UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING THE EFFECT OF TECHNOSTRESS ON STUDENTS' ACADEMIC PRODUCTIVITY IN SELECTED UNIVERSITY IN CENTRAL REGION

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DECLARATION

STUDENT'S DECLARATION

I, **ERNEST SITSOFE KOFI MATTIE**, declare that this Thesis, except quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my original work, and it has not been submitted, either in part or whole for another degree elsewhere.

SIGNATURE……………………………………………………………………

DATE………………………………………………………………………………..

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work were supervised per the guidelines for supervision of the thesis as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR……………………………………………………….

SIGNATURE……………………………………………………………………

DATE………………………………………………………………………………..

DEDICATION

I dedicate this research work to my father, Peter Kudjo Mattie, and my mother, Gladys Akuvi Adipah, and most importantly to my brother, Prince Yayrah Mattie. Thank you for the love and support.

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Special thanks to the Almighty God for protection, guidance, preservation, strength, and provision granted me throughout the beginning and completion of my education and this research work.

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May God richly bless you all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

In the first quarter of 2020, the COVID-19 pandemic struck numerous countries around the world, including Ghana. To prevent the virus from spreading, the Ghanaian government ordered universities to close, although most had only recently begun the academic year. Despite its benefits for both students and academic faculty, the use of Emergency Remote Teaching (ERT) had negative consequences, such as technostress. The study examined the effect of technostress on students' academic productivity in UEW during the COVID-19 pandemic. The descriptive correlational study method was used to discern the prevalence of technology-induced stress among university students in UEW. 385 respondents participated in the study, and they were recruited using the non-probability convenience sampling technique. A structured questionnaire was used to collect primary data. SPSS and SmartPLS software were used to analyze the data. The study found technostress to be prevalent among students of UEW, but the level was moderate. Also, based on the demographic characteristics, results showed that students experienced the same levels of technostress. Finally, Technostress was found to have no negative impact on students' academic productivity. In conclusion, the study recommended that the university should take a keen interest in finding students who may be severely stressed because of ICT, and help them improve their ICT skills so that technostress and its effects can be reduced to its barest minimum among students.

CHAPTER 1

INTRODUCTION

1.0 Overview

This chapter focuses on the following topics: background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, scope and delimitation, and definition of key terms.

1.1 Background to the Study

Many governments across the world have ordered the closure of all educational institutions as COVID-19, a novel coronavirus disease spreads around the world. As a result, educational institutions have stopped operating because they had to shield their students from the widespread infection of the virus, which can spread very fast among a social student population (Crawford et al., 2020; Day, 2020; Ebrahim, 2020; Kokutse, 2020; Muthuprasad et al., 2021; Quinn, 2020). To prevent the pandemic's detrimental effects on education, governments across the world have launched a crisis response initiative (Agormedah et al., 2020). The crisis response initiative included making modifications to the schools' academic calendar and curricula, providing both physical and technological resources, and setting guidelines for how education should be delivered and assessed (Ebrahim, 2020; Muthuprasad et al., 2021). Schools in the Philippines were compelled to integrate online learning at all grade levels to make schooling flexible (Cacho et al., 2022).

Schools, colleges and universities in China were closed at the beginning of February 2020 owing to the spreading contamination (Agormedah et al., 2020). Later, nearly 75 countries announced the closure of all educational institutions by mid-March, and this forced one in every five students out of school (Muthuprasad et al., 2021). In the latter part of April 2020, 191 nations had imposed nationwide lockdowns and closed educational institutions, which affected over 80 per cent of all students admitted to school across the world because they were not attending school (Agormedah et al., 2020; Crawford et al., 2020; Day, 2020; Ebrahim, 2020; Kokutse, 2020; Muthuprasad et al., 2021; Quinn, 2020; UNESCO, 2020d, 2020b; UNICEF, 2020). Although the closure of educational institutions has tremendously impacted the vast number of students (UNESCO, 2020d, 2020b), implementing lockdowns and social or physical distancing were the only proven and effective measures that can break the chain of transmission of the COVID-19 virus (Huzar, 2020; Muthuprasad et al., 2021; World Health Organization, 2020c, 2020a, 2020b).

Ghana is among the countries in the world afflicted by the Coronavirus disease, and the government has taken pragmatic measures, locking down certain cities that have recorded cases of the disease. This is to prevent the virus from spreading further. In addition to the lockdown, the government also authorized all schools to be closed until further notice (Essel et al., 2021). Amid the profound paradigm shift, the government enacted a slew of emergency measures, including making it easier for universities to access remote teaching (Molino et al., 2020). The universities had to figure out how to keep teaching and learning going while at the same time adhering to government directives (Essel et al., 2021). This made students and educational institutions explore various ways to complete their mandated syllabi within the time window set by the academic calendar (Muthuprasad et al., 2021).

As a result, the universities in Ghana have had to improvise alternate ways of teaching, such as emergency remote teaching (ERT), which in the event of a crisis, is a brief change in instructional delivery to a different medium such as online (Essel et al., 2021; Hodges et al., 2020; Mohmmed et al., 2020). According to Muthuprasad et al. (2021), even though the measures put in place by governments across the world, have caused some inconveniences for educational institutions, they have also inspired new instances of educational innovation by using digital technology. They believe that the situation is a silver lining on a gloom cloud because the pandemic has prompted educational institutions throughout the world to explore innovative techniques in a very short time, accelerating information technology use in education.

Emergency remote teaching (ERT) entails the use of entirely remote teaching solutions for instruction or education that would ordinarily be offered face-to-face or as blended or hybrid courses, to return to that format after the crisis or emergency has passed (Hodges et al., 2020). However, some scholars have made a distinction between ERT and online learning, because they believe that the major goal of ERT is to give temporary access to teaching and instructional aids in a way that is easy to put up and reliable during an emergency or crisis, rather than to re-create a comprehensive educational environment that provides high-quality online learning (Hodges et al., 2020; Penado-Abilleira et al., 2021). ERT according to Sangrà et al. (2012) varies significantly from online learning, in that it reflects an unanticipated and abrupt transition from traditional brick-and-mortar classes to a distance system of education (Aguliera & Nightengale-Lee, 2020; Essel et al., 2021). Even though it was not widely used in Ghanaian institutions before the COVID-19 lockdown, ERT has shown to be a necessary and popular alternative (Essel et al., 2020).

During the pandemic, ERT adoption dramatically boosted the use of information and communication technologies (ICTs) in modern education around the world, setting ICT usage as the standard (Upadhyaya & Vrinda, 2021). Ghanaian universities took a hybrid approach, but despite this approach, many of the universities lack explicit rules for implementing and managing online instruction (Essel et al., 2021; Henderson et al., 2015; Higgins et al., 2012). Even though universities and students faced numerous challenges with online learning, it was considered the best alternative. This is because, according to Hodges et al. (2020), since the universities have been faced with a rapidly expanding and widely dispersed public health emergency, the only way they can keep teaching and learning going while at the same time keeping their employees and students safe is to resort to online platforms.

The shift from in-person teaching to ERT saturated the learning environment with innovative digital technologies such as intelligent tutoring systems (ITS), learning analytics, and a variety of learning applications that supported distance and blended learning, but these technologies were new and unfamiliar to most students (Cho & Byun, 2017; Essel et al., 2021; McGuinness & Vlachopoulos, 2019; Nistor & Hernández-Garcíac, 2018). For instance, through the ITS, online learning became feasible for universities to make high-quality curricular resources available to students to study at home. Also, the ITS served as a platform-based application where academics can instruct without in-person instruction (Cao et al., 2021). Zoom, University Learning Management System (LMS), Microsoft Teams, Blackboard, Google Meet, and Google Classroom were the popular and frequently used e-learning platforms among the various computer and web-based applications that were used in universities to support teaching and learning during the pandemic (Fuady et al., 2021; Muthuprasad et al., 2021; Pallathadka, 2020).

