

POSITIVE LEARN

R1: Overview of European distance learning positification

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Contributors

	Name	Organisation
	Jan Pawlowski	HRW
	Dimitra Pappa	NCSR
	Arttu Tanskanen	JYU
	Mikko Muilu	JYU
	Sofoklis Sotiriou	EA

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EXECUTIVE SUMMARY

The primary aim of POSITIVE LEARN project is to address this skills gap in school education, to

- (1) develop the competencies of teachers to ensure wellbeing and health,
- (2) provide learning scenarios and materials to include well-being across subjects,
- (3) create a unique open exchange platform to allow competency development and collaboration across Europe.

This report will explore the concept of European distance learning positification through an extensive literature review, complimented by empirical study of 23 stakeholders (teachers, education professionals, technostress experts etc.) conducted by focus group activities and interviews in Finland, Germany and Greece. Our overview shows that yet as there are many ways that technology is causing negative effects on students' and teachers' health, such as anxiety, tiredness, lack of concentration etc., it is also possible to mitigate these effects by positifying the classroom and distance learning situations. More resources for teachers to assist them in this task is needed to support the technological well-being in schools around Europe.

1 INTRODUCTION TO LEARNING POSITIFICATION

The use of technologies has grown significantly in recent times. Calvo and Peters (2014) report that there are more mobile devices in the world than people. Berte (2018) and Lee and Lee (2015) cite studies estimating the number of smart devices to be around 20 million by 2020, which means that each person will own on average 2-3 smart devices. The number of smart devices has been growing and will continue to grow year on year according to several estimates. Allaby and Shannon (2020) point out in their study how it is good to be aware that time spent on technology is always taken away from other activities. Carter and Grover (2015) write in their study that technology is interwoven into our daily lives, being part of almost every aspect of our lives. Often, the use of technology is seen as entertaining, bringing pleasure to its users and benefiting life. Technology helps us in our lives through various devices and applications, such as designing, searching for information or sharing experiences (Salo, Pirkkalainen, Chua and Koskelainen, 2022).

In our project, we explore positive computing, which is about building digital environments that can make us happier and healthier, not just more productive. Positive computing concept rises from the background of positive psychology, which is a scientific approach to studying human thoughts, feelings, and behavior, with a focus on strengths instead of weaknesses, building the good in life instead of repairing the bad (Peterson, 2008). By positive education, we mean 'education for both traditional skills and for happiness'. (Seligmann et al, 2009) Therefore, in our project, we define positive computing in the following manner:

“Positive computing comprises concepts, processes and systems which contribute towards the quality of life and well-being of users” (Pawlowski et al, 2015)

The study by Maier, Laumer, Wirth and Weitzel (2019) confirms previous studies by highlighting the numerous benefits of using technology for its users, including increased performance and productivity. Nevertheless, more and more users are experiencing harmful technostress and, if untreated, it can cause serious harm to health. Researchers, doctors and medical professionals have highlighted that technostress is ubiquitous and has serious consequences, including a general decline in well-being and fatigue (Salo, Pirkkalainen, Chua and Koskelainen, 2017). In

particular, learning-related characteristics such as memory function, concentration and decision-making can be impaired as a result of stress (Mäkikangas, Mauno, Feldt and Feldt (2017).

Tarafdar, Cooper and Stich (2019) define technostress as, in its simplest form, the stress caused to an individual by the use of technology. According to Pribbenow (1999), technostress is comparable to ordinary stress. The better one understands its underlying causes and triggers, the better one can manage technostress. The study of technostress began four decades ago with Craig Brod. Research on technostress has initially focused on business and the workplace, which is why there are still unexplored areas of technostress in contexts such as school and leisure. As the use of technology becomes more and more a part of teaching and learning in primary schools, it is important to understand the effects, consequences and mitigation measures of technostress in the classroom environment. Technology has become an increasingly important part of classroom equipment at all levels of education over the past decades (Player-Koro, 2012.) The European Commission's decision in 2018 to enrich primary school classrooms with technology will bring about an increased use of technology in primary school teaching and classroom environments (European commission, 2018). In his study, Özgür (2020) calls for the proliferation of technological products and services in the learning environment to require more care in design, as devices and services do not automatically add value by themselves.

From a number of perspectives, ICT is widely seen as contributing to learning. However, the transition from a less technology-rich to a more technology-rich learning environment has proved slow. Society's aim is to provide children and young people with the benefits of technology to promote learning. However, it is difficult to show convincing evidence that learning outcomes improve with the use of technology. Technology offers a wide range of tools to promote learning, such as e-books, videos and games. However, the introduction of technology and its effective use require changes at many levels of the education system. Changes need to be made in school infrastructure, teacher training, curricula, learning materials, classroom practices and assessment methods (Livingstone, 2012). In the past, parents were asked for advice on how to solve a problem, but now they also seek help from 'experts' on the internet. In the past, painting was only possible by painting on paper. Nowadays, painting can be done virtually using technology and painting software (Livingstone, 2012).

Aims of this R1 Report: Overview of European distance learning positification report is to:

- To analyze the current situation of school transformation in the participating countries and Europe.
- To understand stakeholders needs, requirements and barriers when using technology for distance education
- To incorporate the positive computing interventions into curricula and daily life of teachers It is necessary to understand their current situation, in particular the current curriculum as well as the organisational and individual context.

Therefore, a stakeholder analysis is planned to analyze technology use for distance education during COVID-19 to identify key issues on stakeholder well-being and barriers with respect to curricula and daily teaching with technology, resulting in better understanding on (“what would be the key obstacles to achieve a specific change”). The barrier and stakeholder analysis approach has been chosen as it has been applied in a variety of projects (Open Discovery Space, Open Educational Ideas and Interventions) and is thus a validated methodology.

In this Project Result 1 report, we present results of literature review on distance learning positification and technostress mediation as well as the results of our empirical study on the European stakeholder needs, requirements and barriers when using technology. To identify the situations that cause technostress and how to mitigate them, the study will use the themes of the HECC model, which is aligned with the European Commission: technological equipment, connectivity, teacher professional development and digital content. Finally we give out recommendations on how to positify distance learning education.

2 BACKGROUND: TECHNOSTRESS & WELLBEING IN DISTANCE LEARNING

2.1 Distance learning well-being

The benefits of the school environment are not limited to education. According to De Coninck et al. (2022) schools provide structure and stability in young people's lives, help develop talents and abilities, and foster social skills through interactions with peers and teachers. The rapid shift to distance learning is not only likely to have a significant impact on learning outcomes, but also impact students' well-being.

Distance learning can lead to social isolation and loneliness, and a lower sense of connection to school, their teachers, and their peers, which can have a negative impact on the mental health and overall well-being of students. The fact that distance learning experiences can lack the structure and routine of in-person learning students are familiar with, can make it difficult for them to manage their time and stay on track with their studies. It may also decrease students' motivation and engagement, leading to a decline in both academic performance and overall well-being.

Distance learning makes extensive use of technology, which can lead to increased screen time, which has been linked to physical and mental health problems, including eye strain, headaches and trouble sleeping. Lack of technical skills and technical problems by the use of distance learning equipment and services can also affect students' well-being.

Therefore, promoting well-being in distance learning requires a holistic approach that addresses students' social, emotional, and academic needs. Besides dealing with the technological and organisational challenges of distance learning, it is also important to consider and address the potential well-being challenges to both students and teachers.

This includes promoting self-care and resilience, fostering social connections and encouraging communication with teachers and peers.

2.2 Definition of Technostress

Selyen (1956) writes that stress is inevitable in life. According to him, stress is an unspecific reaction of the body to any external stimulus. Lazarus and Folkman (1984) explain in their study how stress is generated by the individual and the environment. They defined stress as a relationship between a person and the environment in which a person judges his or her resources to be being used up or exceeded, endangering his or her health. They found that individuals differ in the formation and effects of stress experiences. People who have experienced exactly the same situation may have different experiences of its stressfulness. Cooper, Dewe, O'Driscoll (2001) define stress as a psychological reaction due to an imbalance between the person and the environment. Bienertova-Vasku, Lenart and Scheringer (2020) and Cooper et al. (2001) point out how the concept of stress is challenging to define unambiguously or simply, as different disciplines approach the concept from different perspectives. Physiologically, stress can be viewed as a reaction, while psychology approaches stress as a negatively perceived factor or situation. In biology, the term is used as an environmental factor affecting cells, organs or the body.

Mäkikangas et al (2017) say that stress can be physical or mental for an individual. Factors that predispose to stress include physical strain, task demands, rush, role ambiguity, interpersonal relationships, traumatic events and changes. Physical symptoms of stress are seen as changes in stress hormones, blood pressure, heart rate, etc. Stress hormones are generally positive in the short term, but when they are repeated and prolonged, they increase the risk of heart disease, reduce resistance and lower alertness, for example. Mental reactions to stress include irritability, anxiety and depression. In addition to mental and physical symptoms, stress can lead to challenges in cognitive functioning such as memory, concentration and decision-making.

In their study, Ragu-Nathan, Tarafdar, Ragu-Nathan and Tu (2008) use the interactive stress model (Figure 1) originally developed by Lazarus and Folkman (1984) to illustrate the formation of stress. In this model, stressors are events, demands, stimuli or circumstances that individuals encounter in work and organisational environments that cause stress to individuals. Stressors are further broken down into two main categories: job role-related stressors and job-related stressors. Role-related stress can be caused by role ambiguity, workplace conflict or overload. Job-related stressors are the difficulty or ambiguity of the job. Situational factors describe measures that have a stress-relieving effect. These measures include information sharing, social support, counselling and assistance. Strain refers to the psychological or

physiological symptoms of stress in an individual. Symptoms include dissatisfaction, poor performance on assigned tasks, lack of creativity and disruptive behaviour. Stress can result in other organisational outcomes, such as absenteeism or changing jobs (Ragu-Nathan et al., 2008; Cartwright and Cooper, 1997).

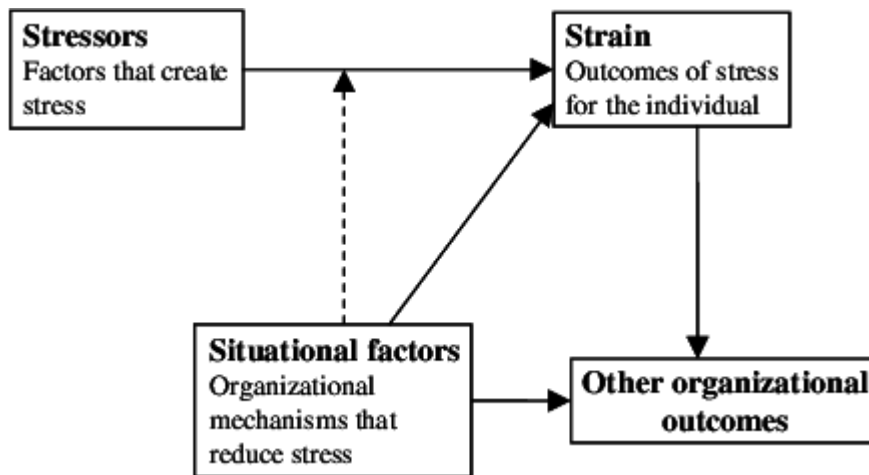


FIGURE 1 Interactional stress model (Ragu-Nathan et al., 2008).

According to Pribbenow (1999), living in the 21st century will require technological expertise more than ever before. The advent of technology was supposed to make work easier and free up time for other things, but he argues that technology causes frustration, work inefficiency, overload and a sense of being out of control. According to Ayyagari, Grover and Purvis (2011), the first person to define technostress was Craig Brod. Even then, he described technostress as a modern disease. According to Brod (1982), technostress is a condition in which an individual is unable to cope with the use or adoption of new technology. He found that factors influencing technostress include the age of the user, previous experience of using information technology and a sense of mastery of new tasks, and the workplace climate.

Technostress is the inability of an individual to adapt or cope with the demands of using technology (Tarafdar, Tu, Ragu-Nathan and Ragu-Nathan 2007; Tarafdar, Tu and Ragu-Nathan, 2010; Hwang and Cha, 2018). They also highlight technostress in an organizational context, defining it as resulting from individuals' attempts to struggle with the ever-evolving and changing technology, and the changing physical, social and cognitive demands associated with it. Wang, Shu, Tu (2008) define technostress as arising from learning how to use technology or from using it, as a result of which the individual experiences either directly or indirectly anxiety,

nervousness and fear. The emotional experience causes an inhomereaction to technology, and prevents learning new skills, or using technology at all.

Tarafdar, Tu, Ragu-Nathan and Ragu-Nathan (2011) refined the interactional stress model (Figure 1) into a framework for describing technostress, the stress model (Figure 2). The purpose of the stress model is to explain the emergence of technostress and its variation among individuals, and to highlight the adverse consequences and ways for organisations to reduce the emergence of technostress. The factors that influence the individual in the framework are gender, age, education, confidence and effectiveness in using technology, and previous experience of using technology. A study by Ragu-Nathan et al. (2008) on user experience of technostress at the organisational level highlights the influence of gender on the experience of technostress. Their findings showed that men experience more technostress than women. According to Tarafdar et al. (2011), the gender difference in the experience of technostress is at least partly explained by the fact that men tend to start using technology at a lower threshold compared to women, which in itself predisposes to technology use and hence to technostress. Ragu-Nathan et al (2008) found that higher age, previous experience and confidence in using technology reduced the development of technostress. More experienced people are seen to have a better ability to manage stress than younger people, which also helps them to cope better with technostress. On the other hand, according to Marchiori, Mainardes and Rodrigues (2019), older people perceive the ever-changing environment with technology as more complex than young people, which predisposes older people to experience technostress more easily than young people.

There are five types of stressors that cause technostress in the technostress model: **techno-invasion**, **techno-overload**, **techno-uncertainty**, **techno-insecurity** and **techno-complexity**. The mitigating factors for technostress include, according to them, the provision of technical support for the use of technology and the involvement of users in the design and development of systems. The purpose of the stress-relieving measures is to help workers cope as well as possible with the adverse effects of technology use. In the framework, individual differences, technostressors and technostress mitigants result in more or less harmful consequences for each individual. In the technostress model, adverse consequences are divided into psychological and technological consequences. Adverse consequences include reduced job satisfaction, overwork, dissatisfaction with the use of technology and reduced productivity (Tarafdar et al., 2011).

