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Mitigating Effects of the Early Warning Time on Individual Work Technostress

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ABSTRACT

Despite the popularity of remote work in the Covid-19 pandemic, little research attention has been paid to examining how individuals can mitigate technostress in the remote work, especially work from home. To fill this gap, the authors first reviewed the extant literature and found some difficulties of adopting the mitigating approach suggested by those studies. Then, the authors suggest a new model and a workable plan to moderate remote work exhaustion when the proposed approach is used for reducing progressive distancing technostress. To be more specific, the authors posited that early warning time could moderate the relationship between technostress and remote work exhaustion. The authors suggested presetting it in the computer system using a tool called "Windows Task Scheduler" to activate this early warning mechanism. The novel concept should make contributions to the mitigation of technostress.

Keywords: Technostress; Work Exhaustion; Early Warning

INTRODUCTION

Before the outbreak of COVID-19, remote work was an unusual way in the enterprise, moreover, the studies on remote work focused almost completely on those who voluntarily work from home (Kniffin et al., 2021). However, as the COVID-19 was spiraling out of control, the pattern of remote work has become an essential part of pandemic control meanwhile the public acceptance of remote work has increased over time (Mukherjee & Narang, 2023). While remote work is gradually becoming common, technostress is still on the rise and invades the life of individual day-in-day-out (Oksanen et al., 2021). The authors now have enough evidence to support the fact that the psychological challenges and risks (i.e., work exhaustion) that remote employees confront in the event of COVID-19 (Estrada-Muñoz et al., 2021; Gabr et al., 2021). It is hence relevant to understand how different mechanisms reduce perceptions of technostress and, as a workable approach, mitigate the work exhaustion of employees (Ru-zhe & Agmapisarn, 2023).

The studies on mitigation of technostress have mostly studied the coping strategies of technology stressors, e.g., IT control (Salo et al., 2019) and venting (Pirkkalainen et al., 2017). Some studies have considered technostress mitigation must directly reduce the technical creators (Salo et al., 2022; Weinert et al., 2020). However, the ICT interface as the only communication channel for remote employees seems to be unable to be easily removed, which means that technostress has to be handled in a segmented manner. The studies related to remote work exhaustion have long suggested that online health strategies are required to assist the public in dealing with rising levels of technostress and burnout during COVID-19 (Mheidly et al., 2020). Equally, there are limited studies about the design of views for the computer system to cope with technostress mitigation. Based on this view suggested from the literature, the authors attempt an early warning mechanism on the computer system to allow the remote employees can be away from IT devices in a process of conscious perception with a relaxed status.

In summary, this study was conducted in the form of literature reviews, collecting the current studies about technostress mitigation and emphasizing the importance of the topic.

In the following part, the authors first initiate the literature reviews highlighting the barriers shown in the context of technostress mitigation. Second, the proposed conceptual model is expressed. Third, the authors then discuss the conclusions and contributions of this study. Finally, the authors present the limitations and further research.

LITERATURE REVIEWS

Theory of Stress and Coping

Inspired by the theory of stress and coping (Lazarus, 1966). Coping is defined as adjusting cognitive and behavioral efforts in response to certain additional demands that are perceived to be exceeding the individual's resources (Lazarus & Folkman, 1984). The theory of stress and coping emphasizes the dynamic chain process of how individuals experience stressful events to support adaptive behavior. More precisely, the coping process consists of two component parts, cognitive appraisals, and coping strategies. In cognitive appraisals, the persons evaluate the negative effects of the stress to the individuals by primary and secondary approaches, namely that stress identification and stress strategic management. In coping strategies, the persons strive to handle the conflicts in exceeding personal capability, for example, by mitigation or controlling stress. Taken together, the theory of stress and coping implies acknowledging the general principles of stress mitigation. The authors' focus is to construct

the mitigating mechanism on the computer system to minimize the negative effects of technostress-creating conditions (i.e., work exhaustion) as possible. Thus, the authors adopt the theoretical views of the theory of stress and coping.

The Studies Overviews of Individual Mitigation of Technostress

Technostress was originally viewed as a computer-generated health ailment (Brod, 1984). Afterward, technostress expanded into workplaces and considered that it is non-optional leads to changes in organizational performance and individual roles (Tarafdar et al., 2014). As the clear definition of "technostress" is rather intricate, several studies have specifically explained that "technostress" is associated with technology fatigue and technology addiction (Salanova et al., 2013). Remote work is characterized by contact with members of an organization through the use of ICT and computer systems all day, with the ICT panel being the almost and only channel at work, remote workers often experience disruptions (e.g., frequently and explosive text messages), workload loads, and work-family conflict (i.e., the blurring of virtual and reality) (Stich, 2020). Also, the common characteristics of ICT to result in work exhaustion are technology overload, technology insecurity, technology invasion, technology complexity, technology uncertainty (Ragu-Nathan et al., 2008). Hence, remote work could be regarded as a phenomenon of technology addiction and technology strain. To better understand the mitigation of the technostress, Weinert et al. (2014) classified technostress mitigation into two distinct aspects, organization-level, and individual level (Weinert et al., 2014). With regard to technostress mitigation at the organization level, technology-support strategies, and emotional-support strategies often symbolized the main approaches to relieve technostress inside the firm. First, technology-support strategies usually refer to providing technical assistance to reduce the technology anxiety of employees. For example, organizations provide the latest system operating guidelines (Reinke et al., 2016). Second, emotional-support strategies usually refer to strengthening the connection between system developers and employees and increasing employees' confidence in the technology. For example, organizations encourage users to use, try out, and evaluate new systems and give feedback (Ragu-Nathan et al., 2008). Here, the authors' interest is to help the remote employees to cope with technostress by mitigation. Thus, the authors concentrate on the reviews for the studies of technostress mitigation at the Individual level in the following part.