Regardless, ICTs assist students by improving performance, saving institutional resources and time, increasing student happiness (Barbuto et al., 2020; Thulin et al., 2019), providing convenience, and flexibility, and extending access to high-quality learning support (Wang et al., 2020). As a result of ICTs, distance and time are no longer barriers, allowing educators and students to save on travel time, avoid wasting resources, and most importantly avoid the potential risk of contracting the COVID-19 disease (Cao et al., 2021). Universities may use ICT to improve institutional management, promote transparency, and speed up the processing of academic data for students (Upadhyaya & Vrinda, 2021; Vlachopoulos & Makri, 2021). The students' learning processes are thought to be aided by these advantages (Mirzajani et al., 2016). Furthermore, students are often enthusiastic about incorporating ICT into the teaching and learning process (Vahedi et al., 2021), and this is because, one of the most widely used platforms during the pandemic, the Zoom Meeting application, Purwati and Khairunisa (2022) found that students had a positive perception about using the app for online learning, and they stated that their knowledge and understanding of using ICT for educational purposes has improved.

While the importance of using ICT cannot be denied, however, there is a rising worry about the harmful impact of technology on students (Essel et al., 2021). Technology can induce stress in its users (Ayyagari et al., 2011; Brod, 1984; Ragu-Nathan et al., 2008; Salanova et al., 2013), and university students may be more susceptible to technology-induced stress due to the increasing use of sophisticated technology in education (Ayyagari et al., 2011; Ragu-Nathan et al., 2008; Salanova et al., 2013; Salem, 2018). ICTs have a dark side, but because it is widely assumed that university students are tech-savvy and unaffected by technology-induced stress, their psychological and cognitive responses to new applications, features, and workflows are overlooked (Qi, 2019; Ragu-Nathan et al., 2008). Due to changed conditions and expectations, requests for more time and effort, time management biases, and an expanded call for more self-regulated learning (Jung, 2013; Qi, 2019), students may experience negative consequences or have anticipated interactions with ICTs (Korunka et al., 1997). The term 'technostress' was used to describe the stress or negative feeling caused by ICT (Ayyagari et al., 2011; Brod, 1984; Essel et al., 2021; Ragu-Nathan et al., 2008; Salanova et al., 2013).

Technostress is an inverse psychological condition linked to the use or potential threat of ICTs, characterized by a sense of an imbalance between resources and demands associated with ICT use, resulting in increased psychophysiological activation and the development of negative attitudes toward ICTs (Salanova, 2003). It is also referred to as an adaptable problem caused by students' incapacity to deal well with growing digital technology (Ayyagari et al., 2011; Brod, 1984; Penado-Abilleira et al., 2020), or a maladaptation situation created by students' lack of ability to survive in a constantly changing technological world (Jena, 2015; Ragu-Nathan et al., 2008). As a result, technostress develops when ICT core competencies required in an institution exceed students' level of knowledge in ICT, or when technological expectations exceed students' capabilities or capacity to meet them (Fischer & Riedl, 2017; Galluch et al., 2015; Penado-Abilleira et al., 2020; Srivastava et al., 2015). Aside from that, Ayyagari et al. (2011) identified usability, intrusiveness, and dynamism, as the three technological traits linked to workplace stress.

Technostress should not be underestimated because it has social, psychological, economic, and physiological consequences. The psychological effects on students may lead to a fall in academic performance, and this aversion may stand in the way of their academic achievement (Hung et al., 2011, 2015; Lee et al., 2016; Salem, 2018; Tarafdar et al., 2015). A recent study of the phenomenon by Upadhyaya and Vrinda (2021) among private university students in India showed that technostress influenced students' academic productivity negatively. Another study of technostress among postgraduate students in a management university in India by Sethi et al. (2021) also showed that technostress and academic productivity are inversely related, therefore technostress negatively affects academic productivity. The study by Essel et al. (2021) concluded that technostress has adverse effects on academic achievement and academic productivity. The psychological barrier to using computer technology induced by technostress might inhibit one from further learning (Wang et al., 2008).

Technostress as described by Brod (1984), causes people to feel anxious, reluctant, and even afraid of using ICT. Amin et al. (2012) found that modern technologies cause technology-related stress, which in effect causes anxiety and trauma in those who use it. Nightmares, headaches, and irritation are all symptoms and physiological effects of technostress when using ICT or completely refusing to use any form of ICT (Salem, 2018). The effects of technostress on people who use ICT are far-reaching, hence it is frequently necessary to explore the negative sides of technology, such as technology-induced stress, which can have a detrimental impact on performance and productivity (Hung et al., 2011, 2015; Lee et al., 2016; Tarafdar et al., 2015).

1.2 Statement of the Problem

After the invention of computers, gradually they made their way into businesses and organizations, changing the way employees work and feel about their job (Brod, 1984). Organizations that were concerned about improving employees' productivity adopted and idolized computer usage because of computers' capacity for speed, accuracy and efficiency (Brod, 1984). Later, researchers like Craig Brod developed a keen interest in examining the computer revolution happening within organizations. Brod (1984) discovered that employees experienced stress induced by computers, which he termed 'technostress'. Employees felt fear and anxiety, endless hours of tension, and difficulty in maintaining personal relationships when attempting to manage and master computers effectively.

The educational sector over the years also has seen increasing use of information communication technologies (ICTs) (Oliver, 2002; Shu et al., 2011). Higher institutions of learning were gradually digitalizing and incorporating ICTs use into education (Qi, 2019). Because ICTs can defy barriers such as time and distance (Cao et al., 2021; Upadhyaya & Vrinda, 2021), higher educational institutions perceived an opportunity and took ample time to carefully design and roll out online education for people who for some reason cannot take up courses that are offered face-to-face on campus, especially distance education targeted at people who are working and willing to school at the same time (Falvo & Johnson, 2007). But the situation during the COVID-19 pandemic is alarming and raises concerns about using ICTs for online learning (Essel et al., 2020). The online learning approach is the only option for universities to continue teaching and learning (Hodges et al., 2020), and suddenly, the universities had to migrate all teaching and learning activities online to reduce the spread of the COVID-19 virus (Essel et al., 2021). Due to that, all kinds of new ICTs flooded the learning space, causing ICT adoption in education to reach its highest peak (Upadhyaya & Vrinda, 2021).

The problem is that the increasing level of digitalization experienced in higher education during the COVID-19 necessitated the use of several ICTs (Essel et al., 2021); nonetheless, research has shown that ICTs can induce stress in its users (Ayyagari et al., 2011; Brod, 1984; Fitzgerald, 2021; Ragu-Nathan et al., 2008; Salanova et al., 2013; Tarafdar et al., 2007), negatively affecting their physical and mental health (Adam et al., 2017; Wang et al., 2008), as well as their productivity (Tarafdar et al., 2007). Technology-induced stress among students can lead to decreased learning commitment, burnout, deficient performance, and plans to stop using technology (Jena, 2015; Qi, 2019; Salanova et al., 2013). Several studies (Adam et al., 2017; Ayyagari et al., 2011; Galluch et al., 2015; Ragu-Nathan et al., 2008; Salanova et al., 2013; Tarafdar et al., 2013; Tu, 2008; Weinert et al., 2013) were conducted in the organizational setting, and very few studies (Essel et al., 2021; Qi, 2019; Upadhyaya & Vrinda, 2021) have focused on examining the phenomenon in the educational environment.

These few studies that have examined the phenomenon in the educational context failed to take into account the new developments and advancements in the technology of contemporary times (Salem, 2018), especially those that emerged during the COVID-19 pandemic. Because ICT use and online learning of this magnitude have never been seen on this scale in the educational space, it is unclear how students, who are perceived to be tech-savvy, feel about the influx of new technologies, and online learning, and how that improves their performance. Therefore, this study sought to fill that gap. It is imperative to constantly examine the situation to fully comprehend the negative side of ICTs and how it affects academic productivity, hence the need to investigate technology-related stress (technostress) and students' academic productivity during the COVID-19 pandemic.

1.3 Purpose of the Study

The purpose of the study was to assess the effect of technostress on students' academic productivity in selected universities in the Central Region.

1.4 Objectives of the Study

The study objectives are:

1. To ascertain the level of technostress among students in a technology-enhanced learning environment during the COVID-19 pandemic.
2. To investigate whether there is a statistically significant difference in technostress among students based on age, gender, academic level, and knowledge in ICT.

3. To determine the extent of influence technostress has on students' academic productivity.

1.5 Research Questions

The study answered the following research questions:

1. What is the level of Technostress among students in a technology-enhanced learning environment during the COVID-19 pandemic?
2. Is there a statistically significant difference in technostress among students based on age, gender, academic level, and knowledge of ICT?
3. To what extent does technostress influence students' academic productivity?