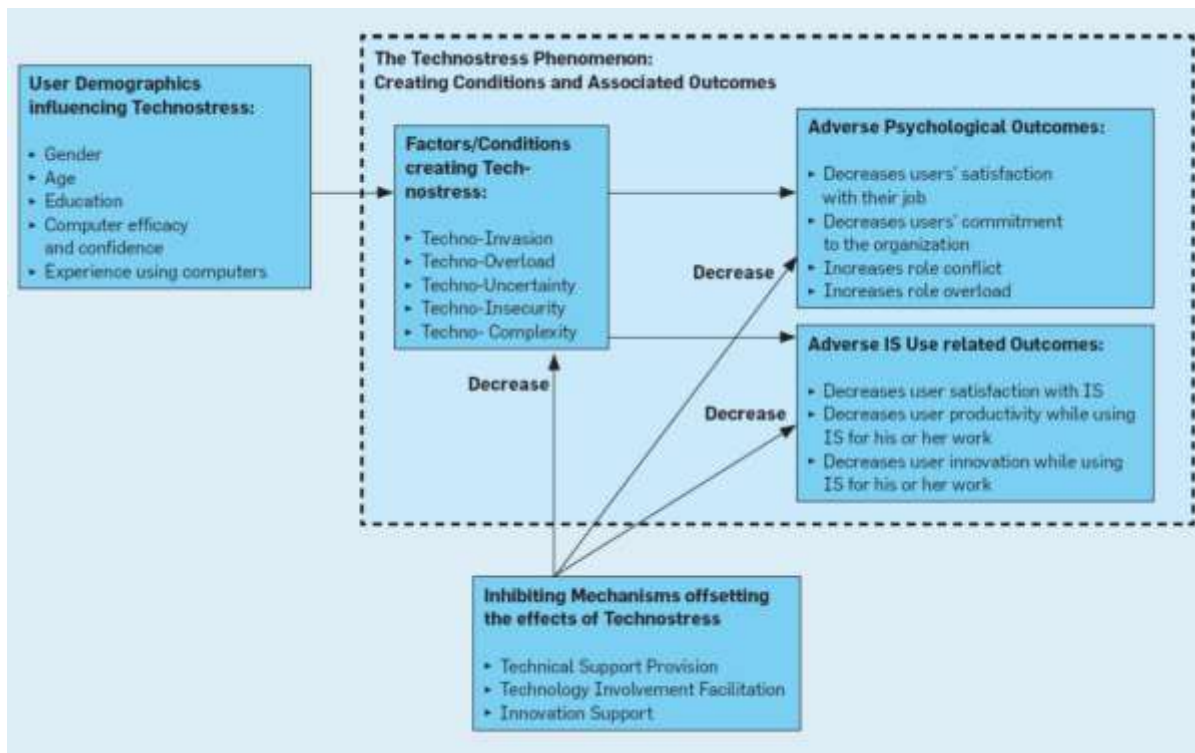


FIGURE 2 Technostress model (Tarafdar et al., 2011).

2.3 Factors causing technostress

Technostress is generally considered to be caused by all factors that result from the use of technology, which cause stress and reduce a person's mental well-being (Hwang and Cha, 2018). In a study focusing on social networking sites and services, Salo, Pirkkalainen and Koskelainen (2019) define invasion as a harmful, overly central factor in an individual's life. According to Ragu-Nathan et al. (2008) and Tarafdar et al. (2011), techno-invasion refers to situations where employees can be reached anytime and anywhere. In addition, they have developed a sense of need to be available at all times. This need causes individuals to feel that technology is intruding into their lives and at the same time they feel bound to use technology. Techno-invasion also often causes a blurring of the boundaries between work and leisure.

Techno-overload refers to situations where technology forces individuals to work harder and faster, causing them to become overloaded. The wide range of devices, software, applications and services available to individuals today allow them to process information from many different directions simultaneously in real time. However, this leads workers to multitask, causing interruptions and overload. Multitasking refers to working on different tasks and

applications at the same time, with the aim of getting more done with less time. A typical source of interruption for employees is the incoming email messages that need to be responded to. Interruptions interrupt work, make it difficult to concentrate and cause feelings of pressure and anxiety. Users have a limited capacity to process information. Information overload therefore refers to situations where the amount of information at hand exceeds an individual's ability to process and use it effectively (Ragu-Nathan et al., 2008; Tarafdar et al., 2011).

Techno-uncertainty is caused by changes and upgrades. Constant changes in technology mean that individuals do not have the opportunity to learn just one application or system. Instead, there is a constant need to be prepared to absorb new knowledge, update skills and train, as knowledge is rapidly becoming obsolete. In addition, changes in the workplace in the adoption of new technologies can be rapid. To an appropriate extent, change, such as learning a new application or technology, can be refreshing, but as a constant state of flux, it ultimately causes frustration, stress and anxiety for the individual. New applications and technologies take time to become established in use and support for their use can be weak (Ragu-Nathan et al., 2008; Tarafdar et al., 2011).

Techno-insecurity refers to situations where an individual feels that their job is under threat. Often, the threat of losing one's job is caused either by changes in technology or by another person who has shown themselves to be more capable and possibly more enthusiastic about using technology. Today, young people are the main drivers of fear of losing their jobs, as they are seen as more natural users of technology and often have a greater desire and enthusiasm for new technologies. Technology-related changes can include the automation of an activity or the introduction of a new system (Ragu-Nathan et al., 2008; Tarafdar et al., 2011).

Techno-complexity refers to situations in which an individual experiences a sense of inadequacy about his or her own abilities as a result of the complexity of using technology and, in addition, a compelling need to start learning and making an effort to better learn and understand how to use technology. Often, the individual also faces the challenge of finding enough time, alongside other work, to study and develop their own skills to facilitate the use of technology (Ragu-Nathan et al., 2008; Tarafdar et al., 2011.) In the leisure context, one of the factors that causes technostress is the constant and compulsive use of smart devices. There is a wide range of different technologies, but one device stands out above the rest. The smartphone has become an indispensable part of people's lives. For many users, it is the first thing they use after waking up and the last thing they use before going to bed (Lee et al., 2014). Hsiao, Shu and Huang (2017) studied the compulsive use of smartphones, and their findings confirmed the notion that compulsive smartphone use has a significant impact on the

development of technostress. According to Lee et al. (2014), one of the factors contributing to persistent and compulsive smartphone use is being available almost all the time through different communication channels.

Oulasvirta, Rattenbury, Ma and Raita (2012) studied smartphone use and found that on average, respondents checked their smartphones 34 times a day. Not so much because there was a need or a specific reason, but because of habit or addiction. In Allaby and Shannon's (2020) study, each young person reported spending 2-4 hours on weekdays and even more on weekends. Smartphones were in their possession, or at least visible most of the time. The interviewees' descriptions showed that smartphones were a central part of their lives. A survey conducted by Ebrand Groupi Oy in cooperation with the City of Oulu's cultural and educational services shows that more than 70% of Finnish young people aged 13-17 use the internet for more than 3 hours a day on average. Most of their time was spent on social media. Of this age group, 10% reported using the internet for more than 7 hours a day. Among 18-29 year olds, more than 75% reported using the internet for more than 3 hours a day. (Ebrand Group Oy, 2019.) Nowadays, smartphones are used almost everywhere, including when driving. In a study by Musicant, Lota and Albert (2015), respondents report using their smartphones to make calls, send messages and navigate while driving, but also occasionally to read the news and browse social media.

Kankaanranta, Mehtälä, Hankala, Merjovaara and Rousi (2021) study the experiences of primary school children on what factors undermine their emotional well-being in digital environments. The majority of children perceived the use of digital environments as mainly pleasurable and well-being-enhancing. Only a few children were able to identify excessive use as reducing mental well-being and causing symptoms such as eye irritation and a negative impact on sleep. The majority of children surveyed said that content in the digital environment was detrimental to their well-being. The children mainly highlighted videos containing material that was inappropriate for them, such as violence or content directed at their parents, which caused them fear, horror and anxiety. They also mentioned that advertisements in games and video services disturbed their constant activity. A few of the children mentioned digital content as contributing to their well-being, such as humour, soothing music or adventure games. Children felt that individual factors mainly improved their emotional well-being. In this context, individual factors included a sense of achievement and the experience of learning. Some felt that games gave them a sense of achievement and success in the form of winning, while others felt that games provided the opposite experience. Children described learning new things by watching videos and playing games (Kankaanranta et al., 2021).

Social interaction in the digital environment was largely responsible for the decline in mental well-being. They cited cyberbullying, nasty messages, wrong number calls and online scams as factors affecting mental well-being. Similarly, some felt that their mental well-being increased from interacting with friends and playing good games and watching videos. The majority of children also felt that technological features caused a decline in mental well-being. They cited internet use in general, running out of battery, poorly functioning apps and especially latency, which interferes with gaming, as technical problems. (Kankaanranta et al., 2021.) Andersson (2008) also writes in his study that the functionality and speed of the online connection has a significant impact on the enjoyment of studying in an online environment.

Primary school pupils, on the other hand, identified reaction time in online social interaction as a factor causing technostress. They felt pressure to respond quickly to messages, and some felt frustrated if their messages were not answered quickly enough. They also felt under pressure about the content they posted, due to issues such as being compared to others and their own insecurities. They also felt that the announcements caused technical stress. Users were disturbed by the large number of notifications, and some respondents had also found that people around them, such as family members, were disturbed by the notifications. Social distance and online trainings caused users to experience excessive use of technology, and they experienced challenges with participating in online trainings (Mehtälä, Salo, Tikka and Pirkkalainen (2022.)

2.4 The effects of technostress

The effects of technostress can be very diverse, depending on the situation and the individual. The figure below (Figure 3) summarises and breaks down the effects of technostress at organisational and individual level from the sources used in this study. Mehtälä et al. (2022) found that feeling pressured to respond to messages, excessive notifications and social distance, and online education caused headaches, frustration, irritation, eye fatigue, and exhaustion in primary school students. Kankaanranta et al. (2021), in their study on the well-being of primary school children in the digital environment, found that the use of the digital environment, content, individual factors, social interaction and technical features cause eye irritation, sleep deprivation, fear and dread, and anxiety. Pribbenow (1999) describes technostress from technology use as causing frustration, inefficiency in work, overload and a sense of being out of control. According to Wang, Shu, Tu (2008), technostress causes users to feel anxious, nervous, fearful and disgusted by technology and prevents them from learning new skills. Tarafdar et al. (2011) and Ragu-Nathan et al. (2008) find in their studies that

technostress causes reduced job satisfaction, overwork, job dissatisfaction, feelings of inadequacy, reduced worker productivity, increased absenteeism and reduced employee commitment to the job and the organisation.

Technostress has a negative impact on human performance. It causes internal states of anxiety that slow down the ability to process information and the ability to meet work demands (Brod, 1982.) Thomée, Härenstam and Hagberg (2011) studied the effects of young adults' smartphone use on stress levels, sleep disturbances and depressive symptoms. The highest levels of mental health symptoms were observed in respondents who found being constantly contactable stressful. Overall, the results confirmed that heavy smartphone use is associated with symptoms of stress, sleep disturbance and depression, regardless of gender. A study by Salo et al (2017) sought to explain the ways technology users mitigate technostress. Subjects reported suffering from technostress due to their own personal leisure time use. The reasons for technostress were reported to include using multiple devices, maintaining a social network through technology, using instant messaging applications and playing games. They reported that technostress caused them exhaustion, pressure to be constantly on call, time management problems due to excessive use, and difficulty getting sleep due to late-night technology use. In addition, they reported occasional feelings of anger towards complex devices, regret and sadness due to excessive use of technology.

Technostress effects	
Individual level	Organisation level
Headache Frustration Eye irritation Exhaustion Trouble on sleeping Fear Hate Anxiety Nervousness Hate-reactions toward technology Tiredness Diminishing cognitive abilities	Will diminish: Job satisfaction Job productivity Worker's profitability Job wellbeing Ability to process information Will increase: Dissatisfaction Absences Feeling of inadequacy Feeling of insecurity Feeling of uncertainty Cognitive Overload

FIGURE 3: Effects of technostress

Many researchers see the main difference between technostress and stress as the use of technology. There are similarities in the factors and symptoms that predispose to technostress and stress. Mäkikangas, Mauno, Feldt and Feldt (2017) previously wrote that stressors include workload, task demands, change and role ambiguity. The same and similar factors also emerged in the context of technostress (Ragu-Nathan et al. , 2008; Tarafdar et al. , (2011). Arthralgia, anxiety, impaired cognitive functioning such as impaired concentration and memory are seen as symptoms of both technostress and stress.

2.5 Mitigating technostress

Psychology and stress studies have been dealing with coping for decades, but technostress is a relatively new phenomenon. As a result, so far we know little about the ways in which technology users deal with and cope with technostress in both leisure and work (Pirkkalainen, Salo, Makkonen and Tarafdar, 2017). Little research has been done on individuals' own personal ways of coping with technostress. A huge number of people use technology for non-work purposes, which means that everyone is responsible for their own technology use and for managing technostress (Salo et al., 2017). Technostress was initially discovered to be studied from the perspective of organisations and employees. As a result, many studies on technostress have focused on studying technostress in organisations and the technostress experienced by employees. In recent years, however, the focus has increasingly shifted to the individual level and to the leisure context. The study by Salo et al. (2022) deals with an as yet unexplored area of the development of technostress in the leisure context and users' means to alleviate it personally. Technostress mitigation refers to changing the way technology is used to reduce stress.

According to Salo et al. (2022), the starting point for mitigating technostress is that the user recognises that the use of technology causes negative effects such as fatigue or impaired thinking ability. The user then needs to see a link between their specific use of technology and the adverse effects it has on them. In their study, they write about an example where one subject felt a general sense of strain, but the cause was unknown to him. Detailed monitoring helped him to understand the true state of his own technology use. The addictive use of social media, with its constantly intrusive notifications, was revealed to him as a factor causing general stress. This example is one illustration of how difficult it can be to identify technostress and the true state of one's own technology use. Mitigating technostress requires a great deal of self-regulation on the part of users and is accompanied by significant barriers. A study by Salo et al. (2022) also reports that some users recognised that their technology use was causing them negative effects. They were able to link them to their specific technology use patterns, but did not change their behaviour despite this. Even if users know that their own technology use pattern will change their situation for the better, this may not be enough. Users need to be convinced that the change will lead to a significant improvement in their current situation.