With regard to technostress mitigation at the individual level, table 1 explains the workable way that the ICT employees relieve technostress. Several studies have indicated that distancing the ICT environment is the best way to mitigate burnout (Galluch et al., 2015; Salo et al., 2022). Specifically, being away from the ICT environment can relieve the technostress creators, meanwhile, offset the negative effects of technostress antecedent variables on ICT-oriented productivity (Salo et al., 2022; Salo et al., 2019). However, distancing the ICT environment merely offer a channel to temporarily separate from work for employees and conduct alternative tasks, nor a wise and long choice, more importantly, the employees carefully understand how and when to use IT devices (Tarafdar et al., 2020). However, the truth is that employees often undervalue IT usage, and many issues make it tough to turn off the IT device (Salo et al., 2022). In comparison, IT control possibly causes a sense of conflict though reducing the effect of overload (Galluch et al., 2015). On the basis of the above observation, to mitigate the technostress of employees should be a progressive process and automatically conduct the set of activities of distancing technostress on the computer system.

Table 1: The General Method of Mitigation of Technostress

Mitigation	Core Definition	Resources
IT Control	Individuals freely view messages, instead of being forced to ICT intrusive messages	(Galluch et al., 2015); (Salo et al., 2019)
Method Control	Individuals have the right over the method of accomplishing primary tasks.	(Galluch et al., 2015)
Distancing	Implementing the option of disconnecting from the ICT environmental scenarios and engaging in non-ICT activities.	(Galluch et al., 2015); (Tarafdar et al., 2020); (Salo et al., 2019)
Venting	Expressing emotions verbally in stressful events.	(Tarafdar et al., 2020); (Salo et al., 2019)
Positive IT Outlook	Rebuilding stressful situations as positive.	(Tarafdar et al., 2020); (Pflügner et al., 2020)

Source: This study.

Technostress and the Remote Work Exhaustion

Technostress was originally viewed as a computer-generated health ailment (Brod, 1984). Afterward, technostress expanded into workplaces and considered that it is non-optional leads to changes in organizational performance and individual roles (Tarafdar et al., 2020). As the clear definition of "technostress" is rather intricate, several studies have specifically explained that "technostress" is associated with technology fatigue and technology addiction (Salanova et al., 2013). Remote work is characterized by contact with members of an organization through the use of ICT and computer systems all day, with the ICT panel being the almost and only channel at work, remote workers often experience disruptions (e.g., frequently and explosive text messages), workload loads, and work-family conflict (i.e., the blurring of virtual reality and real reality) (Stich, 2020). Also,

the common characteristics of ICT to result in work exhaustion are technology overload and technology invasion (Ragu-Nathan et al., 2008). Hence, remote work could be regarded as a phenomenon of technology addiction and technology strain.

METHODOLOGY

This conceptual study is established by reviewing the literature from previous studies, the approach was by searching on academic journal research on Google Scholar such as "the mitigation of Technostress on remote work exhaustion". Nevertheless, not all the studies did match this research interest. Most of the related studies would not target the field of remote work and little connect the relationship between remote work exhaustion, technostress, and mitigating method. Hence, the authors make literature reviews and seek the complicated relation.

Proposed Propositions and Conceptual Model

The aim of this study is to develop a conceptual model for technostress (Figure 1.) and understand the effect of the proposed early warning mitigation mechanism on the relationship between work exhaustion and technostress. Since the emphasis is on explaining the mitigating role of the early warning mechanism, the authors consider the impact of different early warning times, which can lead to various mental and physical reactions. These variations could result in different levels of remote work exhaustion. Therefore, the research questions are as follows: What are the effects of implementing an early warning mechanism on the computer system in relation to technostress and remote work exhaustion? In the following part, the authors show the development of the proposed propositions.

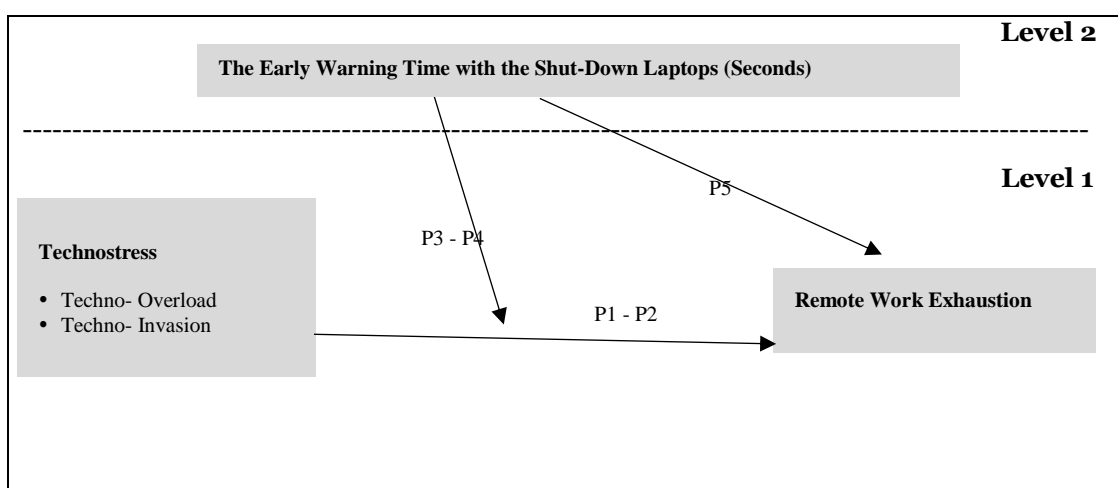


Figure 1: Research Model

Source: This study.

Proposition 1: Techno-overload is positively related to remote work exhaustion.