1.6 Significance of the Study

First and foremost, this study contributed to knowledge by providing in-depth information on technostress among students, to understand how students feel about online learning, and how that experience has impacted their academic productivity. Secondly, the management of the University of Education, Winneba (UEW) can rely on the findings of the study to make decisions on how best to implement online learning, and find ways to mitigate the negative consequences of using ICT in education among students, to improve their academic performance. Lastly, the findings of the study may play a significant role in helping the management of UEW to select the online learning environment that will best support successful learning.

1.7 Scope and Delimitation

The study was situated in the Central Region of Ghana, West Africa and involved full-time regular undergraduate and master students of the University of Education, Winneba (UEW), who were located on the three campuses in Winneba. UEW is located in a town called Winneba, in the Effutu Municipality, in the Central Region. The University has two main campuses: Winneba and Ajumako. The Winneba campus is divided into three campuses: the North, South, and Central. The study covered students studying on the Winneba campus only. The key reason for conducting this study at UEW has to do with, as part of the measures to control the spread of the COVID-19 virus, the Management of UEW issued a directive to use the blended or hybrid approach (face-to-face and online modes), and made it the dominant approach for all teaching and learning activities during the 2020/2021 academic year. The University's LMS and other online platforms were adopted for the online learning experience. Throughout the academic year, some mid-semester and end-of-semester exams were taken online. Such a situation made the researcher choose students of UEW because the prevailing condition makes it appropriate to study the variables under consideration.

Also, in terms of the variables, the study only investigated two variables: technostress and academic productivity. The survey questionnaire collected data only on students' demographics (age, gender, academic level and knowledge in ICT), technostress and academic productivity.

1.8 Organisation of the Study

The study is organised into five chapters. The first chapter is the introduction. It comprises the background of the study, statement of the problem, the purpose of the study, objectives of the study, the significance of the study, delimitation, organization of the study, and definition of terms. The second chapter is a review of related literature. The third chapter considers the methodology, and it discusses among others: the research philosophy, research approach, research design, population, sample size and sampling technique, instrument, reliability and validity of the instrument, data analysis, and ethical issues. The penultimate chapter is concerned with the presentation of results and discussion of findings whilst the final chapter summarized the findings and drew a conclusion, the managerial implications and limitations of the study, and lastly suggests areas for further research.

1.9 Definition of Terms

Technostress: It refers to "the problem of adaptation that an individual experiences when he or she is unable to cope with or get used to, ICTs" (Tarafdar et al., 2007, p. 304). Another definition states that it is one's discomfort, fear, tenseness, and anxiety when learning through computer technology or ICT, ultimately leading to psychological and emotional problems (Berg-Beckhoff et al., 2017; Shu et al., 2011; Wang et al., 2008).

Technostress creators/stressors: They are the factors responsible for creating technostress in the organization (Ragu-Nathan et al., 2008). According to Tarafdar et al. (2007), five (5) factors relating to technologies or ICTs can induce stress in an individual: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty.

COVID-19: The novel coronavirus disease-2019, later designated as COVID-19 by the World Health Organization (WHO), is an infectious illness that affects the respiratory system of humans, and it is caused by a virus named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (Lai et al., 2020).

Academic productivity: It is defined as an increase in student academic output due to the use of technology (Upadhyaya & Vrinda, 2021).

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter carefully reviewed related literature to contextualise and explain the study problem taken into consideration in this study. Because the literature on technostress in the educational setting is limited, the study drew literature from research carried out in various disciplines such as psychology, administration and information systems, to understand the phenomenon among students forced to use ICT for learning due to the pandemic. The literature in this chapter is reviewed thematically, and to present a clearer understanding of the situation, the chapter started by explaining what is meant by stress and technology-related stress, the features of ICTs capable of inducing stress, how stress is induced, and empirical findings of past research relevant to the study.

2.1 Underpinning Theory

2.1.1 Transactional model of stress and coping

Based on several empirical investigations by Richard Lazarus at the nexus of physiology and psychology in the 1960s and 1970s, Lazarus and Folkman (1984) presented a seminal theory to explain human stress reactions. The major characteristic of this Transactional Model of Stress is that stress is not solely conceptualized as a biological phenomenon, but as a complex construct that results from the interplay between an individual and the environment (hence, the term "transactional"). In particular, the theory states that stress (1) emerges from an imbalance between demands from the environment and an individual's resources, and (2) is subject to the meaning of a stimulus to the perceiver, implying that the same stimulus may differently affect the stress of different individuals.

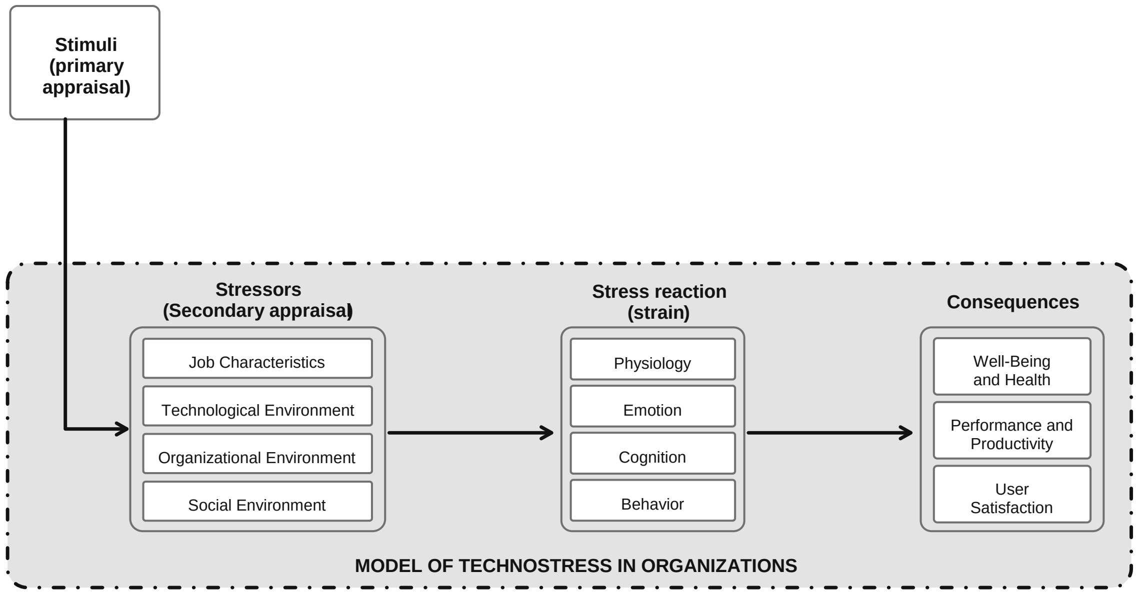


Figure 2.1: Model of technostress in organisations

Source: Adam et al. (2017)

According to the seminal stress theory by Lazarus and Folkman (1984), the underlying rationale is that when faced with stimuli (see Fig. 2.1 above and Fig. 2.2 below), an individual evaluates whether they are irrelevant, benign-positive, or stressful (primary appraisal). In the latter case, another evaluation process takes place (secondary appraisal). Here, the individual assess whether he/she can cope with the stimulus (stressor) by using the available resources (e.g., institutional, personal, and social). Two outcomes are possible: the resources are either sufficient or they are not. In the latter case, stress reactions are possible on four levels: physiology, emotion, cognition, and behaviour. Next, to mitigate these stress reactions, an individual applies different coping strategies, which can be either problem-focused or emotion-focused (Hudiburg & Necessary, 1996; Lazarus & Folkman, 1984). The former strategy has the goal to actively change the person-environment realities related to a stressful situation (e.g., by increasing the amount or quality of resources), while the latter seeks to reduce negative feelings by changing the primary and/or secondary appraisal of a given stressful situation.