Salo et al. (2022) state that the use of technology can provide users with pleasurable experiences, but can also easily have harmful effects. Because of the pleasurable experiences, it is difficult for the user to reduce or stop using the technology altogether. They also felt that peer pressure influenced their ability to modify their own technology use. One respondent

highlighted that he had identified that using an instant messaging app caused him fatigue and said that he was motivated to change his use. However, he was unable to significantly reduce his use due to peer pressure to continue using the instant messaging app. Lack of technology skills was also identified as a barrier to mitigating technology stress. The constant notifications on their smartphone can be frustrating and they would like to get rid of them, but they may lack the skills to reduce or stop them. In addition, service providers, such as social networking services, make it difficult to reduce use, take breaks, switch to another service or stop altogether by providing reminders or making it challenging to switch to another service (Salo et al., 2022). Salo et al (2022) have listed **modifying technology use, changing technology use to an alternative, taking a break and stopping use altogether** as ways to alleviate technology stress. Modifying technology use refers to modifying notification settings, privacy settings and features, and reducing the number of times a technology is used. These measures include reducing or eliminating the number of notifications and the number of people or sites to follow on social media. Switching to an alternative technology means switching to a new alternative device or application, an older device, application or version. An example of switching to an older device is switching from a smartphone to a mobile phone. Taking a temporary break is when a user temporarily disables or stops using an application, device or account. Permanent disconnection refers to the complete removal of an application or user from the application, getting rid of the device, and stopping the use of the device or application.

Mehtälä et al (2022) studied young adults' stressful experiences of technology use and their ways of coping with them. The young adults' coping methods to mitigate the stress of technology use **were to stop using technology altogether** and to **stop and modify use on a situational basis**. They described how unpleasant things such as excessive ads, notifications or the addictiveness of a game made them stop using or remove an app, game or device altogether. Means of situational deactivation for young adults include: muting, masking, moving away, leaving at home and turning off ads, the internet or the entire device. As ways to modify situational use, they reported limiting their own use and the number of accounts they follow, reducing the number of notifications, adjusting screen brightness, changing the messaging app and deleting messages, and turning off active mode. The ways that young adults cope with technology stress have been found to be similar among the adult population (Salo, Pirkkalainen, Chua and Koskelainen, 2017).

According to Pirkkalainen et al. (2017), in some cases, users can mitigate the adverse effects of technostressors by defusing their emotions during a stressful situation. Often, venting and expressing emotions is done by swearing and sighing. There can also be a downside to strong

emotional expression. Intense and repetitive venting can increase personal negativity and cause harm to those around them (Salo et al., 2017). According to Pirkkalainen et al. (2017), distancing oneself from technology use does not alleviate the technostress experienced by users. In the study, distancing oneself from technology means, among other things, the user's attempt not to think about the problem. Controlling the use of technology and feeling in control helps to alleviate technostress. In workplaces, it is often the case that the devices, applications and services to be used are predetermined, but employees still have the opportunity to influence their use. Email doesn't always have to be open, and notification settings can be used to set sounds or visual displays of incoming emails.

In your free time, you can control your personal use of technology by taking breaks and even stopping altogether. At work, the situation is often more challenging, as an employment contract requires an employee to work for a certain amount of time or to perform certain tasks. Ragu-Nathan et al (2008) explain how employees' stress can be alleviated by offering help, counselling, social support, sharing information and, if necessary, redesigning their job description or changing their job role to a less stressful one. In many respects, the means to alleviate worker stress are similar to those to alleviate technostress. Tarafdar et al (2011) list training, assistance, involvement and encouraging employees to learn and experiment as mitigating factors. Training aims to help workers learn and cope with the demands of new technologies by providing clear instructions on how to use them, encouraging knowledge sharing among co-workers, and training workers in the use of technology before its formal introduction. New technologies are often introduced at short notice, which means that users need training and guidance, especially in the early stages (Ragu-Nathan et al. 2008). Facilitation refers to the provision of technical support to employees in an effort to reduce the technostress caused by the complexity and uncertainty of the technology. Tarafdar et al. (2011) emphasise the importance of an organisational help desk. Its role is to be knowledgeable, easily accessible and to respond well and quickly to questions from employees. Ragu-Nathan et al (2008) also stress the importance of a help desk to solve technical problems faced by employees.

Involvement means keeping employees involved in the adoption and development of technologies. Ensuring that employees are involved in the design of new technologies, communicating the reasons for adopting new technologies and highlighting their potential to make work easier reduces feelings of uncertainty and complexity. In addition, rewarding and encouraging the use of new technologies is seen as a mitigating factor (Ragu-Nathan et al., 2008; Tarafdar et al., 2011.) The purpose of encouraging learning and experimentation is to

create an atmosphere that fosters relationships between employees, facilitates a culture of discussion in the workplace and encourages ideas, risk-taking and learning new things. These tools are helping to reduce the insecurity experienced by employees due to the use of technology (Tarafdar et al., 2011.)

Technology has a big impact on our daily lives. People are concerned about how the use of technology affects our emotions, quality of life and happiness. The design and development of technology that supports psychological well-being and empowers people is called positive computing. Increasingly, professionals working in the field of technology are shifting their goals from the pursuit of profit to the production of social good (Calvo and Peters, 2014.) Increasingly, research into the use of technology and an increased understanding of the effects of technology use are contributing to the evolution of technology in a direction that promotes human well-being. One example of this is research on the digital well-being of children and young people from the perspective of user interface design. It is recommended that those developing digital resources for children and young people pay increasing attention to privacy, social interaction and collaborative design (Mehtälä, Kankaanranta, Rousi and Clements, 2019.) Technology should increasingly be designed with children's abilities, interests and developmental needs in mind, as technology is increasingly present in learning environments and as part of learning (Hourcade, 2008).

2.6 High-tech and well-connected classroom (HECC) model

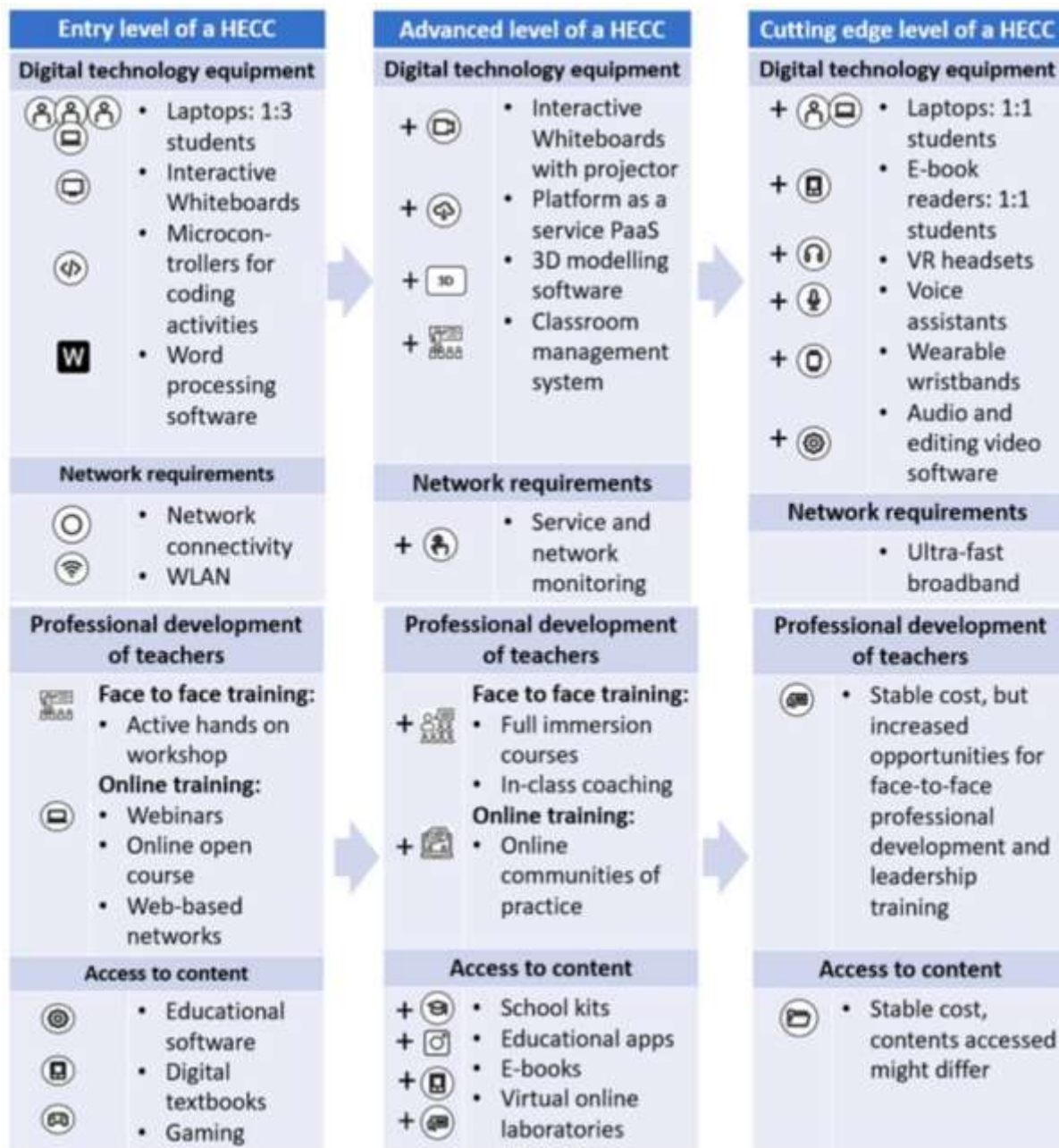


Figure 4: The 'Highly Equipped and Connected Classroom' Model (European Commission, 2018)

Technology is an important part of diverse learning environments. It reinforces student participation, collaborative working skills and supports individual learning. The introduction of new technologies is designed to promote and support pupils' learning. In accordance with practices agreed with parents and teaching staff, students' own technology can also be used in teaching situations (POPS, 2014.) Cuban (1986) explains that the use of technology in the classroom began in the 1920s with the use of films and radios as part of teaching. After films and radios, the next big change came in the 1980s, when newspapers reported on computer

mania. Schools started to invest in computers and gradually began to use them to support pupils' learning. Today, the situation is different. The European Commission adopted the Digital Agenda for Education and published a conceptual HECC (highly equipped and connected classroom) model for use in primary education (Figure 4). A highly equipped and connected classroom is the answer to the era of rapid digital transformation. (European Commission, 2018.)

While each European Union Member State has responsibility for the education and training it provides, the EU has an important role to play in stimulating innovation in its education and training systems. The European Commission adopted an Action Plan for Digital Education and Training to make better use of technology in teaching and learning, to increase the development of skills for living and working in an era of digital transformation and to improve education through better data analysis and anticipation. The EU is prepared to support the high-cost classroom equipment under the Digital Education Action Plan through a range of funding programmes now and in the future. High-tech classrooms with good online connectivity are seen to significantly improve learning outcomes, equity and efficiency (European Commission, 2018.)

The HECC model defines three different levels. The entry level, the advanced level and the cutting edge level. For each level, the technological equipment, online requirements, professional development for teachers and access to digital content are defined separately. The technological equipment includes a range of technologies used in educational environments for learning and teaching purposes. The purpose of the online requirement is to provide a basis for successful use of educational technology in the form of internet connectivity. Teacher professional development focuses on building teachers' capacity to use technologies effectively in teaching, learning and assessment practices. Capacity building will be ensured through workshops, ongoing reflection and collaborative coaching. Digital content is designed to support students and teachers in meeting the requirements of the curriculum. Digital content can include e-books, educational software and applications, or virtual laboratories (European Commission, 2018.)

To reach the basic level of the HECC model, the technological equipment of the classroom must include laptops for every third student, interactive whiteboards, microcontrollers for coding and word processing software. Network requirements include a working internet connection and a wireless local area network (WLAN). Professional development for teachers requires face-to-face training in workshops at basic level and online training, including webinars and

online courses. Digital content requires access to educational software, digital textbooks and gaming. To reach the advanced level means finding all entry-level requirements in the classroom, plus meeting the requirements at the advanced level. To give a few examples, at the advanced level, the technological equipment requires interactive whiteboards to include projectors, and the network requirements include a working internet connection, wireless LAN and monitoring of their use. To reach the top level, all basic, advanced and top-level requirements must be met (European Commission, 2018.)

TABLE 1: Positification measures in classrooms rising from this literature review

HECC areas	Positification mechanisms	Source
Technology	Technology use: -alteration -changing the tech -Avoiding use -Controlling use -Diminishing use -Using earphones in the classroom - disabling/restricting notifications -Altering the brightness of the screen	Mehtälä ym. (2022); Salo ym. (2022); Salo ym. (2017); Pirkkalainen ym. (2017); Dunleavy ym. (2007)
Network connections	-Stable network connection	Kankaanranta ym. (2021)
Professional development	-Training -Tech support -Social support -Changes in the school management -Renewing teacher training	Ragu-Nathan ym. (2008); Tarafdar ym. (2011); Webb (2005); Ferreira ym. (2018); Ally ym. (2014)
Access to digital content	-Developing content to support well-being	Calvo ja Peters (2014); Mehtälä ym. (2019)

HECC areas	Positification mechanisms	Source
Other (Psychological capacity)	<ul style="list-style-type: none"> -Praise -Encouragement -Rewards -Adding resources -Opening emotions -Understanding technostress -keeping timely recess 	Pirkkalainen ym. (2017); Salo ym. (2022); Ragu- Nathan ym. (2008); Tarafdar ym. (2011); Delgado ym (2015); Pribbenow (1999)

3 METHODOLOGY

In this chapter we describe the methodologies used in the empirical work of R1 Stakeholder analysis. Our approach had three main data collection methods:

- a. **Literature review** - all partners collected academic work on the background of technological well-being and wellbeing.
- b. **Experts interview individual/Focus group method**

In our expert interviews, we explored (n=23) educational professionals (including teachers) from Finland, Germany and Greece. In our approach we allowed the different countries to approach this experts information gathering phase to be executed with flexibility which meant that the experts could choose either to be individually interviewed or discuss together in a focus group setting. Rubin and Rubin (2011) and Hirsjärve and Hurme (2008, p.35) explain how qualitative interviews can help to further explore previously researched areas and discover things that we often observe but rarely understand. As a research method, qualitative interviewing is one of the most common and important data collection techniques, in which the interviewer plays an important role. In an interview, first impressions play a significant role in the success of the interview. It is also important to show empathy, understanding and respect for the interviewee. In addition, an atmosphere must be created which allows the interviewer to dare to speak openly. If the interviewer talks too much, it is easy to stifle conversation and can limit the amount of information obtained. One of the main advantages of the semi-structured interview is the deepening of the social situation. At the same time, the interviewer has to take care that the conversation does not stray too far from its original purpose and also allows for the conversation to develop (Myers and Newman, 2007).

