concluded that the sample is international, and the primary languages used in the collected resources are English (63%) and Finnish (37%). The resources are either targeted towards children (12%) or youth (74%), or they have content relevant to both age groups (14%). The mental health emphasis of the resources is on mental health problems (53%) or mental wellbeing (12%), or both mental health problems and mental wellbeing (35%). More than three-quarters of the resources analyzed come from Finland, Canada or Australia. Other countries of origin include the United Kingdom, New Zealand, Ireland and the United States of America. Based on the information, it can be noticed that the amount of Finnish resources is quite high in the set. This is due to the fact that Finnish and English search words were used in parallel when conducting the searches. Additionally, a large portion of the resources focus on mental health problems and are targeted towards youth. Yet, this is likely due to the fact that digital mental health resources tend to focus on mental health problems, and more digital resources generally exist for youth than for children.

Results

The prevalence of design strengths reflects the quality of a digital resource in regards to child and youth mental health resource design. In this heuristic model, there is a total number of 14 design strengths. To understand the design strengths of individual websites and applications, the resources were observed one by one and individual profiles were formed based on the ability of each resource to meet the design heuristics. Based on this set of profiles, five noteworthy strength categories could be distinguished. The strength categories and relating statistics are presented in Table 3.

Strength Category	Amount of Resources	Percentage (%)
Category 1: 0-3 strengths per resource	0	0%
Category 2: 4-6 strengths per resource	19	39%
Category 3: 7-9 strengths per resource	18	37%
Category 4: 10-12 strengths per resource	12	24%
Category 5: 13-14 strengths per resource	0	0%
Total	**49**	**100%**

Table 3: Design Strengths of Digital Mental Health Resources for Children and Youth

Based on the statistics, it can be stated that each resource has at least four design strengths, but none of the resources include all of the design strengths. Almost an equal amount of resources, a little over third, fall into the categories of 4-6 strengths and 7-9 strengths. That being said, it is noteworthy that the amount of resources in the higher strength category does not noticeably decrease as the amount of strengths increases. Finally, nearly a quarter of the resources analyzed have up to 10-12 strengths in their design. Even though this categorization provides information about the strengths of individual resources, it tells little about the ability of the resources to meet the

heuristic dimensions and individual design heuristics. Thus, a more detailed analysis is required to conclude how the resources analyzed compare to the different areas of the heuristic model used in this study.

Heuristic Dimensions

The heuristic dimensions reflect the main areas of UI design of digital mental health resources for children and youth. To gain a better view on the ability of the resources to meet the heuristic dimensions, the data collected from the design heuristics were used to calculate mean percentages for each heuristic dimension. The statistics relating to different heuristic dimensions are presented below (Tab. 4).

Heuristic Dimension	Mean Percentage	Percentage of Resources Meeting the Design Heuristics
Visual Design	78%	Visual design is consistent (90%) Colorful pictures and animations are used (65%)
Functional Design	73%	Navigation is effortless (73%)
Engagement	56%	Narrative elements are used (76%) Gamification / game elements are used (33%) Interactivity between user and UI promotes engagement (61%)
Content	56%	Target group age range is defined and narrow enough (22%) Provided content is light (90%)
Reliability	56%	The owner is trustworthy (90%) Sources are presented for the content provided (22%)
Co-Design	41%	There are mentions of target group inclusion (41%)
Information Privacy	33%	Privacy policies are thorough (33%)
Social Interaction	28%	Ways for social interaction are provided (35%) Ways for social interaction experience are provided (20%)

Table 4: Design Strengths Categorized by Heuristic Dimensions

Based on the mean percentages, it can be concluded that the dimensions of visual and functional design are most often met by the resources. This means that on average, over three-fourths of the resources meet the visual design dimension and nearly three-fourths the functional design dimension, indicating that the foundational dimensions of UI design are well acknowledged in the resource design. On average, over half of the resources analyzed meet the dimensions of engagement, content and reliability. However, the design heuristics within the dimensions of co-design and information privacy are met by less than half of the resources, with this number being merely a third in the case of information privacy. Finally, less than a third of the resources are able to meet the design heuristics within the social interaction dimension, which might imply that the resource design focuses on individual use, disregarding the wider context of collaborative learning.

Conclusions

In light of the results, it can be established that digital mental health resources for children and youth have strengths in their design, and some of the resources meet nearly all of the design heuristics set in this research. Additionally, all of the resources analyzed include positive design in more than four areas of observation. Based on the closer analysis of the heuristic dimensions, it can be concluded that the resources include strengths especially in the dimensions of visual and functional design. This is very important for child and youth UI design since functional UIs have the chance to not only provide better user experience, but also enable children to perform tasks that are interesting to them. In turn, the possibility to, e.g., produce and share content can promote the personal and social development of children (Shneiderman & Plaisant, 2005).