During the pandemic, remote workers encountered an elevated risk of exhaustion due to extended working hours and blurred boundaries between work and personal life (Routley; Toniolo-Barrios & Pitt, 2021). While remote work boasts advantages like flexibility and reduced commuting, it also brings about the feeling of being in a perpetual "always on" state (Rudnicka et al., 2020; Shreedhar et al., 2022). This continuous engagement can take a toll on both mental and physical energy (Adisa et al., 2023).

Research has shown a positive correlation between techno-overload and burnout among employees (Srivastava et al., 2015). This finding corroborates the notion that excessive technology usage can amplify burnout and exhaustion, particularly in remote work setups. Also, employees exposed to an overload of technology, such as excessive emails or videoconferencing, are at an elevated risk of experiencing burnout (Bregenzer & Jimenez, 2021; Luce, 2019). Consequently, organizations need to be vigilant about the extent of technology exposure to avert adverse outcomes like burnout and exhaustion.

Additionally, the excessive utilization of technology has been associated with heightened stress levels and diminished job satisfaction in employees (Ingusci et al., 2021; Lai et al., 2015). This insight underscores the importance of organizations being mindful of the quantity of technology exposure. Failing to do so may lead to unfavorable consequences like burnout and exhaustion (Ravindran et al., 2014; Smith et al., 1999).

In conclusion, techno-overload poses a significant risk to remote work, resulting in exhaustion and diminished productivity. It is imperative for organizations to be cognizant of the extent of technology exposure employees face. By proactively managing technology usage, organizations can effectively prevent unfavorable outcomes such as exhaustion and burnout.

Proposition 2: Techno-invasion is positively related to remote work exhaustion.

Technology invasion refers to the widespread use of technology, particularly digital communication tools and remote work platforms, to permeate traditional workplace boundaries and alter work practices (Lythreathis et al., 2022). In the context of remote work, technology invasion signifies the increasing reliance on technology to enable remote work and blurring the lines between work and personal life, as workers are more interconnected and accessible than ever before (Molino et al., 2020). Technology invasion has a range of effects on remote workers, including enhancing flexibility and productivity but potentially posing risks to mental health and work-life balance (Currie & Eveline, 2011). Importantly, technology invasion is positively correlated with remote work fatigue (Montreuil et al., 2022). A study found that employees who reported higher levels of technology invasion, such as frequent technological disruptions and a deluge of emails, often experienced heightened emotional exhaustion and decreased job satisfaction (Rohwer et al., 2022). Many remote workers report feeling exhausted, with maintaining constant connectivity often cited as a primary source of stress (Van Zoonen & Sivunen, 2022).

Proposition 3: The early warning time with the shut-down laptops (Seconds) could moderate the effects between techno-overload and remote work exhaustion.

Technology overload refers to the feeling of being overwhelmed by a constant influx of information and notifications (Molino et al., 2020; Sbaffi et al., 2020). For employees who receive a warning before their computer is about to shut down, they are more likely to save their work and exit programs, thus reducing the risk of data loss and frustration (Neumann, 1994). Additionally, due to the shift towards remote work brought about by the pandemic, the problem of technological overload has become increasingly severe, as individuals struggle to manage the continuous stream of information and communication resulting from virtual collaboration (Williamson et al., 2020). Therefore, providing a warning time when shutting down a laptop can assist individuals in better managing their workload, mitigating the effects of technology overload and remote work exhaustion, ultimately improving their mental and emotional well-being (Mordi et al., 2023). Through the use of early warning mechanisms, one can consciously allocate fixed periods to handle messages, reducing the need for immediate responses.

Proposition 4: The early warning time with the shut-down laptops (Seconds) could moderate the effects between techno-invasion and remote work exhaustion.

Techno-invasion can be a significant source of stress for remote workers, especially when employees need to be on call and respond actively throughout the day (Borle et al., 2021; Edú-Valsania et al., 2022). This constant state of connectivity can make it challenging to power down and recharge, ultimately leading to fatigue and burnout. Workers who experience high levels of techno-invasion are more likely to exhibit symptoms of fatigue and job dissatisfaction (Edú-Valsania et al., 2022).

By setting early warning times for laptop shutdown, remote employees could mitigate the issues of continuous technological intrusion into their lives. Many remote workers struggle to disconnect from work-related technology, which can result in fatigue and other adverse outcomes (Lowy, 2020). This underscores the necessity of implementing strategies, such as setting early warning times for laptop shutdown, to assist remote workers in defining clear boundaries and managing their workload effectively (Pflügner et al., 2020).

In conclusion, setting early warning times for laptop shutdown may serve as an effective strategy to alleviate the negative impact of techno-invasion and mitigate remote work exhaustion.

Proposition 5: The early warning time with the shut-down laptops (Seconds) is negatively related to remote work exhaustion.

Remote work exhaustion is an increasingly concerning issue for many organizations, as remote employees often find it challenging to disengage from work-related technology and establish clear boundaries between work and personal life (Eddleston & Mulki, 2017; Feldmann, 2022). This can lead to exhaustion and fatigue, negatively impacting both job performance and personal well-being (Costin et al., 2023). Remote work can result in extended working hours, increased stress, and overwhelming fatigue (Schreibauer et al., 2020). By setting alerts for laptop shutdown, remote workers can prioritize their personal lives and recharge, thereby reducing the negative impacts of remote work and preventing burnout (Talent, 2023).