Focus group interviews are one of the qualitative research methods widely used in human and social sciences, among others. A focus group interview is a situation in which there are several interviewees and possibly interviewers (Eskola and Suoranta, 1998, p. 95). The purpose of the research method is to create an open group discussion on a particular socially important issue. Focus group interviews typically involve between 4 and 12 people discussing a set of questions predetermined by the researcher, and typically last between 1.5 and 2 hours (Markova, Linell, Marková and Grossen, 2007; Denscombe, 2003). As Rubin and Rubin (2011) emphasized the importance of the interview atmosphere, Markova et al. (2007) also report that a relaxed

atmosphere is an important factor for a successful focus group interview. When the atmosphere is relaxed, the interviewees can also relax and the conversation becomes natural. According to Denscombe (2003), focus groups are characterised by the fact that the participants have previous experience and knowledge of a predefined topic to be studied.

The focus groups emphasise the interaction between the participants, as the role of the facilitator is more to facilitate and support than to lead the discussion. The HECC themes used in the focus group interviews helped to keep the interviewees' interaction around the selected themes. Hirsjärvi and Hurme (2008, p.35) point out how the interviewee must ensure that the themes used in the interview are all covered. The interviews/focus groups were also recorded and analysed with content analysis methodology.

Example schedule for the focus group was followed:

Table 2: Focus group schedule

Schedule	Topic	Presenter
15mins	Welcome, Introduction to Positive learn project; Participants present themselves	Main facilitator
15mins	Introduction Positive Computing/Technostress	Expert lecture
55mins	<p>Focus group discussions</p> <p>1. Have you or your students experienced technostress in classroom? (20mins)</p> <p>Write down at least 3 situations/cases on red post-it notes if you yourself experienced it and yellow if student experienced it (no limit on how many you can write) 5mins</p> <p>2. Under which theme can you categorise your experiences to? (10min)</p> <p>Take your post-its under matching theme</p> <p>Theme I: Technostress related to technology use and network connections</p> <p>Theme II: Access to learning materials/educational content</p>	Group of facilitators

Schedule	Topic	Presenter
	<p>Theme III: Professional development of teachers</p> <p>3. Go around the room: If you also experienced similar situation that someone else mentioned, go and put 'X' on that post-it. (10min)</p> <p>Can you think of an additional situation where you experienced technostress? You can add another red post-it note</p> <p>4. Now take 5 minutes to think which ways did you resolve/mitigate the technostress? (20min)</p> <p>Now write potential ways to help technostress in classrooms on green post-it notes</p> <p>Go and match the mitigation mechanisms with relevant red post-its/technostress experiences</p>	
5mins	Conclusions and fairwell	Main facilitator

4 RESULTS

In this chapter we describe the results of the results of the Educational experts' focus groups and interviews rising from the three countries: Finland, Germany and Greece.

4.1 Finnish stakeholder needs and barriers

Table 3: The Finnish interviewees

Interviewee code Country_Gender_Age	Experience in teaching (years)	Expertise in using tech in teaching (years)	Distance teaching experience before Covid-19	Subject area (field of education)	Student levels (age groups)
FinnTeacherMale42	11	11	0	Math, physics, biology	Middle school, high school, high school graduates
FinnTeacherFemale39	2	2	0	English, swedish, spanish	Elementary school, middle school
FinnTeacherMale64	30+	20+	20+	Finnish language, Mathematics, history, science	Primary school, (1-12years old)
FinnTeacherFemale41	20	20	7	Computer Science, Mathematics,	Secondary level (13-15years)+high school (15-19years)+University (19+-->)
FinnTeacherMale28	<1	0	0	Substitute teacher for history and crafts	Secondary level (13-15years)
FinnTeacherFemale27	1,5	1,5	0,5	Computer science research methods	University teacher (19+-->)

4.1.1 Technological equipment

Of all the themes that emerged from the focus group interviews, technological equipment is the one that has generated the most technostress, mitigation and discussion. This finding is not surprising given the European Commission's decision a few years ago to enrich classrooms with technology and the general increase in technology year on year. The enrichment of classrooms is still partly a work in progress, as one interviewee also identified a lack of equipment as a factor causing technostress:

Enough and decent equipment. For example, if I had had two screens, I could have kept the teaching materials on the second screen. That would have made it so much easier.
(FinnTeacherFemale39)

Technology is abundant and the associated policies, practices and guidelines are still in a state of flux. Ally et al (2014) point out that successful use of technology requires common rules and practices for its use. Indeed, several interviewees commented that clear guidelines and rules for the use of technology are important for the smooth running of work.

When you've been an itinerant teacher and travel between different schools, they have different ways of working and different equipment. Even in the schools I was in, one had ipads, and the other had their own Chromebooks. No one at any point even told me at first that what devices are in use here that I could use, but then I had to ask the students.

(FinnTeacherFemale39)

The fact that you have instructions for a system, but it doesn't cover the situations you'll encounter in practice. **(FinnTeacherFemale27)**

There were great instructions and then when you first started using it the interface had changed and all the instructions were new, but the lesson was already in progress.

(FinnTeacherMale42)

Özgür (2020) also points out that the proliferation of technologies in the learning environment does not automatically add value, but their use and exploitation requires careful planning. Equipment should not be purchased just for the pleasure of purchasing it, but should have a purpose and a plan for its use. Interviewees identified situations where there was room for improvement in the use of technology in the learning environment.

It's essential that the school equipment is up to date and that the software and hardware is such that you can do things without it always being terribly difficult. In general, new purchases should be made to ensure that they are not purchased just because it is technology and others will buy it. **(FinnTeacherFemale27)**

It's totally like a circus day, where you take out the machines and try to do some maths with some Ville. It's a completely wasted math class, that then just practice a little computer skills. It is no joy as a teacher for me, and it is probably not for the students either. **(FinnTeacherMale42)**

The equipment, software and applications used in schools vary depending on what each school has decided to purchase. This diversity of technology can cause technostress . According to interviewee **FinnTeacherMale42**, a way to alleviate this would be to make the view of programmes and applications the same for everyone, regardless of the manufacturer of the device. Learning new and unfamiliar devices and applications always requires the user to learn something new, which in turn takes time and energy away from teaching, or in the case of a student, learning. Techno-insecurity is caused by constant changes in the use of technology,

requiring the individual to be constantly prepared to adopt new things. The complexity of using technology can also lead to a sense of inadequacy about one's own abilities and a compelling need to learn and make the effort to learn new things (Ragu-Nathan et al., 2008; Tarafdar et al., 2011). Interviewees described the issues that cause techno-insecurity from the teacher's perspective.

I like to use mac and it has a different combination of keys... command c, command d are just basic stuff and then on Windows it's different. Snapping a picture differently, then all the shortcuts to make it more efficient. It's a clear stress point for me.

(FinnTeacherMale42)

There are programs that you have just introduced yourself and you are not sure how they work and then you should try to teach them. Then something goes wrong, so we think for 15 minutes first, how the teacher can make it work. **(FinnTeacherFemale39)**

If there was anything you wanted in the test, it was to get there in the first place, you had to log in three times to different services, and always deeper and deeper into something. And then when you want to give a seven to, say, Tuomas, four clicks and then the next grade. Whereas with Vilma, you look at it and then tab forward and bam bam bam it's there. **(FinnTeacherMale42)**

To mitigate the technostressful situations mentioned by interviewees, training in the use of new equipment and software was suggested, among other things. Tarafdar et al. (2011) also point out in their study that training mitigates technostress among employees.

If you are unfamiliar with the equipment, then it is a matter of general training. Each teacher must be given time and shown how the equipment works.

(FinnTeacherFemale39)

In addition to the diversity of technologies, practices, procedures and guidelines, a wide range of challenges can arise in the classroom. Not all devices or applications may work as expected, or they may start updating in the middle of a lesson. According to interviewee **Ope<1**, updating a device in the middle of a lesson causes technostress. Other interviewees also had similar experiences.

In the evening you went to check that everything was working and when I came in the morning, the machine was running for an hour and a half. **(FinnTeacherMale64)**

Sometimes a situation that causes technostress can be caused by a problem that is even bigger than the upgrade. During a power outage, using technology is challenging for the duration of the outage. One interviewee described contingency plans as a mitigating measure, both in the event of a power outage and for other technostressful situations in general. Interviewees

reported playing sink the ship and using a traditional pen and paper as backup plans, among other things.

A lot of it depends on the planning of the lesson. When a teacher teaches and plans a lesson, you cannot rely on one tool, you must have a plan A, B and C. Then you also have the fact that if the digital content is not enough, then other options then complement and expand it. **(FinnTeacherMale64)**

Interviewees mentioned many situations of technostress related to devices, such as device inoperability, login problems, dead batteries or insufficient number of devices. On the computer side, according to interviewee **FinnTeacherMale42**, a dead battery can be solved by introducing a general rule for the school to put the computer on charge after use, by moving next to the power outlet or next to another computer.

We had Chromebooks in one school and each student had their own. A fourth-grade student who uses the Chromebook from time to time, he really can't remember his password and his ID once during the whole year. **(FinnTeacherFemale39)**

As a solution to the technical stress of remembering passwords and passwords, it was suggested that everyone should use the same passwords, have their own devices, have a sticky note taped to the device, or, as suggested by **FinnTeacherFemale41** and **FinnTeacherFemale27**, devices without passwords and passwords.

It doesn't have to be one that you're constantly changing (the password), and no one will look askance if it's taped to the side of the machine. I'm in favour of their own devices without a doubt. **(FinnTeacherMale42)**

I think that they (the students) would not have their own devices or devices that they have to log in to with their personal IDs, but they would have common devices that you can access with the same ID. **(FinnTeacherFemale39)**

At another school, where they had iPads, each with the same ID, so everyone could get in. It was easy when someone always remembered. **(FinnTeacherFemale39)**

Moving to work alongside someone else or working in pairs was also seen as a way to relieve technostress when the amount of equipment was insufficient. However, according to the interviewees, working in pairs is not the most preferable option for the students and potentially reduces the effectiveness of the exercises and motivation to learn. Increasing resources, i.e. additional funding for equipment, was also seen as a mitigating factor. Indeed, according to Delgado et al. (2015), the number of resources is the biggest barrier to a technology-rich classroom.

Or the exercises have to be planned in pairs from the beginning, which is really boring, because one person writes and the other watches from the side. (FinnTeacherMale42)

If the intention is to think about solutions that happen in the moment, then there is no additional funding. (FinnTeacherFemale39)

In terms of device-related challenges, BYOD (bring your own device) was mentioned by interviewees as a way to alleviate technological stress, in addition to the technological equipment at school. The use of own devices is also associated with technostressful situations and school-specific regulations.

Of course, having your own equipment can be an added bonus in some situations. (FinnTeacherFemale27)

A certain kind of technology stress, or perhaps stress from not knowing how to work at school, that when there are not enough devices, can I tell a primary school student to go and get his own phone from his backpack, when the use of phones is basically forbidden at school (FinnTeacherFemale39).

One interviewee also described a situation of technical stress, where the devices themselves would have allowed smooth access, but the login server in use only allowed a limited number of users at a time. The solution to this kind of technostress is the one that has already been mentioned: up-to-date software and hardware.

Perhaps the biggest technology stress has been when Sanoma Pro login didn't work because we had too small a login server. (FinnTeacherMale64)

The use of technology can also put pressure on both the teacher and the pupil. The wide variety of devices and software requires extensive skills in the use of many different devices and teaching materials. According to interviewee FinnTeacherFemale41, a way to alleviate technology stress is to practice and anticipate situations such as connecting a video projector. Salo et al. (2022) describe in their study how reducing the use of technology is a way to mitigate technostress. In addition to training and anticipation, schools could also reduce or standardise the technology used.

It became a kind of distressing experience, because I wondered what they would think of me now, when I couldn't even put the slide on the whole screen. (FinnTeacherFemale41)

Teachers' ability and skills to use technology also help in situations where a student might need help to solve a problem. Sometimes the situation is particularly challenging because of the diversity of technologies in schools and distance learning.

I'm in a distance learning class and a student has tried to share a screen and he hasn't been able to. I'm there behind another screen in my own home and the student is at

school, so I can't go and advise him how to do it. They all tried to tell me that there should be such and such in the corner. We have a little different views of the students and the teacher to the equipment. **(FinnTeacherFemale39)**

One interviewee mentioned a situation of particular technical stress when the device is unfamiliar. An unfamiliar or unfamiliar device does not only cause technostress for teachers, but can also be for the student. In the words of Wang et al. (2008), not knowing how to use technology can indirectly or directly cause anxiety, nervousness and fear. At worst, experiences of incompetence or failure can cause an inhomore reaction to the use of technology and prevent learning new skills.

I've never used a Chromebook, when the students brought them into the rooms and I should have instructed them on how to use them **(FinnTeacherFemale39)**.

The others can't wait for the fact that if, for example, Mikko can't do it, then he is helpless. Then, when he comes to school, it's all "hahaha". **(FinnTeacherMale64)**

The challenges that students face when using technology in the classroom can also be situations that cause teachers to become technostress ed. Furthermore, experiences that have caused challenges do not encourage future use of technology as part of teaching.

Yes, I think it's stress that my lesson is going nowhere. It didn't go the way I planned, but that's because of the technological skills the student has. For example, if the student doesn't know how to use (technology) **(FinnTeacherFemale39)**.

If you're going to teach English and you end up teaching computer science, so they get the machine going and you don't get taught anything you meant, then the threshold to use them again goes up. **(FinnTeacherMale42)**

According to Delgado et al (2015), traditional classroom teaching is equally effective as online learning. Rovai and Jordan, (2004), on the other hand, report that the best learning outcomes are achieved by combining both traditional classroom and online learning. According to the interviewees, a particularly challenging form of teaching is hybrid lessons. In primary school, with corona exposure and illness, distance and hybrid learning has already become familiar. According to interviewees, the most challenging aspect is the simultaneous monitoring of students in the classroom and online. According to all interviewees, the best outcome for both teachers and students is to have the lesson in one place only. Either remotely, or face-to-face in the classroom.

The fact that you have to keep eye contact with your students. You have to stare at the screen sometimes and then look at the class. It would take another person to see what is being written in the comments and what is happening there, and that other person could

say that this is what is happening here. It's just like general order control with keeping the class together, that you have to look people in the eye so they don't start fooling around. (FinnTeacherMale42)

Then there's the kind of enthusiastic students who are there for a hybrid class and would like to participate, but can't. It's really difficult to look at the same time, okay, does that refer or not, and how can we make your voices heard from there, etc. (FinnTeacherFemale39)

Yes, I think that students also have difficulties to follow if there is a hybrid lesson. If you are a student in a hybrid lesson, either the teacher focuses on those who are there in the zoom or those who are there live (FinnTeacherFemale41).

A positive aspect of Tuome's (2007) study is that learning is nowadays not limited to the classroom. Indeed, learning is also possible at home through distance learning. In situations such as exposure to high interest rates, students do not have to interrupt their learning, but can participate in lessons remotely if they are well enough to do so. Interviewees reported that keeping cameras and microphones on for remote students alleviates the stress of technology. The teacher has the opportunity to see and hear what the students are doing. According to Wang et al. (2016), technology-rich classrooms promote learning and can provide unique opportunities for interaction. Interaction between students and teacher is one of the keys to successful learning, in addition to enhancing motivation and attentiveness, which are important for learning.

