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Title: Exploring early adolescents' stressful IT use experiences

Year: 2022

Version: Published version

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Please cite the original version:

Mehtälä, S., Salo, M., Tikka, S., & Pirkkalainen, H. (2022). Exploring early adolescents' stressful IT use experiences. *Behaviour and information technology*, Early online. <https://doi.org/10.1080/0144929X.2022.2109991>

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.

ARTICLE HISTORY

Received 15 October 2021
Accepted 1 August 2022

KEYWORDS

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 (Lisak 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

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

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.

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.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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