Setting clear boundaries between work and personal life can help remote workers disengage from work and recharge (Park et al., 2011). By setting alerts for laptop shutdown, remote workers can detach from work-related technology and focus on other aspects of life, such as family, friends, and hobbies. In conclusion, there is a negative correlation between laptop shutdown alerts and remote work fatigue. The authors argue that laptop shutdown alerts are defined as the time when computer systems emit warning notifications and prepare to shut down the laptop when employees are engaged in remote work. The authors believe that setting alerts through technological configurations on computer systems to issue warnings at specific times will proactively mitigate or minimize the negative effects of ICT intrusion on remote exhaustion. This suggests that the regular display of overtime notifications will maximize the reduction of ICT intrusion's negative impact on remote exhaustion. Due to the lack of physical interaction with colleagues during remote work, the authors suggest that employees may remain glued to the computer interface (e.g., online shopping or work tasks). In such cases, the longer the computer system is in use, the higher the level of technological stress. Subsequently, this can lead to significant remote work fatigue. It is important to emphasize that employees can obtain overtime information through alert settings, regardless of whether they decide to immediately disengage from IT devices.

PRATICAL DESIGN

The authors have designed a practical solution to automatically initiate a shutdown on employee computers by utilizing the Windows Task Scheduler (Figure 2 ~ Figure 10). This system functions by executing the command 'shutdown -s -t 100' to initiate

an automatic shutdown after a brief 100-second interval. While this may be an effective approach to ensuring employees adhere to rest schedules, the authors posit that increasing the duration of the warning period could be a more advantageous alternative. By extending the warning period, employees would have more time to effectively prepare for rest, such as saving their work or making note of important deadlines before their computer shuts down. Furthermore, increasing the warning time can help mitigate the stress and anxiety caused by abrupt shutdowns, thereby promoting a more relaxed and productive work environment. Overall, while the current notification system is a functional step toward promoting adequate rest for employees, increasing the warning time is a more effective solution to ensure employees have sufficient time to prepare for rest. Figure 2 provides a clear depiction of the implementation of an early warning system within a computing environment.



Figure 2: Task Scheduler

Figure 3 provides a concise depiction of the steps required to enable a warning time announcement within the computing environment.

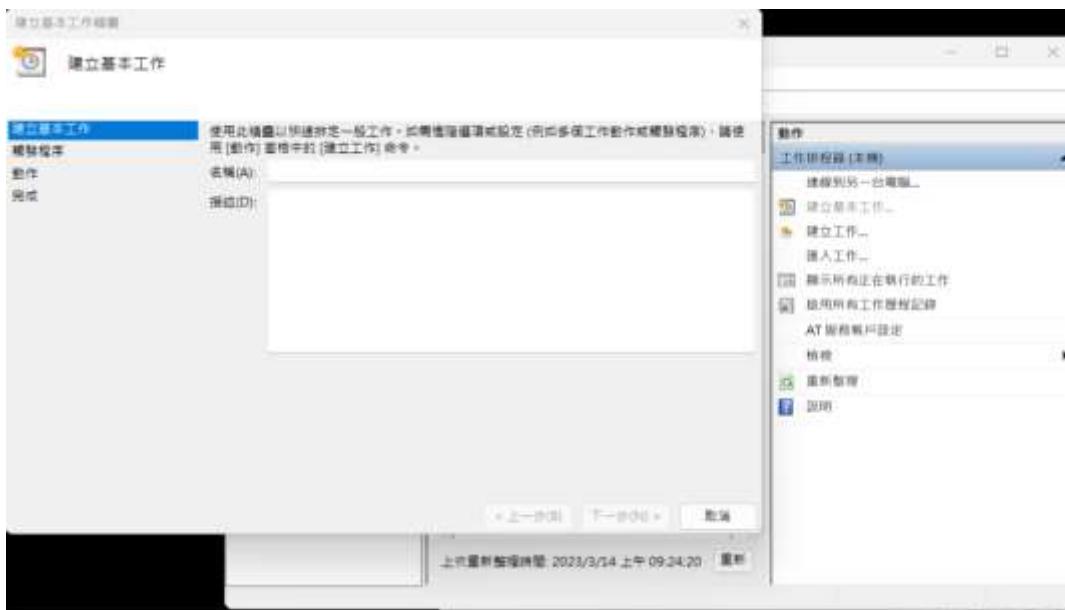


Figure 3: Prepare Schedule

Figure 4 provides a clear depiction of the announcement of the early warning system. This announcement is a crucial aspect of the early warning system as it informs users of impending system shutdowns, enabling them to save their work and take necessary measures to minimize the impact of the shutdown.