The student is not on the black screen there. If it is in zoom, then you put the video on. I think you get so much better contact if you have video and on. Insist on talking and video. (FinnTeacherFemale41)

The interviewees felt that most of the technostress was due to the use of technology that was unfamiliar to them. The use of technology only for lessons leads, among other things, to difficulties in controlling the timing of updates, unfamiliar key combinations or unfamiliarity with the device. This technology stress affects both teachers and students. They do not have the opportunity to familiarise themselves with and try out the equipment, and thus to develop their own skills, which would in turn contribute to teaching and learning and alleviate the stress of technology. As a solution to this problem, dedicated equipment was proposed for both teachers and pupils. According to Dunleavy et al (2007), having a personal computer contributes and adds value to both the teacher's teaching and the student's learning. At the same time, he also notes the drawbacks, such as students arriving at school without a computer due to forgetfulness. In the worst case, pupils are left with nothing to do and can disrupt lessons. In a

situation where the functionality of the device causes technostress , the Salo et al. (2022) remedy of replacing the device with an alternative can also be applied.

Schools have machines that may not start. There might be a button missing somewhere, and it's a complete crapshoot what you get. The school should pay the teachers for a machine that you can use at home and have the same programs. It would become familiar and tried and tested by the user then. If you have your own device yourself, then the updates are in order or at least know that it is coming. It can't force it anymore at that stage. (FinnTeacherMale42)

When you don't have your own equipment, you have no idea what's out there. There might be Windows upgraded, but whether the software. And then there's something anyway, like battery dead, or not working r. (FinnTeacherMale42)

Having students and teachers with their own devices would reduce the stress of technology and also allow lessons to be much more effective than they are today. Fetching, switching on, setting up and restoring computers consumes a relatively large proportion of the lesson.

You also have to choose early to take the machines away and make sure everything is putting the charging in there and stuff. That really took up very little of the 45-minute lesson. Then, when you still have to instruct on what to do and how to use it (FinnTeacherMale42).

Forty-five minutes to give a lesson and when the students arrive, that's the first 5 minutes. Then we go and get the computers from the class next door where they are. That's where a surprising amount of time is really wasted. Someone has a dead battery, someone has to update and someone has to do something else. You have to hang around there to get them on the same starting line. It's not that easy to do it with pencil and paper. (FinnTeacherMale42)

According to Ragu-Nathan et al. (2008) and Tarafdar et al. (2011), technical support has been studied as a mitigating factor for technostress and would be a solution to many technology-related technostress situations. However, access to technical support in schools is not a given. The interviewee FinnTeacherFemale41 reported that he had carried out a survey of peripheral schools in Finland to assess the situation of technical support.

There were 50 applications from Finland, so schools don't have their own technical support. The municipality does, and that's who you call in case. Some schools had (technical support), but it's less common (FinnTeacherFemale41).

In my hometown, you have to phone somewhere where there is a queue. That's where everyone else calls, and then they give you a new ID. (FinnTeacherMale42)

Technostress situations and mitigation measures (Table 4) due to technological equipment can be seen in numerous situations in the primary school classroom as reported by teachers and experts. As the experience of technostress is individual, the situations that cause it are also individual. Interviewees felt that a contingency plan, practice, and an adequate amount of proper and up-to-date technology mitigated technostress in most situations. Interviewees felt that having their own equipment contributed to its reliability, as the user has the opportunity to familiarise themselves with their own equipment and ensure its functionality, including by upgrading the equipment.

TABLE 4: Technostress situations and mitigation measures due to technological equipment.

Situations causing technostress	Means to alleviate technostress
Power cut	Backup plan, pen and paper
Battery empty	General practices and instructions for using equipment, moving to a socket or next to another student
The device starts updating	Contingency plan, use of own equipment
Not enough equipment	Separate equipment for pupils and teachers, pairing tasks, moving next to another pupil, extra funding
Connecting your Mac to a video projector	Practising, anticipating
Unknown device	General training, time to practice, own equipment, technical support
Hybrid education	Students with microphones and cameras on, adequate and proper equipment, teaching only remotely or face-to-face
Forgetting identifiers	Same IDs for everyone, own devices, notepad, devices without IDs and passwords.
The device does not work	Sufficient number of proper equipment, contingency plan, technical support
Inadequate guidance	Up-to-date and adequate guidance

Situations causing technostress	Means to alleviate technostress
Several different devices in the school	Own equipment, common rules and practices, up-to-date instructions, same view for all
Poorly performing devices, software and applications	Up-to-date software and a sufficient number of decent devices, technical support

4.1.2 Online connections

According to Kankaanranta et al. (2021) and Andersson (2008), latency, i.e. the slowness and functionality of the internet, can cause technostress for users. These two key factors for online connectivity also emerged in the focus group interviews. Interviewees did not perceive network connectivity as a frequent cause of technostress, nor did they experience it as being very intense. Previous literature suggests that the slowness and functionality of online connections also causes technostress for students.

If one day the internet doesn't work and you don't learn what you thought you would, the world doesn't end there. (FinnTeacherFemale41)

In the case of network connections, interviewees reported a contingency plan before the lesson and sharing a phone until the network connection is restored as ways to alleviate technical stress.

Let's do it with something else, for example. That's the first thing teachers are taught. You can't ever trust that things will work. (FinnTeacherMale64)

If I don't work, I can always share from my mobile phone. (FinnTeacherFemale41)

To reach the most advanced level of a technologically equipped classroom according to the European Commission's HECC model, a fibre-optic connection is required. A fixed fibre connection stabilises and speeds up internet performance and is therefore helping to reduce and mitigate technostressful situations. Speed and stability can also be inferred as mitigants of technostress from previous studies by Kankaanranta et al. (2021) and Andersson (2008). Learning and teaching is a process that takes years, so occasional network outages or slowness can cause technostress, but in FinnTeacherFemale41's words, will not bring down the world.

4.1.3 Teachers' professional development

According to the HECC model developed by the European Commission, teacher professional development includes face-to-face training for teachers at different levels, such as workshops and classroom coaching. In addition to face-to-face training, another aspect of teacher

professional development is online training, such as online courses for teachers, webinars or the development of common practices for online use. This sub-section discusses teachers' professional competence and related situations of technostress and ways to mitigate them. The teaching profession is perceived as autonomous, often leaving teaching itself, despite the community of teachers, to the framework provided by the curriculum and the teacher's own discretion. Despite this autonomy, teachers, according to interviewees, crave peer support and feel that this helps to alleviate the technical stress of teaching. Ragu-Nathan et al. (2008), in the context of the stress model, highlight social support as a means of alleviating technostress, which is similar to peer support. However, not all schools and teachers take advantage of the peer support provided by the community and colleagues.

It's more rewarding if you can think about things together with a colleague, that it would be at least definitely a way to get over problems. **(FinnTeacherFemale41)**

There are few schools where teachers work in teams. And where you work in teams, then it works. But if it's a secondary school where the subject teachers are only allowed to talk about hockey or crossword puzzles at recess, then there's not a lot of skill exchange. **(FinnTeacherMale64)**

In the interviews, the problem of the teacher's independent work was interpreted as the teacher's own professional development. Without peer support and discussions with colleagues, it is difficult to know how other teachers teach. Other teachers could provide tips, good practice and models for their own teaching. Teachers often teach as they have learned.

That is the biggest challenge for all teachers, that teachers teach as they have learned. That's the only thing you have to leave out. **(FinnTeacherMale64)**

School is such a strange place to work. Someone (a pupil) is good at history, for example, and has learned it by writing things on the blackboard and writing them in a notebook. Then they go to study history, get a teaching qualification and go and teach history in exactly the same way as they learned it. **(FinnTeacherMale42)**

Given that teachers' teaching is influenced by their own experiences as students, the current training of teachers is not conducive to harnessing the use of technology in teaching. As discussed in the previous chapter, hybrid lessons are now part of classroom teaching in primary schools. In primary schools, teachers also teach distance learning alongside traditional classroom teaching due to factors such as exposure to high levels of interest and illness. According to interviewees, it would therefore be desirable for education studies to better prepare students for distance learning. In their study, Ferreira et al. (2018) therefore suggest that the entire education system needs to be reshaped in order to keep up with the opportunities

offered by technology in teaching. Livingstone (2012) also writes about the need for changes in teacher training and curriculum. One of the interviewees described the challenges of studying education remotely.

I was not able to do the course (remotely). Nothing. You would have had to be present for all of them. **(FinnTeacherFemale39)**

If teachers are also taught this way, at what point do they get access to the possibilities of technology. **(FinnTeacherMale42)**

According to a study by Ally et al (2014), reforming teacher training is important to enable teachers to make better use of technology as part of the learning process and to support students in using technology. In relation to reforming or modifying teacher education, one interviewee recalled his own education studies, suggesting that change could be possible.

If I think about it, pedagogical studies are pretty intensive, but technology could be brought into all of them all the time to see how to teach. It could be there all the time and then you should teach the management software. **(FinnTeacherFemale41)**

As the discussion on teachers' professional development continued, the difficulty of teachers asking for help also emerged. The difficulty of asking for help makes it difficult to draw on peer support and community, and to develop teachers' own professional skills.

I have yet to meet a teacher who asks for help. Yes, it's a hateful thing. Asking for help and telling a colleague that I don't know how to do it is a pretty tough self-esteem issue. **(FinnTeacherMale64)**

Everyone is used to being right there in their own class, and no one is going to challenge that competence. If there is even the slightest risk of that in the teacher's room, it's a dispute. **(FinnTeacherMale42)**

Many different experiences, but above all negative ones, influence how teachers perceive the use of technology as part of their teaching. The interviews revealed a number of challenges in using technology, with one interviewee experiencing technostress due to her own reluctance to use technology.

It could be seen as technostress, which just raises the threshold of why I don't want to use these devices and these programs in my lessons. They are really handy and they are wonderful to use, but then there is the hassle. **(FinnTeacherFemale39)**

For me, the use of equipment and the willingness to use it is influenced by the fact that if something comes up. 15 minutes of a lesson is spent thinking about how to implement this, so it is wasted. Especially when you're doing distance learning, and you don't even know what the other students are doing there. **(FinnTeacherFemale39)**

According to Ragu-nathan et al. (2008) and Tarafdar et al. (2011), employees' technostress can be mitigated by encouraging, rewarding and incentivising situations where the use of technology causes technostress for the user. It is also useful to understand the underlying causes of technostress. The underlying causes are individual and understanding them is a way to mitigate technostress (Pribbenow, 1999). Dunleavy et al (2007) cite the technology-rich classroom as posing challenges and even barriers to teaching. Teachers' group management skills are particularly challenged by the use of computers. Other interviewees also reported experiencing technostress related to the technology used in the classroom, as the problems and challenges associated with their use easily disrupt the rhythm and continuity of the lesson. Breaking the rhythm and continuity easily leads to restlessness or at least a loss of concentration, and regaining it can be challenging.

The stress I feel in that situation is that you have to get the lesson going. There has to be a rhythm and continuity. Because if it breaks, then the other students will start to mess around and it takes time to put it back together again. **(FinnTeacherMale42)**

In the interviews, a support person, a digital tutor or a student supervisor, who could help the teacher in case of problems, was mentioned as a way to alleviate technostress. A pupil could be nominated from the class who would benefit from help in lessons. A classroom helper can be likened to the technical support written by Ragu-nathan et al. (2008) and Tarfadar et al. (2011), which is perceived as a means of alleviating technostress.

There should be another person who does not have to be a teacher. If there's a risk of machines breaking down or the students' skills are not up to scratch, there's someone there to help. The teacher can pull the lesson forward. **(FinnTeacherMale42)**

A named pupil, who may, for example, receive a plus. They always have those behaviour, attention to detail and punctuality numbers. You could get a plus for it if you were a technical support. **(FinnTeacherFemale41)**

The change has happened in the last five years, when digital tutors were paid, but now they have lost the money and there are no digital tutors again. **(FinnTeacherMale64)**

Rewarding you for being interested in getting involved. No one wants to do anything extra voluntarily. **(FinnTeacherMale42)**

One of the challenges of teaching is the different skill levels of pupils in general, but especially in relation to the use of technology. Again, in this situation, the previously mentioned supervisor, digital tutor, or school technology support would alleviate the technostress caused by different skill levels.

It's a crazy situation at the moment. You want to use the computer to support your own teaching so. The fact that if they (the students) have not at any point learned it. They have a completely different starting level. Some have done some basic programming and some have never even met a computer.

Someone writing a history essay with a two-finger system knows that it will not fulfil its potential. **(FinnTeacherMale42)**

The solution to the technology stress caused by different skill levels, both for students and teachers, would be to hold IT classes. Currently, in primary schools, IT lessons are integrated into other teaching, which creates challenging situations for teaching and learning.

Nowadays, the OPS is that there are no extra computer science lessons, but everything is integrated. They (the pupils) are digitally inclined to use the mobile phone, yes, and they are very good at it, but not so much the laptop **(FinnTeacherFemale41)**.

For example, you go through the basics of Excel, then you announce to all the other staff that now they know the basics of Excel. Introduce it in class and then it will be used right away. **(FinnTeacherMale42)**

Technostress situations and mitigants related to teachers' professional development (Table 4) are not all necessarily caused by technostress. In this context, the use of technology, e.g. fetching and using computers, is strongly associated with a breakdown in students' concentration. There are other reasons why pupils' concentration may also break down. Teachers' stress related to working independently can be both ordinary stress and technostress. Teachers experiencing uncertainty about their own professional skills as a teacher can be considered as ordinary stress, but uncertainty related to the use of technology is technostress according to Ragu-Nathan et al. (2008) and Tarafdar et al. (2011). According to the interviewees, the technostress experienced by teachers due to the different skill levels of students is strongly related to, among other things, the interruption of the lesson continuum and the teacher's own competence in using technology in a situation where the student cannot cope with the use of technology.

TABLE 5: Situations and mitigating actions related to teachers' professional development that cause technostress.

Situations causing technostress	Positification measures
"I don't want to use technology"	Good experiences, peer support, technical support, digital tutor, student supervisor
Students' concentration breaks down	Digital tutor, student supervisor
Teacher's independent work	Peer support, teamwork
Studies in Education	Reforming teacher training, increasing the use of technology in education
Different levels of students' skills in using technology	IT lessons, technical support
Teacher's technical skills	Practising, anticipating

4.1.4 Digital content

The Digital Content theme addresses technostressful situations related to learning materials in the classroom and ways to mitigate them. According to Delgado et al. (2015), digital memory is cheaper than paper and also allows access to a vast amount of learning materials such as textbooks. However, interviewees reported that digital content was too limited or sometimes distracting. Too limited learning material is also not motivating and conducive to learning for the student.