On the basis of this study, recommendations can be made to parties developing digital resources for children and youth to pay more attention to information privacy, co-design and social interaction. While these dimensions are less often met by the resources, they are important aspects of digital mental health resource design (Kenny et al., 2016; Wetterlin et al., 2014). Positive design can be increased within these dimensions by providing thorough privacy policies, by increasing the use of co-design with clear descriptions the processes used, and by

increasing means for social interaction or social interaction experience (e.g. ways to interact with content created by other users). However, any adjustments regarding the social interaction dimension should be undertaken with care, since different studies concerning the use of social networking sites as channels for mental health information provide rather mixed results (see e.g. Li et al., 2013; Rasmussen-Pennington et al., 2013; Wetterlin et al., 2014).

The current study focuses on the development of UI design heuristics, as well as, the assessment of existing digital mental health resources for children and youth. Future research should focus on how to include the UI design heuristics into the processes of creating new resources and further developing existing ones. Additionally, this study focuses on the UI design side of human-technology interaction (HTI). In regard to the positive aspects of IT users, there might be a need to pay more attention to children and youth as users with different strengths in the domain of digital mental health resource use. This, together with the strength view on digital mental health resource design, could allow a more holistic approach to positive HTI.

References

Amory, A., Naicker, K., Vincent, J., & Adams, C. (1999). The use of computer games as an educational tool: identification of appropriate game types and game elements. *British Journal of Educational Technology*, 30(4), 311-321.

Asif, Z., & Klein, H. K. (2009). Open and free deliberation: A prerequisite for positive design. *Information and organization*, 19(3), 186-197.

Avital, M., Boland, R. J., & Lyytinen, K. (2009). Introduction to designing information and organizations with a positive lens. *Information and Organization*, *19*(3), 153-161

Baños, R. M., Etchemendy, E., Mira, A., Riva, G., Gaggioli, A., & Botella, C. (2017). Online Positive interventions to Promote Well-being and resilience in the Adolescent Population: A Narrative review. *Frontiers in Psychiatry*, 8.

Baumel, A., & Muench, F. (2016). Heuristic evaluation of eHealth interventions: establishing standards that relate to the therapeutic process perspective. *JMIR Mental Health*, 3(1).

Burckhardt, R., Manicavasagar, V., Batterham, P. J., Miller, L. M., Talbot, E., & Lum, A. (2015). A web-based adolescent positive psychology program in schools: randomized controlled trial. *Journal of Medical Internet Research*, 17(7).

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment* (vol. 17). Thousand Oaks, CA: Sage publications Inc.

Carroll, J. M., Rosson, M. B., Farooq, U., & Xiao, L. (2009). Beyond being aware. *Information and Organization*, *19*(3), 162-185.

Chang, H. T., Tsai, T. H., Chang, Y. C., & Chang, Y. M. (2014). Touch panel usability of elderly and children. *Computers in Human Behavior*, 37, 258-269.

Desmet, P. M., & Pohlmeyer, A. E. (2013). Positive design: An introduction to design for subjective well-being. *International Journal of Design*, *7*(3), 5-19.

Dondlinger, M. J. (2007). Educational video game design: A review of the literature. *Journal of applied educational technology*, 4(1), 21-31.

Drost, L. M., Krieke, L., Iedema-den Boer, Z., Sytema, S., & Schippers, G. M. (2017). Social support in chat sessions for adolescents and young adults living with a family member with mental illness. *International Journal of Mental Health Nursing,* 27, 683-692.

Duggan, M., & Brenner, J. (2013). *The demographics of social media users — 2012* (Vol. 14). Washington, DC: Pew Research Center's Internet & American Life Project.

Edgerton, E., Reiney, E., Mueller, S., Reicherter, B., Curtis, K., Waties, S., & Limber, S. P. (2016). Identifying new strategies to assess and promote online health communication and social media outreach: an application in bullying prevention. *Health promotion practice*, *17*(3), 448-456.

Fok, M. S. & Wong, T. K. (2002). What does health literacy mean to children? *Contemporary Nurse*, 1 3 (2-3), 249-258.

Grist, R., Porter, J. & Stallard, P. (2017). Mental health mobile apps for preadolescents and adolescents: a systematic review. *Journal of Medical Internet Research*, 19(5), e176.

Grover, V., Straub, D., & Galluch, P. (2009). Editor's comments: turning the corner: the influence of positive thinking on the information systems field. *MIS Quarterly*, 32(1) iii-viii.

Hankala, M., Kankaanranta, M., Kepler-Uotinen, K., Rousi, R., & Mehtälä, S. (2017). Towards a scenario of virtual mental health environments for school-aged children. In Proceedings of the 21st International Academic Mindtrek Conference (pp. 239-242). ACM.

Hansen, D. L., Derry, H. A., Resnick, P. J., & Richardson, C. R. (2003). Adolescents searching for health information on the Internet: an observational study. *Journal of Medical Internet Research*, 5(4), e25.

Hourcade, J. P. (2008). Interaction design and children. *Foundations and Trends in Human-Computer Interaction*, 1(4), 277-392.