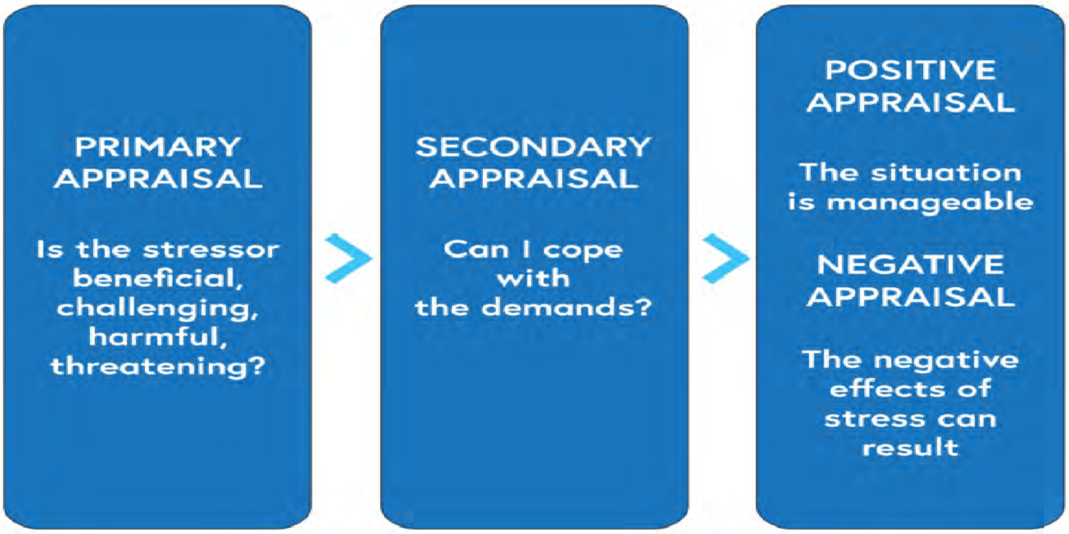


Figure 2.2: Transactional model of stress and coping

Applying the rationale of the Transactional Model of Stress in educational settings, we find that stress is generated as a dynamic process that is triggered by a set of acute and chronic stressors (i.e., stress-creating factors and conditions), and involves individual stress reactions, which, in turn, have several consequences on wellbeing and health, performance and productivity, and user satisfaction (Hancock & Warm, 1989; Lazarus & Folkman, 1984; Riedl, 2013). This dynamic process includes conscious changes in perception; however, there are also unconscious changes in body physiology that usually set in before conscious stress perception (Riedl, 2013; Tams et al., 2014). This includes, for example, the release of the stress hormones adrenaline (Johansson & Aronsson, 1984), noradrenaline (Korunka et al., 1996), and cortisol (Riedl et al., 2012) and other chemical substances related to stress such as alpha-amylase (Tams et al., 2014), as well as changes in heart rate (Trimmel et al., 2003), heart rate variability (Hjortskov et al., 2004), blood pressure (Boucsein, 2009), muscle tension (Emurian, 1993; Hazlett & Benedek, 2007), pupil dilation (Buettner et al., 2013; Partala & Surakka, 2003), and skin conductance (Léger et al., 2010; Riedl et al., 2013).

Importantly, it needs to be emphasized that there is more to the cognitive side than perception alone. Users can cognitively intervene at an earlier stage of the process. As explained by Lazarus and Folkman (1984), the elicitation of stress is subject to the users' appraisal of the overall situation, availability of resources, and coping strategies. In this vein, users can apply, for example, information avoidance, stress management, and other coping strategies to mitigate the elicitation of stress and its negative consequences (Bostock et al., 2011; Denson et al., 2009). Thus, the impact of stressors heavily depends on the users' capabilities and stress-coping strategies.

2.2 The Concept of Stress

The concept of stress has been discussed or studied in various fields, and as such a universal definition has been difficult to establish, as the meaning may differ depending on the scientific context in which it is used (Fitzgerald, 2021). Generally, stress refers to an over-stimulated situation that rises both physically and psychologically when the brain perceives external and/or internal circumstances as dangerous or harmful (Folkman, 1984). Stress can be caused by various factors but is generally divided into traumatic events, continuous troubles, and problems in daily life (Hess & Copeland, 2006). The effect and intensity may differ from person to person and case by case. However, research has shown that exposure to stress for a long time can have severe effects and cause cognitive, emotional and behavioural problems (Schneiderman et al., 2005). Additionally, excessive amounts of stress can cause health problems (Sapolsky, 2004). Eustress, distress, hyperstress and hypostress have been determined as four variations of stress that, if balanced well, can lessen the negative effects and lead to good health (Selye, 1976). Eustress is positive, often short-term, stress that emerges as a result of any activity involving the need for increased motivation and/or inspiration. In contrast, distress is negative stress induced by changes in a routine that causes unpleasantness and unfamiliarity. Distress itself can be further divided into acute (intense, quick and short-term stress) and chronic (prolonged stress) types. Furthermore, hyperstress is induced as a result of overwork when pushed beyond one's limits which often has the consequence that smaller stressors trigger a bigger emotional response. The opposite is called hypostress which is induced by boredom or the lack of challenges and can have the consequence of restlessness and indifference. Stress is intrinsically neutral and varies in degree and effect depending on context and individual perception (Selye, 1983). In other words, the identical stressor can cause eustress or distress, but it is the individual discrepancies that induce either one of them (Hargrove et al., 2013).

2.3 Academic Stress

Academic stress falls into the 'daily life' category of stressors and is a term that specifically refers to stress induced in an educational context. It can refer to any type of educational level but studies have most often focused on university students. Due to the challenging nature of education and academia, students often experience high amounts of stress. High amounts of academic stress can, like other stressors, harm mental and physical health, as well as academic performance (Campbell et al., 1992; Hamaideh, 2011). Stressors such as financial problems, time constraints, and pressures on academic achievement are all part of academic stress, which can cause intense stress for university students (Campbell et al., 1992). The degree of stress the individual experiences is to some extent influenced by the ability to cope with particular stressful events (Zeidner, 1992). The amount of stress can also differ between students and non-student peers, as well as from year to year (Perlberg & Keinan, 1986). Many first-year university students at an undergraduate level struggle to adapt to the academic environment and develop the skills required to navigate it in a short time (Campbell et al., 1992). The struggle to adapt and balance personal life with academic life has also been found to be a cause of stress for undergraduate students (Shirom, 1986). Perlberg and Keinan (1986) demonstrated that there often is a higher amount of stress experienced by first and third-year students compared to second-year students. They suggest that this might be due to the difficulty of finding a balance and ability to adapt for first-year students, while third-year students might perceive an increase in pressure to achieve academically. Some research suggests a difference in the experience of academic stress based on gender. Female students have been found to experience a higher level of stress than their male peers (Anbumalar et al., 2017; Calvarese, 2015). However, the difference can be a result of male students feeling less willing to share experiences of stress openly, and thus create this divide (Zeidner, 1992). Studies have shown that there is a difference in academic stress seen in students with different socio-economic backgrounds (Bhat et al., 2016). Differences in perceived stress also were found to depend on the academic field (Aniţei et al., 2015; Bowen et al., 2016).

2.4 Technostress

Students' every day lives may be influenced by the educational environment and academic stress, which are regarded as possible factors that trigger psychopathological issues (Jaén & Lebrija, 2018; Torales et al., 2022), and information communication technology (ICT) use in education is rapidly increasing, forming part of universities' learning environment. Students at universities are required to be able to utilise computers, machines and the latest electronic devices because they are exposed daily to a range of ICTs. They are forced to conduct a lot of technology-based work as part of their academic curriculum such as using word processing applications, presentation software, searching the web, or using software that performs statistical analysis (Brosnan & Thorpe, 2006; Fitzgerald, 2021; Rolon, 2014).

The concept of stress, as argued by Lazarus and Folkman (1984), is a result of an interaction between an individual and the environment (Adam et al., 2017). Based on their transactional model of stress, they explained stress and defined it as an individual psychological response to a situation, where the situation demands exceed the individual and situational capacity/resources or ability to cope with the situation (Folkman & Lazarus, 1980; Lazarus & Folkman, 1984; Upadhyaya & Vrinda, 2021). Using sociotechnical and role theory, Tarafdar et al. (2007) explained that these stressors are the conditions (creators) that originate from social or role (role stressor) and technical or task (task stressor) or the use of ICTs (technology stressor). Adam et al. (2017) categorized stressors at the workplace into (1) job characteristics, (2) technological environment, (3) organizational environment, and (4) social environment, and stated that these stressor types can induce stress reactions in the users, both individually and collectively, but technology-related stressors exacerbate the others. Therefore, it is evident that ICT is one of the causes of stress from past research studies.