The content is very limited in terms of what you can do on the computer. In maths, it's often the case that here's a graph like this, and you can use it to slide back and forth. You don't bring up machines, well not really taken. Especially in math and physics, it's more of a visual add-on. It doesn't really add much pedagogical value. There's a standard term, so that curve goes up and down. It's a bit of a let down, it was boring.
(FinnTeacherMale42)

The solution to limited digital content is to make more diverse and learning-rich content available, in line with Calvo and Peters (2014), in a way that promotes human well-being, and in line with Hourcade (2008), taking into account children's abilities, interests and

developmental needs. In addition, the already mentioned back-up plan helps to cope with the limited material.

If digital content is not enough, then other options will complement and expand it.
(FinnTeacherMale64)

The interviewee Ope<1 told of a situation in a primary school where she was a substitute. The lesson was about watching an online video on their own and then the students were asked to answer questions about the video. The classroom quickly filled up to the sound of more than twenty computer speakers. Both the students and the interviewee were experiencing technostress. The use of headphones in situations such as the example, or watching a video together on the big screen with a teacher, were suggested as mitigating factors.

Suddenly the class was just ringing out all those sounds and it took quite a while. And so the noise caused quite a lot of disturbance. (Ope<1)

Everyone starts watching videos at the same time and there will be a terrible noise, so for this kind of thing he could have for example all these noise-cancelling headphones.
(FinnTeacherFemale41)

Or just watch the video on the big screen and only the quiet work on your own.
(FinnTeacherMale42)

The interviews also highlighted a situation where the use of digital content was causing students to feel sick instead of noisy. The nausea was caused by a field trip, not by the lesson itself. However, the example suggests that virtual reality glasses purchased for the school to support teaching are not suitable for all students.

We had a VR (virtual reality glasses) field trip for the second grade. It happened to be quite funny that the first one was a static image with a dot pointing at it. The second was that you were actually kind of stationary and the penguins were moving around and the third was the kind where you were flying and able to turn around. Some 20% became unwell in the first, 30% in the next and over half in the last. That's when you plan the lesson for when someone throws up. (FinnTeacherMale42)

During the interviews, the issue of technostress in the classroom was raised by several teachers. Using the computer for non-learning activities such as gaming.

If the machines are taken, it won't take more than 3 nanoseconds for the first one to be playing CS. You have to be there all the time to see what they are doing.
(FinnTeacherMale42)

Turn your back and you've changed this and that. It's more about getting the motivation right. (FinnTeacherMale64)

There were several ways to mitigate this problem. However, the means identified do not eliminate the problem, but are intended to alleviate it, as the study suggests. Students' interest and concentration is not always on learning. One of the interviewees (H20) also suggested, due to the challenging nature of the problem, playing the game itself as a reward for good performance in the lesson.

Some schools use applications that require a person to give permission before they can be taken there. (FinnTeacherFemale27)

Well monitoring could be one. One is probably not having any games available. (FinnTeacherFemale41)

A lot of it depends on what the mandate of the hour is. Is it really possible to start playing something or is the time so limited that you have to do it. (FinnTeacherMale64)

Interviewees found digital content mainly limited and sometimes disturbing due to noise or virtual reality-induced nausea. In line with Calvo and Peters (2014) or Hourcade (2008), interviewees did not report a need for more wellbeing-oriented content or for content to be geared more towards children and young people, taking into account their interests and skill levels. Recently, there has been much debate about the use of smartphones and computers by pupils in the learning environment. In this study, from the point of view of teachers and experts, the need for constant monitoring of pupils' gaming activities. The current learning material available is mainly in need of a wider range of content that is more useful for learning.

Conclusions for Finnish experts

The results of the study show that the situations that cause technostress for individuals are varied. The technological equipment theme included the most technostressful situations and, at the same time, the means to mitigate them. The most common source of technostress is unfamiliar or unknown equipment. The best ways to mitigate technostress caused by unfamiliar or unfamiliar equipment are training, anticipation, a contingency plan and a sufficient number of available, proper and up-to-date equipment. The definition of technostress in previous studies and literature is, in a nutshell, the stress caused by the use of technology. Based on the results of this study, a new perspective can be found in experiencing technostress by simply thinking about using technology rather than actually having to use it. The limiting factors of this study are the examination of technostress from only one, i.e., harmful, perspective and the limited number of interviewees. Further research will explore technostress situations in the primary school classroom and ways to mitigate them from the students' perspective.

Summary of Technostress mitigation strategies included:

1. The need for flexibility: Teachers will always need to have plan B (and Plan C), in case something goes wrong with technology-enhanced learning.
2. Positification of the environment: We recognise the classroom as an environment that can cause technostress and anxiety not only for students with special needs but all of the students and teachers. Turning off devices that might be causing distraction can help
3. Restricting devices use
4. Naming one student to help with the distance group in a hybrid situation (for extra credits etc.)
5. More resources to plan teaching
6. More resources to play with technology
7. Giving teachers the technology to use at home so that they familiarise themselves with it while playing/free time use etc.

4.2 German stakeholder needs and barriers

The German partner has decided to include both the teachers' as well as the students' view on technostress as both groups are targeted by the project. Also, it was intended to understand different views and perspectives on the issue of technostress.

4.2.1 Teacher Focus Group

4.2.1.1 Teacher Focus Group Demographics

Table 6: Teacher Focus Group Participants

Nr.	Gender / Age	Exp. / years	Exp. Tech, / years	Subject	Role
T1	M51	25	25	Comp Science, Physics	Teacher
T2	M32	8	8	Computer Science, Sports	Teacher

T3	W24	1	1	Maths, Sports	Student teacher ("Referendarin")
T4	W48	22	8	German, Music	Director
T5	W54	27	20	Chemistry, Biology	Teacher

The focus group was organized on school premises in Essen, Germany. Due to the school policy, the interview has not been recorded but documented immediately. The statements and summaries were shared with the participants who confirmed the correctness of the documentation.

4.2.1.2 Results

Technostress

The interviews were started to describe the context of technology use in the school to better understand the situation in which the teachers are.

The **context**, as probably in most other schools, were the developments caused by the Covid-19 pandemic in the last years. Due to longer periods of school lockdowns, the schools have introduced many digital tools in a relatively short period of time. Some of the systems (e.g. collaboration with Microsoft Teams) were introduced within two weeks. The main system was Microsoft-based, furthermore tablets for all students were introduced. Last but not least, for certain purposes own devices could be used for a transition period. The following challenges regarding technostress should be seen in this context which is, however, rather typical for German schools at this time.

Infrastructure / technological stressors

As a first challenge, all five teachers have seen the **reliability** of the systems. This includes both hardware and software. The external systems were highly available but not in case of access problems, support processes could take too long. *"I was waiting to get access [...] for 2 days and I had to use colleagues' logins to contact the students - this was disappointing and I could not do anything myself" [T2].*

After Covid-19, the tools were still used, here, the reliability of school internal systems were the main stressor. *"You never know if the WLAN is up in the morning - when we have our classes in the computer pool room, some computers might not be available and we have to find spontaneous solutions" [T1].* As the main reason, the service / support concept was seen - this

is centrally managed for the city of Essen. Due to a lack of staff, they cannot support all schools on the very same day. Also, there is currently no remote service possible.

Digital Materials

The second category of stressors was the **availability of digital materials** - this was discussed firstly on a general level. For many subjects, digital materials were not available to immediately move from face to face to digital school life. After Covid-19, mainly digital solutions were provided by the school book publishers. The teachers said that not all materials have been useful and it was unclear whether own materials could be created or could be used. Secondly, we discussed learning materials regarding technostress. Only two of the five teachers knew about materials for this. They mentioned sources from the federal media center which provides teaching materials for the state of North Rhine Westphalia. Basically, materials are available for the most popular topics such as cybermobbing. Also, trainings for teachers are available. One teacher said “there are many materials but it just takes too long to modify them for our situation.” [T1]

Lack of competencies / trainings

The next category of stressor is caused by the **(perceived) lack of competencies** regarding the use of digital tools. “*We could have trainings any day in the year - but we do not have the time to participate, so the only way to keep up to date is to learn in the evening by yourself*” [T4]. There was consensus that professional development of teachers is highly necessary but due to the lack of staff, this is very limited. Regarding technostress it was mentioned that this has not been on top of priorities so far. It was also consensus that especially counsellors in the school should improve their competencies in this field to deal with new challenges for schools. The competencies of students were described as very different. It was mentioned that some students are almost more qualified than teachers, others are totally new to deal with digital tools. Regarding technostress, it was mentioned that students usually do not report problems to teachers.

Technology misuse

The last category of challenges was misuse of technologies. The first cause of stress was BYOD for the students, so that teachers do not have control on the usage. It was mentioned that students tend to be distracted. “*We always need to check that they are still with us*” [T5]. This was specifically mentioned also for homeworks.

One last challenge was the misuse of school tools - as an example it was mentioned that pornographic materials were sent using the airdrop tool. As a mitigation, a school wide code of conduct was developed and had to be agreed on by all students.

chatGPT

As part of the discussion, all teachers mentioned chatGPT and similar tools as the top challenge for teachers for the future - the following questions were mentioned:

- How to check homeworks?
- How good is chatGPT, what can and what cant be done with it (insecurity, lack of competencies)?
- Will projects use only chatGPT or normal research on the internet?
- How to use chatGPT to create new learning experiences?
- How will life change with these tools?
- How to control facts in chatGPT's outcomes?
- How to reference chatGPT results?
- Can we create learning materials?
- Insecurity of new teaching (some schools dont allow the usage)
- Locking out chatGPT?

It became very obvious that the availability of generative AI tools is the main stressor. It leads the uncertainties and insecurities about the future. Teachers said that training and regulations are necessary.

4.2.1.4 Mitigation strategies

After identifying stressors, mitigation strategies for the different stressors were discussed.

Trainings and competency development

It was consensus that training and professional development is the most important mitigation strategy. There should be an annual training which new sources of technostress could occur (e.g. new tools and trends for students). One teacher mentioned that “[...] we need short briefings and learning clips to learn for ourselves after school” [T5]. It was said that most teachers would use those (short) learning opportunities out of their own motivation to better deal with students and their problems.

Third party assistance / Peer Support

The teachers mentioned that they cannot handle all technostress phenomena on their own. Several strategies were mentioned here: First, peer support was mentioned. It was discussed that all colleagues have been exposed to technostress and have developed their solutions. Even though there was no systematic experience exchange, the teachers reported that they support each other in all situations. It was mentioned that this works in an environment when there is a good and constructive atmosphere.

The second aspect regards third party assistance. Teachers mentioned that sometimes parents provide help voluntarily (e.g. technical support, consulting, experience exchange).

As a conclusion it was mentioned that a systematic experience exchange or some kind of knowledge management would be very helpful.

Use of digital / open educational resources

Even though the use and development of digital resources was also one stressor, teachers agreed that digital resources for students would be extremely helpful to help both students and teachers to deal with technostress. Those should be easy to access and easy to modify. “We need packages which we can download, distribute and use immediately” [T2]. Also, it was seen as helpful to create links to existing resources to quickly identify and find materials. It was said that most teachers would agree on utilizing open licenses to make sharing and re-use easier.

4.2.2 Student Focus Group

4.2.2.1 Student Focus Group demographics

In a second focus group, we intended to understand the needs of students. For this purpose, we discussed with middle school students in grade 8 and 9. The main reason was that teachers stated that they do not see and know all the stressors which arise in the students' community.

Table 7: Student Focus Group Participants

Nr.	Gender / Age	Grade		School type	Role
S1	M13	8		High School (Gymnasium, Essen)	Student
S2	W13	8		High School (Gymnasium, Essen)	Student
S3	W15	9		High School (Gymnasium, Bottrop)	Student
S4	W15	9		High School (Gymnasium, Bottrop)	Student

The context was similar to the teachers view. During COVID-19, distance learning has been introduced without a notice. Also, students said that the use of technologies is intensified after grade 7.

4.2.2.2 Discussion Topics & Sample Questions

Technostress

All students mentioned that they have technostress experiences in and outside the school context. In the school context, very concrete stressors were discussed.

Typical stressors / reasons for stress

In the first round of discussions, students described different situations which cause stress.

Waiting for announcements: In both schools, Microsoft Teams was the main tool for collaboration. The students mentioned that the main stress is caused by the teachers: How to

deal when teachers are late: It was mentioned that teachers announce that tasks / homework will be provided but then they do not post it. It was also said that this issue is very often discussed in whatsapp groups of the students.

Videoconference is not available: The second concrete stressor were problems regarding videoconferences. The first reason can be technical when WLAN is not working or the tool is down. But in most cases it was found that teachers are just late. It was mentioned that more timely and clear communication is necessary and there should be also communication rules for teachers (not just: “look to the collaboration environment”)

Communication late at night: It was mentioned that some teachers communicate very late causing stress in the morning. This is very similar to the previous aspect: better and timely instructions are needed, again communication rules for teachers would be a solution.

Cybermobbing: Cybermobbing is also a very present topic in the students’ community. This is sometimes caused in their internal communication on whatsapp: As an example, it was mentioned that certain students are ignored by all other, messages are not answered. There is a fear that one could become also subject to cybermobbing.

Tools and technostress in school

As a second topic, concrete tools and related stressors were discussed. Here, not only technostress was discussed but also related phenomena were discussed such as cybermobbing.

- **Whatsapp** is used informally for school-related discussions and calls. It was mentioned that especially waiting for answers causes stress for all students. Especially in the morning, students are stress when checking messages from the last night.
- **Ipads for educational apps and sharing materials:** For those, good trainings at school (ipad days) were available for teachers and students. However, the tool **Airdrop** which is used for sharing materials, everyone can share. Here, inappropriate contents were shared. As a mitigation, this function is now available only for 10 minutes and there are quite strict rules for use.
- **“Classroom app”:** This app provides **control for teachers**. Younger teachers are well trained, expert ipad users and students can help. Some teachers do not use ipads (too

complex, not useful for subject languages). As a mitigation, all teachers should use the same tools and processes.

- **Internet sources** are used, especially in natural sciences. Here, it can be stressful when the quality of the sources is not clear. Also, no rules for referencing are given. Sometimes this causes stress whether teachers could see the work as plagiarism.

Tools and technostress outside school

As the next discussion topic, tools which students use outside the classroom were discussed.