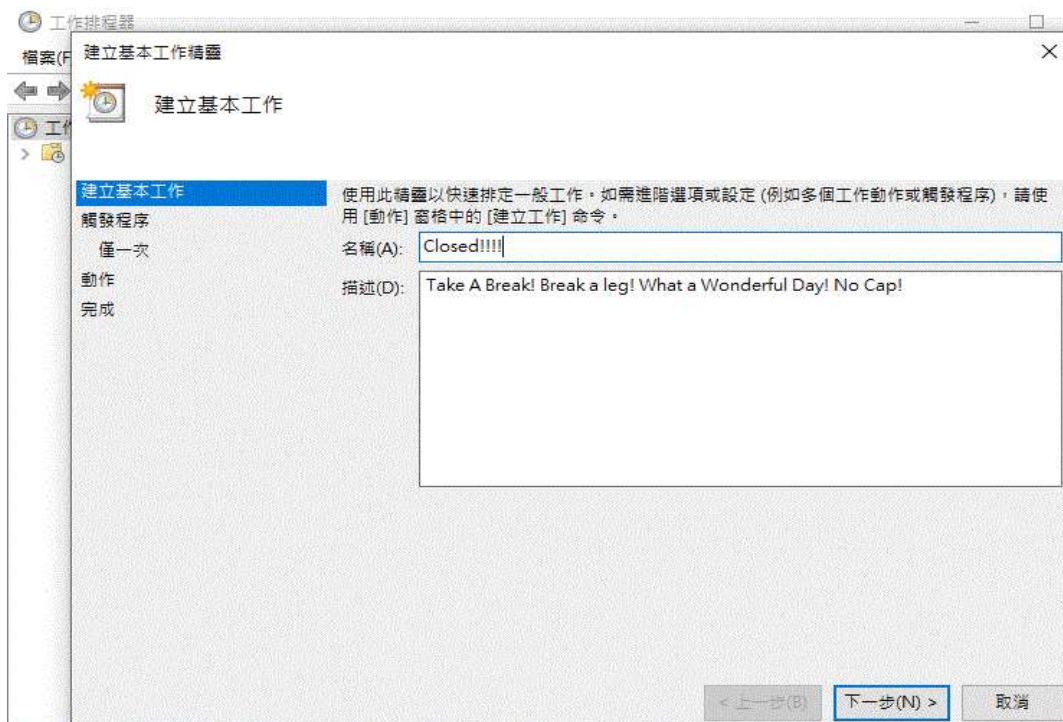


Figure 4: Set Schedule

Figure 5 provides a clear depiction of the number of early warning system activations. This information can be used by system administrators and users to gain insights into the frequency and timing of system shutdowns and take appropriate measures to minimize their impact. Figure 6 depicts the versatility of the early warning system, highlighting that it can be configured according to the day, week, month, and working time of remote users. This level of customization enables companies to tailor the system settings to the unique needs of their workforce, thereby ensuring that users receive timely notifications of impending system shutdowns.

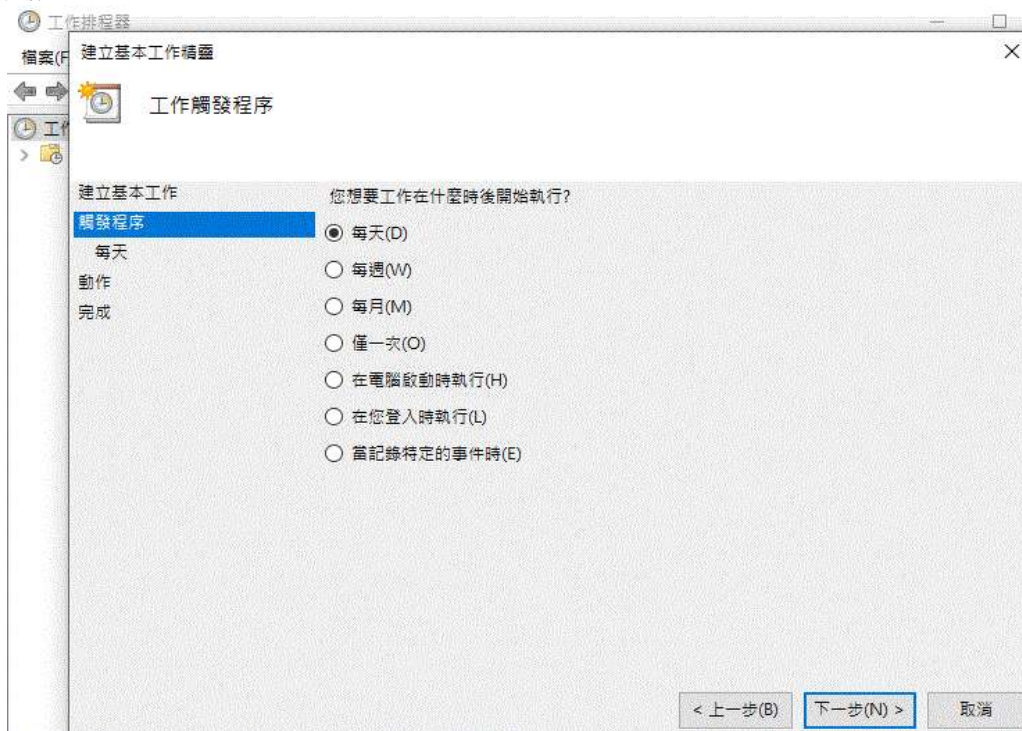


Figure 5: Set the start Time of the Early Warning Mechanism-1

Figure 6 depicts this relationship and emphasizes the importance of ensuring that the early warning system is activated at an appropriate time to ensure that users receive timely notifications in the event of system shutdowns.