The term 'Technostress' was first introduced by Brod (1984) who defined it as a modern disease of adaptation caused by an inability to cope with the new computer world technologies in an unhealthy manner. Clark and Kalin (1996) described that technostress is not a disease, and is a negative psychological, behavioural and physiological impact caused, either directly or indirectly, by technology. Technostress creators are conceptualized as job demands which require high physical, social, and cognitive skills, with an associated psychological cost (Mahapatra & Pati, 2018). Also, technostress is referred to by different terminologies such as technophobia and computer anxiety (Hung et al., 2011; Laspinas, 2015), because Brod (1984) argued that technostress can be felt in the form of technophobia, confusion, and fear, with major symptom being the anxiety. Tarafdar et al. (2007, p. 304) defined technostress as a "problem of adaptation that individual experiences when he or she is unable to cope with or get used to, ICTs". They proposed a multi-dimensional scale with five components: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty.

Universities all across the world are currently actively modernizing educational systems via the use of ICT (Li & Wang, 2021). By utilizing technology-based learning, massively open online courses, and flipped classrooms, these universities began introducing and implementing blended learning. As a result of all these new tools being introduced, it is anticipated that educators will go through a lot of change, particularly in their methods for educating students, which raises their stress levels (Li & Wang, 2021). However, the majority of researchers frequently ignore how ICT-proposed instructional systems affect students' levels of technostress. Despite having grown up with technology, students of Generation Z still have trouble adjusting to the many, novel, and remote learning environments that instructors use.

2.5 Technostress Creators

According to previous research studies (Christ-Brendemühl & Schaarschmidt, 2020; Khedhaouria & Cucchi, 2019; Li & Wang, 2021; Mahapatra & Pati, 2018; Maier et al., 2019; Stadin et al., 2021; Tarafdar et al., 2020; Wang et al., 2020), technostress creators or techno-stressors refer to those factors that cause technostress in different fields, and they are grouped into five: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty.

2.5.1 Techno-overload

When an ICT user is under pressure to operate more quickly and for longer periods, it is referred to as techno-overload (Ahmad & Amin, 2012; Booker et al., 2014; Hauk et al., 2019; Juškaitė, 2017; Marchiori et al., 2019). It happens as a result of the overwhelming amount of information and notifications that consumers may quickly get as a result of using technology. ICT users may become too overwhelmed by the abundance of information and notifications on their smart cellphones and tablets (Chen et al., 2019). Accordingly, techno-overload is defined for this current study as a circumstance in which university students are required to alter their study habits and learn more quickly and thoroughly as a result of online learning.

Concerning students in universities, ICT has made it simpler for them to connect and interact via their smart cellphones and tablets using apps such as WhatsApp and Telegram for communication (Warren et al., 2021). These programs are used not only to interact with one another but also as a forum for debating and disseminating important information regarding courses. University students are expected to respond quickly and whenever feasible due to the convenience of smart cell phones and tablets (Warren et al., 2021). These reactions often demand more time and concentration. It is typical for students to perform more than one task at the same time, work under pressure, and simultaneously have to cope with a plethora of information made available by learning apps, classmates, and even their instructors (Wang et al., 2020). Techno-overload might result from a feeling that others expect a response, social media platforms and mobile marketing app notifications, and information and reminders for academic concerns (Wang et al., 2020). By learning effective coping mechanisms to handle situations proactively, university students can prevent techno-overload. Some studies advise avoiding receiving alerts and occasionally leaving devices alone or turning them off (Stadin et al., 2021).

2.5.2 Techno-invasion

Techno-invasion occurs when an ICT user thinks that the lines between their personal and professional lives are blurred because they are always linked or reachable (Hauk et al., 2019; Juškaitė, 2017; Tarafdar et al., 2010, 2011). ICT users are every time exposed because of technology, making it possible to reach them whenever and wherever. ICT users feel the urge to stay connected as a result of this predicament (Krishnan, 2017). Techno-invasion, according to more recent studies, is the belief that ICT users must forfeit their personal lives (Marchiori et al., 2019). It implies that when technology encroaches more and more on personal life, more time must be spent learning about new technologies, which leaves less time for family time or vacations (Hwang & Cha, 2018; Tu et al., 2005). Therefore, for this study, techno-invasion is defined as an attack on students' privacy, where their academic work and personal lives combine and cause conflict because they are incessantly connected to ICT through online education.

This component of the technostress scale yields conflicting and contradictory results when assessing technostress. For instance, research carried out by Ahmad et al. (2012) revealed that techno-invasion and techno-insecurity did not have a significant impact on academic librarians. Instead, they dealt with mild stress that is attributed to techno-complexity and techno-uncertainty. Techno-invasion was similarly found to have no impact on the challenge evaluation outcome in research conducted by Zhao et al. (2020). They concluded that it is a cultural norm for the majority of Chinese workers to be willing to work after regular working hours. But on the contrary, Qi (2019) found techno-invasion to be the most important stress factor that contributes to deficient levels of academic achievement. They concluded that when smartphones are used as a learning medium, there is stress resulting from role ambiguity between school and home. Other studies have also discovered that techno-invasion decreases individual performance and productivity (Tu et al., 2005), user discontent with certain technologies (Tarafdar et al., 2010), and may result in work-home conflicts (Tarafdar et al., 2011).

2.5.3 Techno-complexity

Techno-complexity, which is the third form of technostress, is when an ICT user believes that their computer abilities are insufficient, and they must devote a lot of time and effort to learning and comprehending the many characteristics of ICT (Juškaitė, 2017). According to Tarafdar et al. (2020), learners also experience techno-complexity when they are required to invest a lot of time, energy, and resources into using learning platforms that can rapidly change and be updated. According to research by Qi (2019), technology-based learning apps that are too difficult for students to understand are the main source of stress, which negatively affects academic productivity. The difficulty may be caused by the complex characteristics of the apps, users' lack of knowledge about the university's learning platform, or mobile-unfriendly systems that only operate on PCs and laptops. Additionally, most universities do not offer formal training to educate students on how to use the official learning websites or platforms they have designed; instead, the students are supposed to figure it out on their own. Students, who are largely from a younger age, frequently utilize the internet and other technologies for video games and entertainment, rather than for educational purposes (Tarafdar et al., 2020).

2.5.4 Techno-insecurity

Techno-insecurity is the kind of stress ICT users experience as a result of the development of new technologies or the presence of co-workers who are more skilled and knowledgeable in ICT (Abd Aziz & Abu Yazid, 2021). The ICT users develop a sense of threat of losing their employment and being replaced by someone with greater ICT skills (Juškaitė, 2017). In this study, techno-insecurity is defined as students who have developed a sense of fear of falling behind in their studies because of ICT and feel threatened by their peers who are more adept at online learning than they are.

According to research by Ahmad et al. (2012), workers below the age of 40 years exhibited less techno-insecurity than older workers because the younger workforce is familiar with using current technology, and is also more tech-savvy than the older workers. Hauk et al. (2019) supported their claim when they said that older employees' cognitive abilities will gradually deteriorate, including their hearing and vision abilities, and other fine motor skills that are crucial for mastering ICT skills. They discovered, however, that age is not a strong predictor of techno-insecurity, as they advanced in their research. Age was found to rather significantly correlate with techno-uncertainty and techno-overload. About these findings, some experts, including Qi (2019), have posited that it is unnecessary to examine and describe techno-insecurity among students of the university because the majority of them are digital natives who were born and nurtured in the internet era. They could be seen as experts in ICT, or as people who can learn ICT more quickly and easily than older people. They are inquisitive and adventurous nature as young people. To avoid being readily replaced by technology or new ones, they never hesitate to gain new skills, especially those relevant and related to ICT (Maier et al., 2019).

2.5.5 Techno-uncertainty

Techno-uncertainty is defined as a user's sense of helplessness about their capacity to keep up with technological advancement (Ma & Turel, 2019). Techno-uncertainty is described in some studies as a state in which an ICT user is anxious and troubled because ICT is always evolving and has to be upgraded (Juškaitė, 2017). The updating and changing of software, hardware, applications, systems, and even the networks utilized are among the changes ICTs go through (Ma & Turel, 2019; Marchiori et al., 2019). According to Ahmad et al. (2012), individuals experience a great deal of uncertainty and ambiguity as a result of frequent and quick changes in technology, which can lead to stress. For this study, the term "techno-uncertainty" refers to the continuous modifications and upgrades of teaching techniques using online learning, which may result in disrupting classes and leave students feeling uncertain about the future because they must be abreast with these methods.