The following tools could cause stress:

- **Instagram:** The students are very aware that Instagram does not represent the real world. However, students see that the influencers promote certain beauty ideals (nose, figure) which are then discussed in the students community.
- **Tiktok:** This tool is probably the most used social media tool in the age group. Here, stress is caused by anonymous comments and critique. The students who are present on Tiktok have to be perfect presented. Also, it was stressful whether a post would receive positive comments or like.
- **BeReal:** This quite new tool requires to take pictures at a random time. It can cause stress when this is done during class, e.g. during sports. Students were aware that a responsible use is necessary but the tool itself is not potentially dangerous. However, there is a pressure to post.
- **Spam** is distributed, e.g. through (many!) stickers in whatsapp class groups. As a mitigation, some teachers make rules for chats but this is not a general solution. Students have to come up with own rules.
- **chatGPT** is a topic for students. This might become a threat for all - e.g. cybermobbing by (generated) chat messages / voice. Also homework cannot be controlled and teachers are not well prepared for those threats. It was criticised that the topic is not (yet) discussed in school

Two more aspects were discussed which causes stress but are only indirectly related to social media. First of all, there is **stress in school for looks and outfit**. This is caused by the above mentioned social media. As a mitigation, offers for counselling should be available, also rules for communication should be made in class

As a last mitigation aspect in general, a **trusted teacher & school psychologist** is seen a very helpful. There should be a safe place for students giving hints and suggestions when there is a

case of technology-related stress. Also, it is important for the students that teachers are educated for cybermobbing.

Finally, the students said that they are aware of other known stressors but they have not experienced it themselves. The first one is bullying (e.g. bad pictures sent), the second is about getting to know unknown people (identity not clear) in social media.

To summarize, the students were well informed about possible danger and problems regarding digital tools. However, there are already many offers to mitigate. It was consensus that the most important is the clear communication. The students mentioned that in their schools, most other issues are solved, support is available and most teachers are well trained.

4.3 Greek stakeholder needs and barriers

4.3.1 The Profile of the Study in Greece

In the framework of the initial stage of the project explored the relationships between technostressors, coping strategies and anxious/depressive symptoms in a group of teachers from Ellinogermaniki Agogi school and a group of teachers from 3 rural schools that are part of the Learning from the Extremes school network in Greece. In our approach it was hypothesized that: Techno-overload, work-home conflict and pace of change would be positively associated with anxiety and depressive symptoms, techno-ease, techno-reliability, and techno-sociality would be negatively associated with anxious and depressive symptoms and coping style would mediate the association between technostressors and anxious/depressive symptoms. The discussions concluded with a number of recommendations of the involved participants that could offer some initial guidelines for the future development of the project. Teachers had to provide their views to the following questions:” How can technology be positively leveraged to support school education amidst the Covid-19 pandemic?” Can we develop new capabilities to support well-being in school education and transform distance learning paradigms into a positive perception and impact for teachers and students?

The interviews were realized in Ellinogermaniki Agogi school and over the web with the three rural schoolteachers.

Table 8: Profile of interviewees

Interviewe e code	Experience in teaching (in years)	Expertise in using tech in teaching (per year)	Distance teaching experience before Covid- 19	Subject area (field of education)	Student levels (age groups)
1	15	10	Significant	Science	12-15
2	21	-	Limited	Maths	12-15
3	12	-	Limited	Literature	12-17
4	14	10	Significant	Primary	10
5	18	12	Significant	Primary	11
6	9	9	Significant	Sports	8-12
7	15	10	Significant	Primary	8-12
8	8	8	Significant	Primary	8-12

Table 9: Technostress experiences of interviewees

Experience description (short)	Stressor (Tech/Content/Skill/Activity)	Who experienced the technostress	Mitigation that happened	Suggestions for mitigation in ideal world
Technical Infrastructure	Not well tested platforms and tools. There were never used at scale.	Teachers and Students	Use of commercial products - quite expensive	Development of platforms for large number of users
Unfamiliar with the device	Teachers with no experience in using computers in class experienced serious problems	Teacher	School provided support	School-based PD and support from a community of practice.
Bad connection	Common problem for both experienced and beginners	Teachers and students (and students' families)	Lessons were video recorded and shared to a platform	Lessons Repository available
Materials not available in Greece	In some cases, digital educational materials are not available	Teachers	User-generated content	Development of materials for all lessons

Technostressors were measured with validated survey items from different studies and published tools. The constructs, items, and internal reliability coefficients for the present study are detailed in Table 10. Participants responded to 17 items on a seven-point Likert scale (1 = Strongly Disagree to 7 = Strongly Agree).

Table 10: Technostressors and references

Technostress Factors and Items	Reference(s)	Overall Sample
Techno-Overload		
<ul style="list-style-type: none"> ICTs create many more requests and problems than I would otherwise experience I feel busy or rushed due to ICTs I feel pressured due to ICTs 	Moore (2000)	$\alpha = .82$
Work-Home Conflict		
<ul style="list-style-type: none"> Using ICTs blurs boundaries between my work and my home life Using ICTs for work related responsibilities creates conflicts with my home responsibilities I do not get everything done at home because I find myself completing work due to ICTs 	Kreiner (2006)	$\alpha = .77$
Techno-Ease		
<ul style="list-style-type: none"> Learning to use ICTs is easy for me ICTs are easy to use It is easy to get results that I desire from ICTs 	Moore and Benbasat (1991)	$\alpha = .85$
Techno-Reliability		
<ul style="list-style-type: none"> The features provided by ICTs are dependable The capabilities provided by ICTs are reliable ICTs behave in a highly consistent way 	DeLone and McLean (2003) Liang et al. (2002)	$\alpha = .85$
Techno-Sociality		
<ul style="list-style-type: none"> The use of ICTs enables others to have access to me The use of ICTs enables me to be in touch with others 	Ayyasari et al. (2011)	$\alpha = .74$
Pace of Change		
<ul style="list-style-type: none"> I feel that there are frequent changes in the features of ICTs I feel that the capabilities of ICTs change often I feel that the way ICTs work changes often 	Weiss and Heide (1993)	$\alpha = .84$

4.3.2 Analysis and Discussion

The interviews were realized in a framework of a workshop that was organized where the key issues related with the project were presented. Participants were informed for our intention to develop a PD programme for teachers. In this section the key messages from the discussion are highlighted to offer an initial set of guidance and recommendations for the future development of the project.

A key message from all the interactions we had with the teachers is that their' professional attributes go beyond their working hours and daily tasks. Thus, analyzing work stress of teachers by only considering the elements of work done in the classroom work would neglect the emotional and moral burden of teaching. In short, teachers work every day and at all times. This is because of the peculiar characteristics of the teaching profession, which can potentially cause significant stress and psychosocial damage. Teachers themselves are increasingly under pressure due to increased workloads, higher expectations and job-related stresses. COVID-19 has further exacerbated the level of stress on teachers and in this post-COVID era,

teacher resilience is low, and the rates of burnout and absenteeism are escalating (Ozamiz-Etxebarria, et al., 2021)[1].

The initial literature regarding teacher technostress considers it to be caused by the introduction of technology into the classroom and from a lack of adaptation to the technological environment. Teachers believe that this can be reduced when teachers receive administrative and pedagogical support for the use of technology (continuous access to technical support and updated technology for the preparation and development of their activities), which gives them a supporting atmosphere that increases their motivation to cope with the difficulties emerging for the related technical issues. That support influences technostress, which, in turn, affects the intention of the technological use by teachers. Research on higher education emphasizes the presence of technostressors and techno-inhibitors that influence job satisfaction; organizational commitment; negative affectivity due to work; and, above all, technology-mediated performance. In general, the lack of adaptation between people and their work environment affects their job performance.

Technical Infrastructure

Studies that focus on Greek educational system have highlighted the failure of the technical infrastructure to support teachers work during the pandemic (OECD 2020[2]). The fact is that although significant investments were done since 2000 for the development of a large-scale digital infrastructure to support the digitization of education in Greek schools the key tools that were available at the time of the pandemic were not capable to facilitate teachers work. According to the Ministry teachers had at their disposal a variety of tools such as the Interactive School Books[3], the Digital Educational Material (“Fotodentro”)[4] and the Advanced Electronic Scenarios (“Aesop”)[5] organized by educational level, course. According to the Ministry, the digital asynchronous platforms “e-class”[6] and “e-me”[7] were also offered and used for e-learning courses, while students had the opportunity to follow “Open Classes” posted in the platforms by their teachers without prior registration. Public TV also supported distance learning by broadcasting educational programs for primary school students.

But it was clear that during the first period of the pandemic that these systems were not developed to host thousands of teachers and students. Most of the services collapsed from the first day. Apart from the access issues the materials that were available were outdated (e.g., there were numerous interactive applications that were developed in Flash about 10 years ago that were not anymore operational.). The analytics from the educational infrastructures of the Ministry clearly presents the limited use from the Greek educational community. Teachers in

EA and in rural schools highlighted that they had to search and find their own resources to support their work during the pandemic.

At the second phase of the pandemic the Ministry of Education deployed commercial systems to support teachers. As far as synchronous e-learning is concerned during the lockdown teachers of public schools mainly used Webex. Again, numerous problems appear as the hosting servers were not able to meet the demand. Teachers had to use Skype, Zoom, Blackboard and Microsoft Teams instead. Some private schools paid for the use of non-free platforms like the blackboard to ensure that students don't miss online courses. During the second year of the pandemic the Ministry has improved the hosting services and all schools (private and public) used the Webex platform.

There are numerous surveys that claim that although, teachers used the online tools they had at their disposal they were not trained with view to develop their digital skills. In fact, the situation was situation was different as the recent study of OECD demonstrates. The key problem was not teachers' skills or readiness to cope with the use of ICT during the COVID pandemic but the lack of "effective online support platform" (see Table 11). The percentage of the students who had an on-line support platform available in Greece was about 34% (OECD Average 54%, OECD Minimum 24%). This demonstrate the major problem Greek teachers faced during the ICT-based instruction during the last two years.

Table 11: The Greek education system's response to the COVID-19 pandemic (OECD 2020)

Selected indicators of system readiness (OECD)		Greece	Average	Min	Max
<i>Students' readiness (according to students' self-reports in PISA 2018)</i>					
1	Index of self-efficacy	0.05	0.01	-0.61	0.36
2	Percentage of students in disadvantaged schools with access to a computer at home that they can use for school work	80.2%	81.5%	23.5%	96.5%
<i>Schools' readiness (according to principals' reports in PISA 2018)</i>					
3	Percentage of students in schools with an effective online learning support platform available	34.2%	54.1%	23.9%	90.9%
4	Percentage of students in schools whose teachers have the technical and pedagogical skills to teach with digital devices	62.8%	64.6%	27.3%	84.1%

All participants mentioned that they faced various difficulties due to digital infrastructure's inadequacy, limited support by the Ministry and the educational authorities, limited digital educational material, as well as low digital literacy of students, parents. Less experienced participants mentioned that they didn't have serious difficulties to re-organise the instruction, still in most of the cases the system was not working as expected. And this was the key obstacle and the key reason for increased stress and anxiety.

We can say that there are negative correlations between technostress, emotion, and self-efficacy, indicating that technostress appears to be an obstacle for their perceived self-efficacy and the development of positive emotion while teachers are on task.

Learning as part of a community

On the other hand, the participants mentioned that there were many opportunities for teachers to experiment and apply their prior training knowledge on distance education. More concretely, teachers managed not only to improve their teaching and digital skills, to enrich and organise their educational material with more interesting online educational resources, but also to collaborate with colleagues, and to maintain effective communication with students. Similarly, students had opportunities to improve their digital and soft skills and receive personalized teaching.

However, most teachers believed that their workload was increased, and their available free time significantly decreased. They also believe that the failure of the provided infrastructure resulted in numerous didactic hour losses. Also, teachers believed that students' participation and engagement decreased significantly.

Finally, teachers mention that a PD programme that will provide support to minimize stress would be a great contribution even in the current situation where the ICT infrastructure of the Ministry is not in use anymore.

Existing Initiatives

During the interactions two existing initiatives were presented and discussed with the participants as examples of provision of psychological support to teachers and students during the pandemic.

The Program for the Promotion of Mental Health and Learning in Schools: The aim of this project has been to promote resilience, well-being, academic achievement, and positive climate in the school setting. Educational material for three age groups (preschool, primary, and secondary education) have been developed and published, including the conceptual framework, eleven thematic units, and the students' activities. Training seminars for teachers and school psychologists were conducted by the Laboratory of School Psychology at NKUA in Greece and Cyprus in collaboration with the Cyprus Pedagogical Institute for the implementation of the program in schools.

Εργαστήριο Σχολικής Ψυχολογίας
Μεταπτυχιακό Πρόγραμμα Σπουδών «Σχολική Ψυχολογία»
Τμήμα Ψυχολογίας
Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Εθνικών και Καποδιστριακ
Πανεπιστήμιον Αθηνών
— ΔΕΥΤΕΡΟΝ ΤΟ ΒΑΤ —

Κύκλος ημερίδων Σχολικής Ψυχολογίας
«Διά-λογοι στήριξης και συνεργασίας στη σχολική κοινότητα»
Ημερίδα Σχολικής Ψυχολογίας (6)
Στηρίζοντας τη σχολική κοινότητα στην περίοδο πανδημίας COVID-19:
Ανάγκες, Πρακτικές και Παρεμβάσεις
Σάββατο, 9 Απριλίου 2022
09:00-15:00

Η Ημερίδα θα πραγματοποιηθεί διαδικτυακά
 Η εγγραφή για την παρακολούθηση είναι χωρίς κόστος συμμετοχής

Διοργάνωση

Το Εργαστήριο Σχολικής Ψυχολογίας και το Μεταπτυχιακό Πρόγραμμα «Σχολική Ψυχολογία» του Τμήματος Ψυχολογίας του Εθνικού και Καποδιστριακού Πανεπιστημίου Αθηνών διοργανώνουν, στο πλαίσιο του κύκλου ημερίδων Σχολικής Ψυχολογίας «Διά-λογοι στήριξης και συνεργασίας στη σχολική κοινότητα», την 6η Ημερίδα με τίτλο «Στηρίζοντας τη σχολική κοινότητα στην περίοδο πανδημίας COVID-19: Ανάγκες, Πρακτικές και Παρεμβάσεις» για την ανάδειξη καλών πρακτικών και παρεμβάσεων για τη στήριξη της σχολικής κοινότητας κατά τη διάρκεια της πανδημίας.