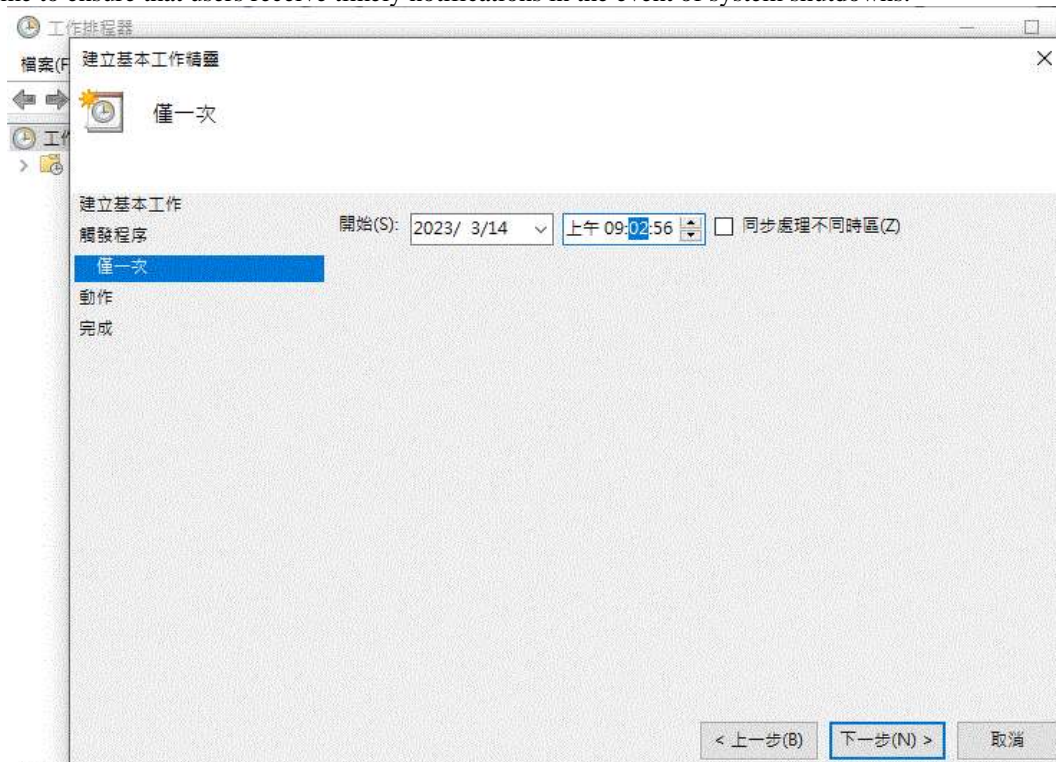


Figure 6: Set the start Time of the Early Warning Mechanism-2

Figure 7 illustrates the process of activating the early warning system by selecting the “Start Program” option.

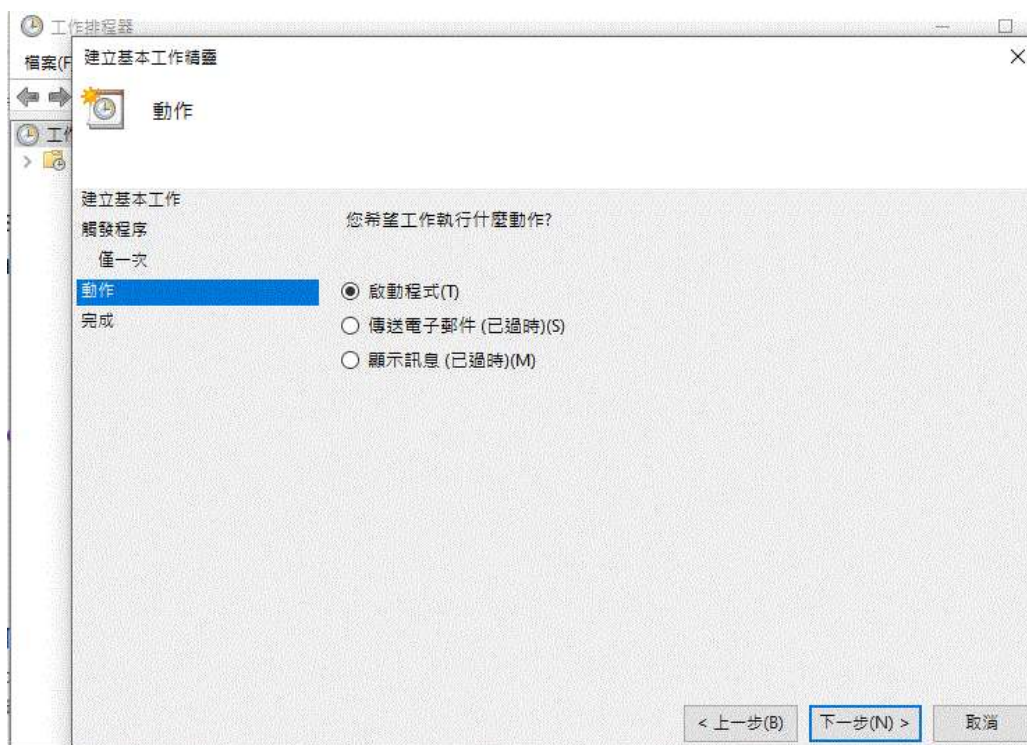


Figure 7: Activate the Schedule

Figure 8 reveal that the warning mechanism has been configured to operate for a duration of 100 seconds. This duration can be activated by executing the "**shutdown -s -t ()**" command, whereby the user specifies the desired time interval in seconds using the parameter within the parenthesis. This configuration allows users to effectively manage the system's shutdown process, thus ensuring that the shutdown operation is carried out in a controlled and orderly manner.