According to a study by Qi (2019), he was of the view that, since university students were raised in the internet era and are already accustomed to all the technology, techno-uncertainty will not be a significant problem for them. However, the biggest concerns would be with the quantity of work due to the portability of mobile technology, which may intrude on students' private life wherever and whenever. In another study by Ma and Turel (2019), they compared male workers and female workers on the technostress scale and discovered that techno-uncertainty is mostly prevalent among female workers who work with the same technologies for a long time than male workers. However, research by Ahmad et al. (2012) has shown that regardless of the degree of their technostress, it would not impact the degree of the users' commitment.

2.6 Technostress as a double-edged sword

Researchers and practitioners have proposed technostress as 'a double-edged sword' (Qi, 2019), by considering both the positive and negative impact of technostress on individuals and their organizations. Tarafdar et al. (2019) proposed a revised framework of Technostress as a trifecta by considering techno-eustress, techno-distress, and information systems design. The framework incorporates both positive and negative outcomes of technostress, along with mitigating negative effects through appropriate information system (IS) design. The framework defines techno-eustress as the process in which an individual elucidate IS as challenging or thrilling, and the individual experiences good stress and results in positive outcomes. Techno-distress is defined as the process where an individual evaluates IS as a threat, experiences "bad" stress, and encounters unfavourable outcomes.

Schlachter et al. (2018) demonstrated that the use of ICT enables the task to be more portable and remotely accessible, leading to an increase in employees' performance, improved job satisfaction, and work-family balance. Ayyagari et al. (2011) found continuous connectivity with ICT enhances work speed and thereby increases the productivity and quality of an individual life.

On the contrary, Wang et al. (2008) found that employees from centralized and innovative organizations, often showcase peak levels of technostress. The dark side of technology usage referred to as 'technostress' (Brod, 1984; Tarafdar et al., 2010) has been extensively researched in the past, examining its impact on organizational behaviour and psychological stress (Tarafdar et al., 2019). Technostress has been found to impact negatively organizational behaviour such as employee productivity (Hung et al., 2015), performance (Tarafdar et al., 2014), end-user satisfaction (Fuglseth & Sørebø, 2014), job satisfaction (Kumar et al., 2013) and continuance commitment (Ragu-Nathan et al., 2008). Few studies also manifested the impact of technostress on the psychological behavioural outcomes of an employee such as strain (Ragu-Nathan et al., 2008) or the extent to which the individual feels tired (Ayyagari et al., 2011). Researchers have reported several other behavioural outcomes of technostress such as burnout (Mahapatra & Pati, 2018) and also physical health implications such as repetitive eyestrain, headaches, blood pressure, backaches, stomach problems, irritability and heart attacks (Tams et al., 2014). In an academic context, Samaha and Hawi (2016) found that there is a significant impact of mobile technology addiction on students' academic performance and satisfaction with life.

2.7 Technology and digital natives

The present generation of students is often referred to as ‘digital natives’. They possess technological fluency which is the inherent ability to familiarize themselves with new technology demands, with greater ease (Prensky, 2001). Furthermore, Prensky (2007) also stated “students (digital natives) are insisting for these (new) technologies to be used as part of their education, in part because they are things that the students have already mastered and use in their daily lives, and in part, because they understand just how useful they can be”. It is believed that current-generation learners have well-developed productive learning habits, multitasking, and teamwork, but on the other side, digital natives are incapable of deep learning and productive work. Digital natives are believed to have sufficient ICT skills and adapt to changes (Joo et al., 2016).

Studies on these digital natives have reported positive effects of ICTs on academic performance. Qi (2019) found the use of mobile devices had a positive impact on students’ academic performance. Morris (2010) found that technology-driven assessment in the classroom boosts academic performance among students. Cerretani et al. (2016) argued that students are using ICT for their personal use, entertainment, and leisure time rather than academic use and found that higher use of ICT leads to better academic performance. Rabiu et al. (2016) posited that the frequency of mobile phone usage does not considerably influence academic performance among undergraduate students. On the contrary, a study conducted by Jena (2015) among Indian University students found that TEL results in burnout, reduced engagement in learning, poor academic performance, and intention to drop out. Tarafdar et al. (2019) in the trifecta model noted the significance of studying the demographical data due to the individual difference in handling the technology with confidence. Hence, the study examined the association between students’ demographic factors and level of technostress.

2.8 Hypotheses Development and Research Model

2.8.1 Technostress and age

A recent longitudinal study by Hauk et al. (2019) proposes that age is positively associated with the level of technostress using cognitive theories on ageing, where an individual experience deterioration of his/her motor skill over age (Reuter et al., 2012). A meta-analysis by Hauk et al. (2018) posited that older adults find higher difficulties in using technology compared to younger adults, specifically with techno-overload and techno-complexity, which require a complex amount of cognitive abilities and physical condition. However, Ragu-Nathan et al. (2008) found that technostress decreases as age increases. Results of a study by Essel et al. (2021) illustrated a significant difference between students in the 0-20 year category and above 20 years category: students in the above 20 years category experienced significantly higher technology-induced stress than students in the 0-20 years category, and additionally, the above 20 years category experienced a higher level of techno-overload and techno-invasion factors.

Upadhyaya and Vrinda (2021) in their study also grouped students into two age groups (18–22 and 23–28 years) and differences in the levels of technostress were observed. Their findings revealed that students in the age group of 23-28 years experienced higher technostress than the younger students of the age group 18-22 years, and the older student groups experienced significantly higher levels of techno-invasion and techno-overload. Therefore, in this study, we propose to examine the following hypothesis for the students grouped into two age groups (below 25 years, and 25 years and above):

H1: There is a statistically significant difference in the levels of technostress of students with different age groups.

2.8.2 Technostress and gender

Several studies (Broos, 2005; Qi, 2019), have noted male students have a lower level of technostress as compared to females and they are involved with innovation performance using technology (Chandra et al., 2019). Female adolescents' frequency of internet and technology use is both psychologically and socially complex affaire (Broos & Roe, 2006) and experience more computer anxiety than male adolescents (Tekinarslan, 2008). A comparison of technostress among male and female students by Upadhyaya and Vrinda (2021) revealed that female students experienced higher technostress than male students, and out of the five technostress components, female students experienced higher technostress in techno-complexity and techno-uncertainty. Essel et al. (2021) finding was similar to the findings of Upadhyaya and Vrinda (2021). Although there are also contradictory results observed that male employees experienced more technostress than female counterparts (Ragu-Nathan et al., 2008; Tarafdar et al., 2015), based on the literature, we propose that:

H2: There is a statistically significant difference in the levels of technostress between male and female students.

2.8.3 Technostress and academic level

The literature on technostress in education is relatively limited. Rather, Ragu-Nathan et al. (2008) and Wang et al. (2008) found that the level of education inversely influences technostress. With experience in computer learning, formally educated students experience less technostress (Tarafdar et al., 2011). In the analysis of students' level of education and technostress levels, Upadhyaya and Vrinda (2021) found significantly higher technostress among postgraduate students, and stress was particularly higher in techno-complexity and techno-overload. Essel et al. (2021) also found that postgraduate students experienced higher technostress than undergraduate students, and especially, they experienced higher technostress in techno-overload and techno-complexity. However, one study reported that educational level has no significant relationship with technostress (Shu et al., 2011). With this mixed result, this current research proposes the following hypothesis below:

H3: There is a statistically significant difference in the levels of technostress of undergraduate and postgraduate students.

2.8.4 Technostress and knowledge in ICT

Zhao et al. (2020) confirmed a positive association of ICT experience with productivity and an inverse association with technostress. Upadhyaya and Vrinda (2021) found that students with lesser ICT experience (10 years and below) experienced higher technostress levels compared to those with higher ICT experience (above 10 years), and particularly those with lesser ICT experience, experienced higher stress in techno-complexity and techno-insecurity. Another study by Essel et al. (2021) showed a significant difference between students with 0-10 years of experience and students with above 10 years of experience regarding the experience with ICT: students with low ICT experience experienced higher technology-induced stress in general, but particularly higher stress concerning techno-insecurity and techno-complexity. Higher levels of technostress are associated with less experience using technology (Shu et al., 2011). Qi (2019) found that there is no significant association of technostress with the level of ICT experience. Ragu-Nathan et al. (2008) found that managers with higher confidence in their ability to use ICTs experience less technostress. Essel et al. (2021) found that, inversely, digital literacy has a statistically significant negative effect on technostress: when students' digital literacy is high, they experience reduced technology-induced stress. Therefore, the researcher proposes the following:

H4: There is a statistically significant difference in the levels of technostress of students concerning their knowledge in ICT.