Περιεχόμενο

Η Ημερίδα αποτελεί συνέχεια των πολυετών δράσεων του Εργαστηρίου Σχολικής Ψυχολογίας και του ΠΜΣ «Σχολική Ψυχολογία», ΕΚΠΑ, για τη στήριξη των σχολικών κοινοτήτων σε περιόδους κρίσης. Ειδικότερα η Ημερίδα εντάσσεται στο πλαίσιο των πολυεπίπεδων δράσεων του Εργαστηρίου Σχολικής Ψυχολογίας και του ΠΜΣ «Σχολικής Ψυχολογίας», ΕΚΠΑ σχετικά με την υποστήριξη των σχολικών κοινοτήτων και των οικογενειών/δομών φιλοξενίας παιδιών στην περίοδο της πανδημίας. Οι δράσεις που αναπτύχθηκαν και υλοποιήθηκαν από το Εργαστήριο περιλαμβάνουν μεταξύ άλλων έντυπα με χρήσιμες επισημάνσεις (εκπαιδευτικοί/σχολικές κοινότητες, γονείς/οικογένειες/πλάισια φιλοξενίας, μαθητές/μαθήτριες), επιμορφώσεις (εκπαιδευτικών, ψυχολόγων, ειδικών ψυχικής υγείας, γονέων), προγράμματα παρέμβασης και στήριξης σχολικών μονάδων σε συνεργασία με τους μεταπτυχιακούς φοιτητές και φοιτήτριες σχολικής ψυχολογίας.

Figure 5: Program for the Promotion of Mental Health and Learning in Schools

Psychosocial support of school communities during the COVID-19 pandemic: In this project, a multi-level approach has been developed by the Laboratory of School Psychology at NKUA to support school communities during the COVID19 pandemic that includes:

- (a) research exploring teacher, parent, student and psychologists perspectives regarding the impact of the pandemic in school communities as well as their perceived needs at different phases of the pandemic,
- (b) the development of 14 resources for schools and families focusing on vulnerable groups, which were distributed through the Department of Education to all public schools in Greece
- (c) the delivery of online training for teachers, school administrators, parents, psychologists and social workers from different educational and other settings,
- (d) the collaboration and consultation on policy making decisions,
- (e) the provision of school psychological services,
- (f) adjustments to the educational curriculum of the graduate program in School Psychology and connection of student internships with school communities.



Figure 6: The website of the Psychology Group of the University of Athens that has offered access to resources related to psychological support of teachers during the pandemic.

4.3.3 Conclusions

Participants have proposed the creation of a series of learning scenarios including modules and lessons to be taught (theoretical knowledge and Practical cases of Positive eLearning innovations, novel ICT tools and instruments supporting the implementation of Positive eLearning, regulatory issues, implementation concerns); the assignments and projects given to students; the books, materials, videos, presentations, and additional readings used in the course; and the tests, assessments, and other methods used to evaluate student learning. Integral to these scenarios an inclusive and collaborative design process should be included, driven by the contributions of teachers, child educators and psychologists, scientists, child physicians, clinicians, and providers of initial and continuing professional development within active communities of practice. The scalability of these collaborative communities will be possible through the teacher-as-multiplier design principle for large-scale continuous professional development.

The results of the study show that the situations that cause technostress for individuals are varied. The technological equipment theme included the most technostressful situations and, at the same time, the means to mitigate them. The most common source of technostress is unfamiliar or unknown equipment. The best ways to mitigate technostress caused by unfamiliar or unfamiliar equipment are training, anticipation, a contingency plan and a sufficient number of available, proper and up-to-date equipment. The definition of technostress in previous studies and literature is, in a nutshell, the stress caused by the use of technology. Based on the results of this study, a new perspective can be found in experiencing technostress by simply thinking about using technology rather than actually having to use it. The limiting factors of this study are the examination of technostress from only one, i.e., harmful, perspective and the limited number of interviewees. Further research will explore technostress situations in the primary school classroom and ways to mitigate them from the students' perspective.

[1] Ozamiz-Etxebarria N., Berasategi Santxo N., Idoiaga Mondragon N., & Dosil Santamaría, M. (2021). The psychological state of teachers during the COVID-19 crisis: The challenge of returning to face-to-face teaching. *Frontiers in Psychology*, 11, 620718. <https://doi.org/10.3389/fpsyg.2020.620718>

[2] <https://www.oecd.org/education/policy-outlook/country-profile-Greece-2020.pdf>

[3] <http://ebooks.edu.gr/ebooks/>

[4] <http://photodentro.edu.gr/aggregator/>

[5] <https://aesop.iep.edu.gr/>

[6] <https://eclass.sch.gr/>

[7] <https://auth.e-me.edu.gr/>

5 RECOMMENDATIONS

In this chapter we provide recommendations based on our needs & requirements analysis for future work in distance learning positification.

Recommendation 1: Need for a community platform for exchanging positive learn experiences and sharing ideas

For whom? Educational project managers

Participants consider that being part of a community where they have the chance to exchange experiences and practices would be a significant support for their work. Such a platform also could act as a networking area, where interested participants can actively network across Europe, keep up to date on the latest news from the research/industry and application side and share ideas, advice and experiences.

Recommendation 2: Teachers need positification best practices

For whom? Teachers

Teachers are resourceful in dealing with troubling situations regarding technology use in the classrooms. However, they would also benefit from a collection of mitigation mechanisms that they could use in the classrooms. These could be short easy-to-use videos or even short audio lessons/podcasts which teachers could listen to on their free time to achieve learning positification.

Recommendation 3: Classrooms would benefit from 'play'

For whom? Headmasters, School managers, teachers & students

Schools are often heavy on the learning goals and objectives of the students' skills growth. However, in the case of innovative technology use, a lot of the anxiety for technology use is due to teachers and students not being familiar enough to use certain technologies. Giving teachers and students time for free play with the technologies, a lot of the fears of using technology can disappear so we recommend to encourage free play time.

Recommendation 4: Peer support for teachers

For Whom? School managers, teachers

Teachers' peer support can be a very powerful tool for positification. Peer-support can help teachers to cope with the challenges of integrating technology in their classroom, which in turn reduces technostress. Teachers can share their experiences and exchange tips and strategies on how to effectively use technology in their teaching, which can lead to an improvement in their instructional practices. Peer-support groups can provide teachers with a sense of community and shared responsibility, which can lead to increased job satisfaction and a sense of wellbeing. Collaborating with peers can also help teachers to stay up-to-date with the latest technological advancements and incorporate them in their teaching practices. Support from peers can reduce feelings of anxiety and isolation that can arise from being a lone teacher in a technology-rich environment, enabling teachers to become more confident and motivated in their use of technology.

Recommendation 5: Empowering students to mentor teachers

For Whom? Teachers

Teachers can have significant fears of technology that can stop them from utilising technology up to its full use in the classrooms. A suggestion that was rising from our expert study was to get students to help teachers with technology use. This has significant benefits as it increases collaboration and interaction between the teacher and the student, but also it will be easier to get students to help the teachers rather than to buy expensive teacher training/IT support.

Recommendation 6: Encourage regular breaks and digital detox

For Whom? Teachers and students

Schools can encourage teachers and students to take regular breaks from online learning activities to prevent burnout and reduce stress. This can include moving around, stretching, or engaging in other non-technology-related activities.

Recommendation 7: Provide easy-to-implement materials

For Whom? Teachers and students

Teachers are always under time pressure - for them, it will be helpful to provide short trainings which they can also use outside school - for preparing lessons, it will be useful to develop easy-to-implement materials which can be modified easily.

Recommendation 8: Enable experience exchange and peer support

For Whom? Teachers

Many teachers cannot catch up with the latest development (such as chatGPT) and do not have time for long trainings. It should be considered to provide tools for a systematic experience exchange and also peer support as this has been proven successful in different settings.

Recommendation 9: Provide materials for counsellors

For Whom? Teachers

Having a counsellor and trusted person is a useful solution for all types of technostress and related problems. It can be helpful to establish such a position in schools. To prepare teachers to taking over this responsibility, specific materials for in-service training can be helpful.

6 CONCLUSION

Technostress in online education refers to the negative effects of using technology on a person's well-being, including physical and mental health, work-life balance, and overall quality of life. It is a phenomenon that affects people who use technology related to online learning, such as Teachers and students. This can lead to decreased motivation, burnout, and negative impacts on mental and emotional well-being, and negatively impact learning outcomes and performance.

Technostress can affect students in several ways. Difficulty adapting to new digital platforms and tools can hinder student learning and increase stress levels. Balancing online classes with other responsibilities and distractions can lead to time management issues and stress. Students can experience information overload and stress from managing and processing large amounts of digital information. Online education can limit in-person interaction, leading to feelings of isolation and stress. Technostress can lead to decreased motivation, burnout and negative effects on mental and emotional well-being. Technical problems and malfunctions can disrupt learning and cause stress.

Similarly, **Technostress can affect teachers** in several ways. Integrating technology into the classroom and staying current with digital tools can increase their workload and stress levels. Technical problems and malfunctions can cause frustration and stress. In addition, teachers can feel overwhelmed when adapting to new digital tools and platforms. Balancing technology-enhanced teaching with traditional teaching methods and administrative tasks can create time constraints and stress. Technostress can lead to burnout, decreased job satisfaction, and decreased motivation. Technostress can negatively impact teachers' mental and emotional well-being, leading to anxiety and depression.

Overall, Technostress **can arise from a variety of sources**, such as difficulty adapting to new digital platforms and tools, information overload, technical problems and feelings of isolation. As new digital tools and platforms are introduced, users may need to learn new skills and ways of working. This can cause stress, especially when the technology is complex or not user-friendly. With the vast amount of digital information available, it can be difficult to sort and prioritize what is important. This can lead to feelings of being overwhelmed and stressed. Technical issues such as system crashes, slow internet connections or device malfunctions

can be frustrating and stressful for both teachers and students. The increasing use of technology in communication can sometimes lead to feelings of isolation and disconnection from others, especially when face-to-face interactions are reduced.

The main **technology stressors** associated with the use of technology in online education include: technical difficulties (e.g. poor internet connection, hardware failure), time management and workload, difficulty in adapting to new digital platforms, lack of human interaction and social support, distractions and lack of concentration, information overload, difficulty in staying organised and motivated, feeling isolated and disconnected from classmates and trainers etc. Overall, technology stressors can be roughly divided into four main categories:

- **Technical challenges:** Difficulties with hardware, software, or internet connectivity.
- **Learning Challenges:** Adapting to new digital platforms, information overload and difficulty staying organised and motivated.
- **Social Challenges:** Lack of human interaction, social support and feelings of isolation.
- **Time Management Challenges:** Heavy workloads, difficulty balancing multiple responsibilities, and distractions.

This implies that **the support teachers need** to better deal with technostress spans several areas, ranging from professional development opportunities to technical, peer and administrative support, and access to mental health resources. Access to training and professional development programs can help teachers develop the competencies they need to effectively integrate technology into their classroom. Availability of technical support staff can help resolve technical issues and provide assistance with digital tools and platforms. Opportunities to collaborate with colleagues will allow teachers to exchange ideas, experiences and strategies for coping with technostress (learn from others' experiences and knowledge, solve problems related to technology use, receive social support). Support from school administration is needed in terms of providing adequate resources, reducing workload and recognizing the importance of managing technostress. To this end, the availability of mental health resources, training and support for teachers struggling with technostress is critical. Overall, stakeholders need to prepare a proactive way to make sure teachers are less stressed with this new norm of teaching and learning (Nang, et al., 2022). The study by Nang, et al. (2022) concluded that “technology is becoming a more important tool in the classroom as the needs of 21st-century skills” and “educators need to look at appropriate learning design

and pedagogy”. Teachers need a combination of **technical, pedagogical and social and emotional competencies** to better deal with technostress.

Technical competencies include the ability to use various technologies including hardware, software and digital tools, knowledge of troubleshooting common technical issues, as well as the ability to adapt to new technologies and tools as they emerge. Pedagogical competencies involve the ability to effectively integrate technology into teaching and learning so as to design and deliver effective technology-enhanced learning experiences, but also the ability to use technology to differentiate teaching and support diverse student needs. Social and emotional competences include an awareness of and the ability to cope with the potential effects of technostress on teachers and students. This includes both the ability to manage stress and practice self-care and the ability to create a positive and supportive learning environment that encourages healthy use of technology.

Following is an indicative list of required competencies:

Table 12: Sample of required competencies

Competency	Description
Technical skills	Proficiency in using technology and digital tools for teaching and learning.
Time management	Ability to manage time effectively and balance technology-enhanced teaching with traditional methods.
Stress management	Understanding of stress management techniques and ability to apply them to reduce technostress.
Adaptability	Flexibility and adaptability in incorporating new digital tools and platforms into teaching.
Digital literacy	Knowledge and understanding of the impact of technology on education and society.
Collaboration	Collaboration skills to work with instructional technology and design support teams.

Competency	Description
Communication	Effective communication skills for engaging students and collaborating with peers and support staff.
Self-care	Awareness of the importance of self-care and ability to prioritize and engage in activities that support well-being

Developing these competencies enables teachers to integrate technology more effectively into their classrooms, support student learning, and manage the stress and challenges that come with using technology.

Similarly, **students need technical, academic, and social and emotional support** to better manage the challenges of online learning and promote their overall well-being. Technical support involves access to reliable internet and devices, resources to troubleshoot common technical issues, as well as assistance in navigating and using online learning platforms and digital tools. Academic support includes clear instructions and expectations for online learning assignments and assessments, support for time management and organization of online learning tasks, as well as opportunities for interaction and feedback from teachers and peers. Social and emotional support includes access to mental health resources and counseling services, and support and opportunities for social interaction with teachers and peers.

This support can help students manage the stress and anxiety that can arise from online learning and other aspects of technology use, including feeling overwhelmed by online courses and assignments. It can reduce feelings of isolation and restore a sense of community among students.

Consequently, the mitigation strategies that can be used to manage technostress in online learning span several areas. Schools can:

- provide technical support to students to help them troubleshoot technical issues and ensure they have access to reliable internet and devices. This can help relieve stress related to technical difficulties and frustrations.
- simplify online learning platforms to make them easier to use and reduce confusion for students. This can help reduce stress associated with navigating complex online learning systems.
- set clear expectations for online learning assignments and assignments to help students manage their time effectively and reduce stress from overwork.

- encourage communication between teachers and students through virtual office hours, online discussion forums, and other communication tools. This can help students feel more connected to their teachers and peers and reduce feelings of isolation.
- encourage students to take regular breaks from online learning activities to prevent burnout and reduce stress. This may include encouraging students to take short breaks to exercise, stretch, or engage in other non-technology related activities.
- educate students about the healthy use of technology and strategies to cope with technostress, e.g., and explore stress management techniques. Education about healthy technology use and strategies to cope with technostress is important. Schools can offer digital citizenship education, including responsible online behavior, internet safety and privacy, to help students develop healthy online habits and avoid stress from negative online experiences.

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