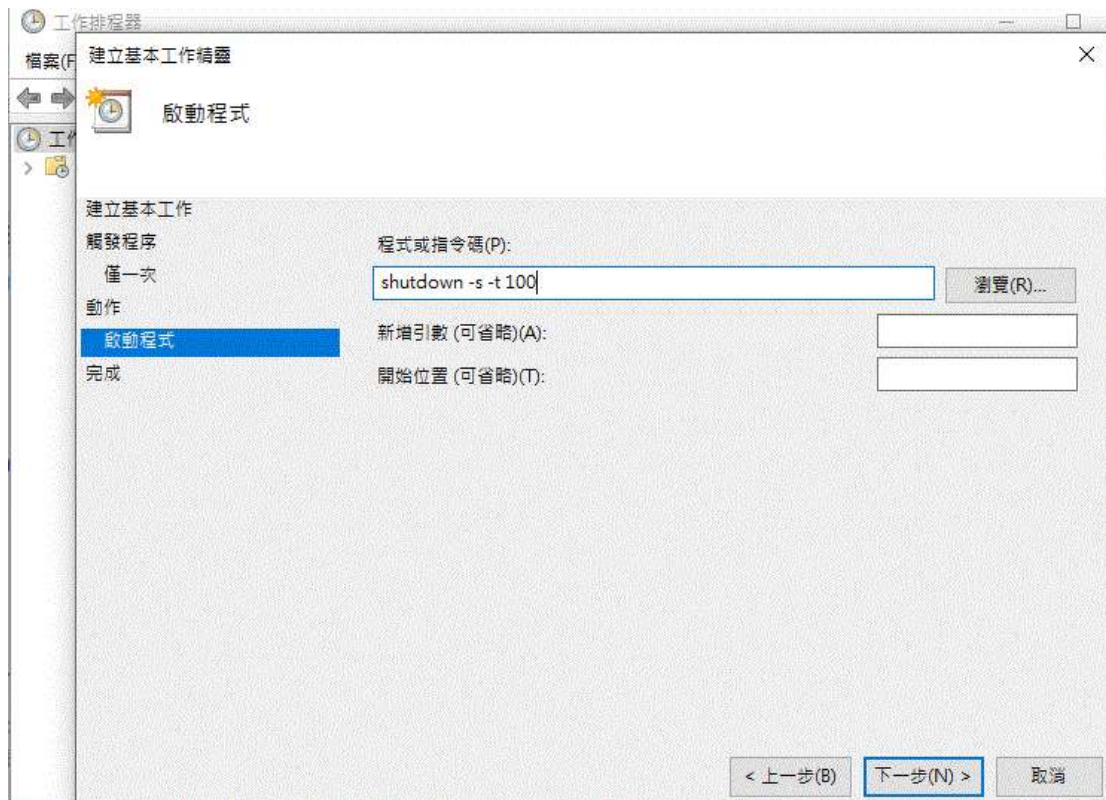


Figure 8: Set the Time Duration of the Warning System

Figure 9 illustrates the graphical user interface (GUI) used by organizations and individuals to configure the early warning mechanism for their employees' computers. This interface enables users to tailor the early warning system to the specific needs of their employees/firms, ensuring that they receive timely alerts before any impending system shutdowns.

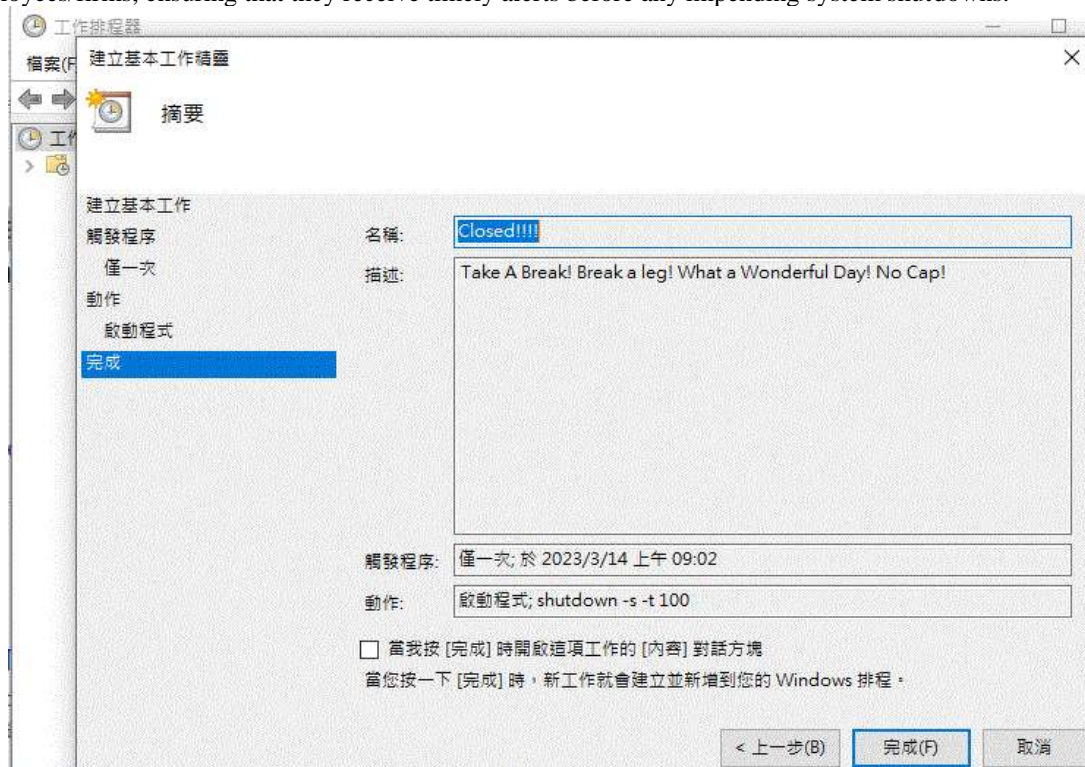


Figure 9: Set the Time Duration of the Warning System

Figure 10 provides a clear depiction of the interface encountered by a teleworker using the early warning system during office work. This figure highlights the importance of setting appropriate warning times to effectively relieve the technological pressure experienced by remote workers. The depiction of the warning system interface in Figure 10 serves as a useful reference for system administrators seeking to optimize the effectiveness of the early warning system and enhance the well-being of remote workers.