2.8.5 Technostress and productivity

In the information systems (IS) discipline, productivity is often referred to as 'task productivity' and defined as "the extent that an application improves the user's output per unit of time" (Torkzadeh & Doll, 1999). Hysenbegasi et al. (2005) measured academic productivity using students' grade point average (GPA). Tarafdar et al. (2007) conceptualized productivity as "increased work efficiency and output during work hours through mobile technologies as perceived by staff members". Tarafdar et al. (2007) found a negative impact of five technostress creators on productivity at the workplace. Lee et al. (2016) validated the inverse association of technostress from mobile communication on quality of life and employee productivity. Hung et al. (2011) found that 'ubiquitous technostress' or stress caused by the overuse of mobile phones at the workplace harms employees' productivity. Essel et al. (2021) found an inverse effect of technostress on students' academic productivity. Upadhyaya and Vrinda (2021) also found a negative impact of technostress on academic productivity. Based on the previous literature, the research model is presented in Fig. 2.3 below, and the researcher proposes that:

H5: Technostress has a statistically significant negative effect on students' academic productivity.

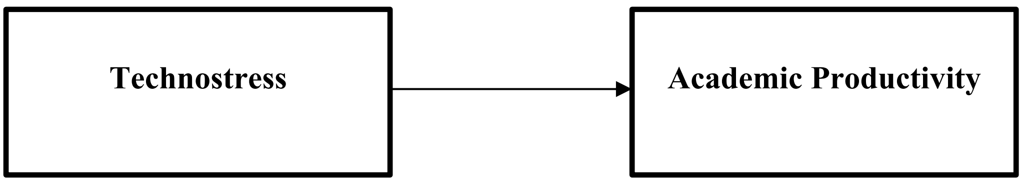


Figure 2.3: Research model

2.9 About the Coronavirus Disease (COVID-19)

The novel coronavirus disease-2019 (COVID-19) is an infectious illness that affects the respiratory system of humans, and it is caused by a virus named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (Lai et al., 2020). The word 'coronavirus' alludes to how CoV virions look under an electronic microscope, with spiky projections from the virus membrane resembling a crown, or in Latin called *'corona'* (Lai & Cavanaght, 1997; Su et al., 2016). According to the World Health Organization (2020), coronaviruses (CoV) are a large family of viruses that cause illnesses ranging from the common cold to more severe diseases. SARS-CoV-2 belongs to a group of viruses belonging to the coronavirus family, which is made up of hundreds of viruses, where some types of coronaviruses are common in humans and others are common in animals (Lone & Ahmad, 2020).

In humans, respiratory illness is linked to alpha (229E and NL63) and beta (OC43, HKU1, SARS, and MERS) coronaviruses (Adams et al., 2017; Kutter et al., 2018). These viruses trigger moderate to serious infections and diseases in the humans' respiratory system (Su et al., 2016). 229E, OC43, NL63, and HKU1 are well adapted and spread widely in human species, with the majority of cases causing mild disease in adults that can produce a normal immune response, and neither of these viruses is maintained within an animal reservoir, according to existing data (Huang et al., 2020; Su et al., 2016).

The two beta-coronaviruses, severe acute respiratory syndrome coronavirus (SARS-CoV) and middle east respiratory syndrome coronavirus (MERS-CoV) however are different. SARS-CoV was first reported in Guangdong Province, southern China, in November 2002, and MERS-CoV originated in September 2012, in Jeddah, Saudi Arabia, where the first case was reported in a 60-year-old who died from severe pneumonia (Lone & Ahmad, 2020; Su et al., 2016). While it is on record that coronaviruses could infect masked palm civets, camels, dogs, cats, mice and bats, among other birds and animals (Cavanagh, 2007; Ismail et al., 2003; Zhou et al., 2021), relevant studies have proven that SARS-CoV and MERS-CoV appeared and spread among human beings from animals such as masked palm civets and dromedary camels respectively, and produced chronic breathing problems with significant fatality rates in the human populace (Lai et al., 2020; Wang et al., 2013; Zhong et al., 2003). SARS-CoV and MERS-CoV have produced over 10,000 cases in the last two decades, with 10% and 37% rates of fatality respectively, making them, especially MERS-CoV one of the deadliest viruses known in history (Huang et al., 2020).

Then on December 31, 2019, the Hubei Provincial Health Commission in China initially identified a cluster of strange pneumonia cases associated with the Wuhan local seafood market (Centre for Health Protection of the Hong Kong Special Administrative Region Government, 2019). According to the World Health Organization (2022), they were notified of instances of pneumonia of an unknown origin in Wuhan, China, on that same date. Then on January 7, 2020, the Chinese officials, after a deep sequencing of substances collected from the lower airways, revealed a new coronavirus, which was given the temporary designation "2019-nCoV" (Huang et al., 2020; World Health Organization, 2022).

Later, on the 11th of February, 2020, the virus was given a new name called severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV), and the disease it causes as COVID-19 (coronavirus disease 2019) by the World Health Organization (WHO) (Gorbalenya et al., 2020; Lai et al., 2020; World Health Organization, 2022). Because the virus shares roughly 75% to 80% of its DNA with SARS-CoV but differs from MERS-CoV, it was given the moniker SARS-CoV-2 (Coronaviridae Study Group of the International Committee on Taxonomy of Viruses, 2020; Zhou et al., 2021; Zhu et al., 2020). Also, according to the World Health Organization (2022), although they are not the same virus, the name SARS-CoV-2 was selected because the virus is genetically similar to the coronavirus that caused the 2003 SARS outbreak.

2.10 COVID-19 in Ghana

In Ghana, the first case of COVID-19 was recorded on the 12th of March, 2020 (Ministry of Health, 2020). The report from Ghana Health Service (GHS) indicated that two individuals who had returned from Norway and Turkey respectively tested positive for COVID-19 per the laboratory results from the Noguchi Memorial Institute for Medical Research (NMIMR) (Ghana Health Service, 2020). The cases of COVID-19 increased from two to four the following day and from four to six infected people on the 14th of March. On the 15th of March, the country recorded additional four cases of COVID-19 resulting in a total of 10 confirmed cases. April 23rd, 2020, the number of confirmed cases of COVID-19 stood at 1,154, where 99 of them recovered and 9 people lost their lives (Ghana Health Service, 2020). To curtail the spread of COVID-19 in Ghana, the president of Ghana interdicted all public gatherings including conferences, workshops, funerals, festivals, political rallies, church activities and other related events. In addition, both public and private basic schools, senior high schools, colleges and universities were closed down (Klynveld Peat Marwick Goerdeler, 2020; Kokutse, 2020; Nyabor, 2020).

In Ghana, in an attempt to continue with academic work, some universities including the University of Ghana, University of Cape Coast, Wisconsin International University College, University of Education Winneba, Ashesi University and Kwame Nkrumah University of Science and Technology have resorted to the e-learning platform for engaging students in academic activities (Anaba, 2020; Ashesi University, 2020; University of Education Winneba, 2021b). The Directorate of Academic Affairs at the

University of Education, Winneba (UEW) released a notice to inform its students about the resumption of official academic work (lectures and tutorials) face-to-face and online before the beginning of the 2020/2021 academic year in January 2021, and the online teaching and learning activities were to be carried out through the University's Learning Management System (LMS) Moodle Platform (University of Education Winneba, 2021b). Lecturers attended a four-day mandatory workshop before the reopening of the academic year to receive training on how to use the LMS Moodle platform (University of Education Winneba, 2021a), and through it all, they were required to develop their model and upload it on the e-learning platform to ensure effective instructional discourse.

2.11 The COVID-19 Pandemic and Higher Educational Institutions

The pandemic caused by the novel coronavirus (COVID-19) has had a profound impact on daily activities and has presented us with unprecedented challenges. As the dreadfulness of COVID-19 became crystal clear, globally, governments closed schools in an attempt to curb the spread of the virus impacting over 90% of the world's enrolled learners (Riggall & McAleavy, 2020; UNESCO, 2020d). The intermission to education can have long-term repercussions, exclusively, for the most vulnerable. This may not only cause a loss of short-term learning but also further loss in human capital and diminished economic opportunities in the long term as well as prejudice towards particular groups (Watson, 2020; World Bank, 2020a). The COVID-19 outbreak affected education in terms of a reduction in utilisation of schools, lack of quality appropriate education, reduction in access to education services, reduction in the availability of education services, lack of maintenance of schools, lack of teacher training, fear of school return and emotional stress caused by outbreak, reduced financial resources, diversion of resources and teachers, confusion and stress for teachers, lack of at-home educational materials, challenges measuring and validating learning, parents unprepared for distance and homeschooling, challenges creating, maintaining, improving distance learning, loss of quality teaching and learning, social isolation, emotional disequilibrium and school dropouts (Bozkurt & Sharma, 2020; Hallgarten, 2020; UNESCO, 2020b).