Huebner, E. S., Gilman, R. I. C. H., & Furlong, M. J. (2009). A conceptual model for research in positive psychology in children and youth. In *Handbook of positive psychology in schools* (p. 21-26). New York, NY: Routledge.

Huen, J. M., Lai, E. S., Shum, A. K., So, S. W., Chan, M. K., Wong, P. W., Law, Y. W. & Yip, P. S. (2016). Evaluation of a Digital Game-Based Learning Program for Enhancing Youth Mental Health: A Structural Equation Modeling of the Program Effectiveness. *JMIR Mental Health*, 3(4), e46.

Kayser, L., Kushniruk, A., Osborne, R. H., Norgaard, O., & Turner, P. (2015). Enhancing the effectiveness of consumer-focused health information technology systems through eHealth literacy: a framework for understanding users' needs. *JMIR Human Factors*, 2(1), e9.

Kenny, R., Dooley, B. & Fitzgerald, A. (2016). Developing mental health mobile apps: exploring adolescents' perspectives. *Health Informatics Journal*, 22(2), 265-275.

King, C., Cianfrone, M., Korf-Uzan, K., & Madani, A. (2015). Youth engagement in eMental health literacy. *Knowledge Management & E-Learning: An International Journal (KM&EL)*, 7(4), 646-657.

Kinnunen, J., Lilja, P., & Mäyrä, F. (2018). *Pelaajabarometri 2018: Monimuotoistuva mobiilipelaaminen [Player barometer 2018: diversifying mobile gaming]*. Tampere: University of Tampere

Livingstone, S. (2007). The challenge of engaging youth online: contrasting producers' and teenagers' interpretations of websites. *European Journal of Communication*, 22(2), 165-184.

Li, T. M., Chau, M., Wong, P. W., Lai, E. S. & Yip, P. S. (2013). Evaluation of a web-based social network electronic game in enhancing mental health literacy for young people. *Journal of Medical Internet Research,* 15(5), e80.

Madan A., Dubey S K. (2012). Usability evaluation methods: a literature review. *International Journal of Engineering Science and Technology*, 4(2):590–599.

Manicavasagar, V., Horswood, D., Burckhardt, R., Lum, A., Hadzi-Pavlovic, D., & Parker, G. (2014). Feasibility and effectiveness of a web-based positive psychology program for youth mental health: randomized controlled trial. *Journal of medical Internet research*, 16(6), e140.

Martens, M. (2012). Issues of access and usability in designing digital resources for children. *Library & Information Science Research*, 34(3), 159-168.

Masood, M., & Thigambaram, M. (2015). The usability of mobile applications for pre-schoolers. *Procedia - Social and Behavioral Sciences*, 197, 1818-1826.

McDaid, D. (2016). Investing in health literacy. What do we know about the co-benefits to the education sector of actions targeted at children and young people? Copenhagen, Denmark: World Health Organization.

Mehtälä, S. (2018). User interface design for children and youth: websites and applications to promote mental health and wellbeing (Master's thesis). Retrieved from https://jyx.jyu.fi/handle/123456789/58509.

Mäntymäki, M., Merikivi, J., Verhagen, T., Feldberg, F., & Rajala, R. (2014). Does a contextualized theory of planned behavior explain why teenagers stay in virtual worlds? *International Journal of Information Management*, 34(5), 567-576.

Naidu, S. (2005). Evaluating the usability of educational websites for children. *Usability News*, 7 (2), 1-7.

Nielsen, J. (1994). Usability inspection methods. *Proceeding CHI '94 Conference Companion on Human Factors in Computing Systems*, 1994, ACM, New York, NY. 413-414.

Rasmussen-Pennington, D. M., Richardson, G., Garinger, C. & Contursi, M. L. (2013). "I Could Be on Facebook by Now": Insights from Canadian Youth on Online Mental Health Information Resources/«Je pourrais déjà être sur Facebook»: points de vue de la jeunesse canadienne sur les sources d'information en ligne concernant la santé mentale. *Canadian Journal of Information and Library Science*, 37(3), 183-200.

Roberts, L. M. (2006). Shifting the lens on organizational life: The added value of positive scholarship. *Academy of Management Review*, *31*(2), 292-305.

Seligman, M. E., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55(1), 5-14*.

Shneiderman, S. B. & Plaisant, C. (2005). *Designing the user interface* (4th edition). The United States of America: Pearson Education, Inc.

Shor, I. (1999). What is critical literacy? *Journal of Pedagogy, Pluralism and Practice*, 1(4).

Te'eni, D., Carey, J., & Zhang, P. (2007). *Human-computer interaction: Developing effective organizational information systems*. New York: John Wiley & Sons, Inc.

Wetterlin, F. M., Mar, M. Y., Neilson, E. K., Werker, G. R. & Krausz, M. (2014). eMental health experiences and expectations: a survey of youths' Web-based resource preferences in Canada. *Journal of Medical Internet Research*, 16(12)

Zhang, P. (2007). Toward a positive design theory: Principles for designing motivating information and communication technology. *Information and Organization*, 19(3), 152-161.

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