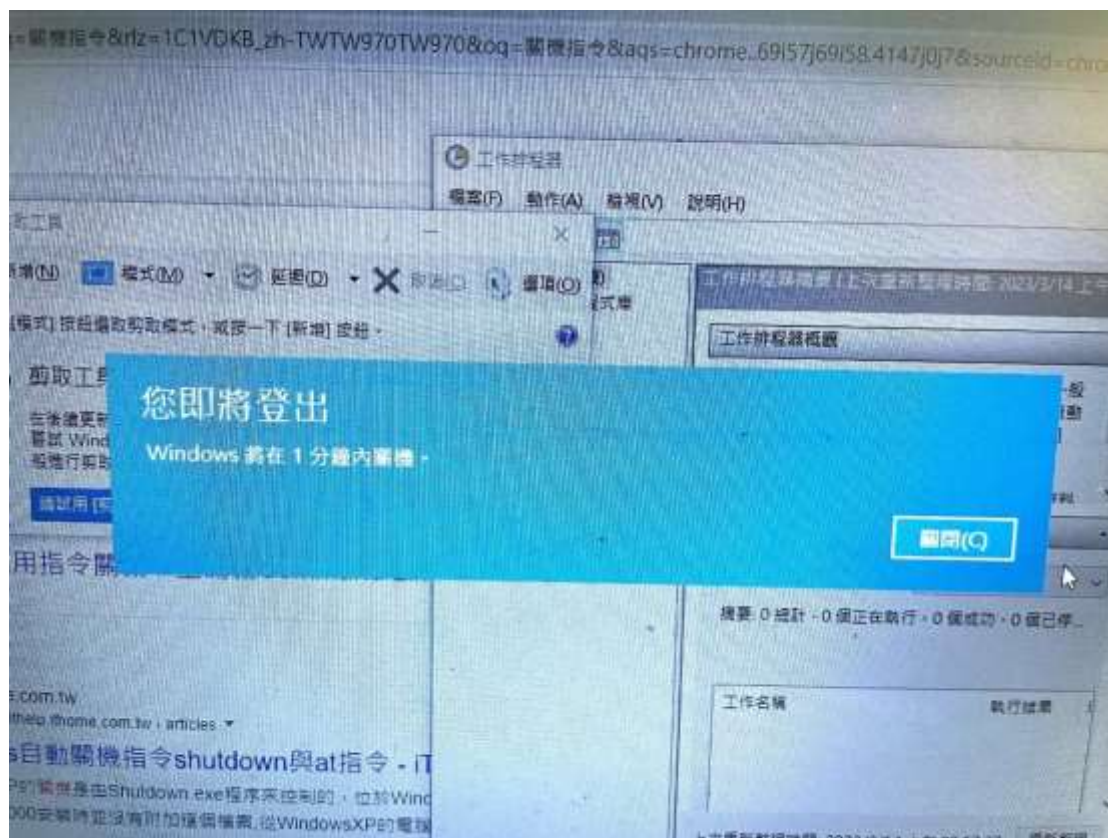


Figure 10: Actual Early Warning Mechanism

CONCLUSIONS

The primary objective of this study is to introduce an innovative model designed to provide a comprehensive approach for addressing technostress and effectively mitigating its impact. To achieve this, a thorough literature review was conducted, aiding in the conceptual development of this paper. The review of existing contributions revealed that technostress mitigation has historically been approached through two main avenues: human-oriented strategies (Tindle et al., 2022) and technology-mediated interventions (Brivio et al., 2018).

Human-oriented strategies encompass various aspects such as social support, personality traits, cultivating a positive attitude, active participation, and engaging in spoken venting (Weinert et al., 2020). These mechanisms recognize the essential role of human interactions and psychological factors in managing technostress. On the other hand, technology-mediated interventions involve strategies like IT control, maintaining a physical and psychological distance from technology, and method control. These approaches acknowledge the potential of technological tools to regulate and alleviate technostress.

Theoretical perspectives from scholars like Matthieu and Ivanoff (2006) characterize stress as the point at which an individual's personal perception of strain reaches a threshold level (Matthieu & Ivanoff, 2006). This notion suggests that individuals take action or communicate distress signals when their stressors exceed this threshold. Notably, the remote work environment often fosters isolation, hindering effective communication of technostress. This is particularly relevant in the context of the COVID-19 pandemic, where information and communication technologies (ICT) have become integral to various aspects of life, including remote work interfaces and communication devices like phones.

In light of these considerations, the severity of technostress has become particularly pronounced during the pandemic era, where ICT has pervaded every facet of daily life. The inevitability of relying on these technologies is evident. Despite attempts to distance oneself from them, previous research highlights that complete mitigation of technostress through IT distancing is not always feasible (Salo et al., 2022). Even when individuals endeavor to distance themselves from technology, negative technostress may persist. Thus, a more direct approach involving the shutdown of IT devices, such as laptops, becomes necessary.

This approach circumvents the potential challenges posed by personal technology addiction and willpower limitations. Interestingly, a prevalent characteristic observed among remote employees is the constant influx of online messages coupled with the simultaneous completion of tasks. Abruptly shutting down an IT device in such scenarios can evoke feelings of annoyance among remote employees. To address this, a novel and balanced mechanism is proposed, allowing remote employees a designated period to prepare for the planned shutdown of their IT devices. This thoughtful approach ensures that individuals have sufficient time to transition and minimizes the disruption caused by sudden shutdowns.

The implications of this novel approach are substantial. Beyond its immediate application, it holds promise for shaping the future of remote work systems and influencing product design strategies for manufacturers. Moreover, it underscores the potential for organizations to take a proactive role in safeguarding the well-being of remote employees. By integrating such mechanisms, firms can demonstrate their commitment to managing employee health and enhancing the overall work experience.

In conclusion, this study not only sheds light on the multifaceted nature of technostress and its management but also introduces an innovative solution tailored to the unique challenges of the remote work landscape, especially in the context of heightened ICT reliance during the COVID-19 pandemic. The proposed mechanism not only benefits individuals but also presents opportunities for organizations to refine their approach to remote work and employee well-being.

LIMITATIONS AND FUTURE RESEARCH

This study includes several limitations, which in turn creates avenues for future studies. First, the authors proposed an innovative idea, but it is unclear how much the effectiveness of the warning mechanism affects the mitigating effects between technostress and work exhaustion. Future scholars might examine this conceptual model by empirical analysis. Second, there is limited mitigation of remote work studies to identify the factors. Consequently, future scholars might offer various insights for effective technostress mitigation for remote work exhaustion.

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