Due to these effects, governments took measures to ensure that education continues via emergency remote teaching approaches with many deploying online learning solutions (Jalli, 2020; Jordan et al., 2021; UNESCO, 2020c, 2020a). This may seem experimental to some higher education institutions, typically, those in developing countries like Ghana, however, there might be others who have managed online teaching/learning before. Regarding this, several organisations assisted to ensure that learners continue their education worldwide. For example, the World Bank vigorously worked with Ministries of Education in numerous countries to support their efforts to employ instructional technologies of all sorts to provide remote learning opportunities for students while schools are closed as a result of the COVID-19 crisis (World Bank, 2020a). Similarly, UNESCO helped countries in their labours to alleviate the instantaneous effect of school closures, particularly for more vulnerable and disadvantaged communities, in other to facilitate the continuity of education for all through remote learning (UNESCO, 2020d).

However, it seems that higher educational institutions understood the pedagogical, logistical, and also technological challenges to these timely measures. Most of the higher educational institutions in low- and middle-income countries, including students and teachers, lacked access to high-speed broadband or digital devices needed to fully deploy online learning options. Thus, the transition from in-person to person instruction to online learning has wide-open cavernous digital divides between and within schools and countries (World Bank, 2020a, 2020b), particularly, among low-medium income countries like Ghana. The condition was far poorer for lower resource environments in middle- and low-income countries with internet dissemination rates typically less than

50% and a large fraction of students without devices to enable emergency remote learning at home (World Bank, 2020b). This result indicated the capacity of parents and even schools to support emergency remote learning or online learning during school closures as a result of the COVID-19 pandemic. Per this, higher education institutions needed to cogitate substitute ways for students to continue learning when they are not in school, like during the case of the COVID-19 crisis.

On this account, UNESCO centred on solidifying the capacities of distance learning systems to overcome the digital divide by providing resource support to teachers, parents and caregivers. Equivalent, the Organization firmly assisted the open educational resource (OER) community to support openly licensed teaching and learning materials in the framework of the 2019 UNESCO OER Recommendation; identified MOOCs and OERs which can provide online courses and self-directed learning content through both mobile and desktop platforms; support, through the OER4Covid initiative, and transition to online learning using OER during the COVID-19 pandemic (UNESCO, 2020e, 2020f).

2.12 Online Learning in Higher Educational Institutions during the COVID-19 Pandemic

Owing to the risk of COVID-19, higher education institutions were confronted with choices about how to continue instruction while keeping their faculty, staff, and students safe from the spread of COVID-19. On this account, many institutions authorised faculty to move their courses online or remotely to help thwart the spread of COVID-19. However, it seems that, in appearance, higher education institutions across the globe are engaged in online learning, nevertheless, in essence, this is rather a provisional solution, one that would be more properly named “emergency remote teaching (ERT)” (Bozkurt & Sharma, 2020; Golden, 2020). Given this, Hodges et al. (2020) indicated that well-designed online learning experiences are meaningfully different from courses offered online in response to a crisis or disaster. Online education/learning is not the same as emergency remote teaching (Bozkurt & Sharma, 2020; Golden, 2020; Hodges et al., 2020).

According to Bozkurt and Sharma (2020), remote education refers to spatial distance and an obligation, which means that we have to use different strategies and approach the case with different priorities. In a similar vein, according to Hodges et al. (2020), emergency remote teaching is a temporary shift of instructional delivery to a substitute delivery mode due to catastrophic situations. It comprises the use of fully remote teaching solutions for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses and that will return to that format once the crisis or emergency has abated. The principal goal in these conditions is not to re-create and design a vigorous educational ecosystem but rather to offer impermanent access to teaching and learning and instructional supports in a manner that is quick to set up and is reliably available during the COVID-19 crisis (Hodges et al., 2020). Emergency remote teaching occurs outside of a physical classroom. ERT which appears to be identical to e-learning takes place online. Remote teaching is naturally facilitated through technology, such as video conferencing software, discussion boards or learning management systems. Both students and instructors interact via two-way communication technologies. Instructors are separated from their learners in time and distance. This type of teaching may be synchronous, where students watch instructors deliver their lectures live, or asynchronous, where students watch lecture recordings at a later point in time. Best practices for remote teaching include: providing ongoing feedback, making assignment guidelines clear, and making effective use of online resources.

Teaching remotely obviously diminishes the number of interactions on campus and thereby also significantly decreases the rate of transmission of COVID-19

(Mukhopadhyay & Mukhopadhyay, 2020). ERT can ensure that students continue learning through a variety of avenues such as digital technologies which can offer a wide set of capabilities for remote learning (World Bank, 2020a). It enables learners to extend learning outside the boundaries of traditional learning institutions through informal and enriched learning experiences using online communities on new platforms such as social media and other social platforms (Saykili, 2019). It can essentially be as effective as face-to-face education when done right. When emergency remote learning is well-planned and structured, conducted in an appropriate learning management system and is in the hands of skilled lecturers, it can provide an equivalent learning experience to face-to-face (Taylor-Guy & Chase, 2020). All higher educational institutions worldwide are seeking viable, blended and sustainable modes of online courses (Ng, 2020). Learning management systems (LMS) such as the University of Education LMS Moodle are designed to support online learning. These systems effectively organise learning resources, including multimedia resources that students can easily access. Students can engage in collaborative activities with their peers and lecturers, through tools such as zoom, WhatsApp, discussion boards and wikis.

The call by higher education institutions to move instruction online enhanced the flexibility of teaching and learning anywhere and anytime, yet, it seems that the speed at which this move occurred is unprecedented and staggering (Agormedah et al., 2020). This abrupt substitution from in-person to emergency remote teaching has left academic faculty, staff and students with challenges. Thus, ERT introduces a change to both the people and the higher education institutions on a large scale (Ng, 2020; Saykili, 2019). For example, educators have not been prepared to teach well with technology, let alone teach remotely with technology, hence, they struggled to figure out how to use digital tools, online resources, and apps to continue their teaching online (Trust, 2020).

Similarly, higher education faculty have limited opportunities to learn how to teach with technology, including how to find, evaluate, adapt and use technology to enrich learning. As a result, the majority of educators were completely underprepared to design remote learning experiences with technology when states and districts started closing schools for COVID-19 (Trust, 2020).

Also, the shift to emergency remote teaching presents several concerns for student learning, issues of equity, internet connection, personal learning devices, student data accessibility, and the digital divide. Thus, the shift to ERT has illuminated and exacerbated the digital divide (Trust, 2020). Likewise, according to Taylor-Guy and Chase (2020), ERT hinders student cohesiveness, peer-to-peer and student-lecturer interaction beyond real-time video or chat interactions. This promotes student disengagement and dropout (Taylor-Guy & Chase, 2020). Saavedra (2020) argued that developed countries are at a gain in introducing emergency remote teaching, but then again, this is invalid for every country. For example, Adam (2020) indicated that it is only the advantaged that will profit from this online learning. The most vulnerable members and poorest of society are being the firmest hit, both by the COVID-19 pandemic and the response (Guterres, 2020). It is evident that both developed and developing countries have already been grief from interludes to education, and for many, this is not a new narrative.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This section outlines the methodology of the study. This includes the research philosophy, research approach, research design, population, sample size and sampling technique, instrument, reliability and validity of the instrument, data analysis, and ethical issues.

3.1 Research Philosophy

The underlying philosophical assumption that underpins the study approach is positivism. As per Levin (1988), believers of positivism consider that the reality of situations is steady and, in their opinion, it can be observed from an objective point of view. This study sought to determine the truth about the relationship between technostress and students' academic productivity objectively by taking students' responses on how they feel about using ICT to learn, how it has helped to improve their academic performance, and then use statistics and probability to determine the truth about the relationship from their responses, whether technostress positively or negatively affect students' academic productivity.

3.2 Research Approach

The research approach is quantitative. Aliaga and Gunderson (2000) defined the quantitative research approach as explaining phenomena by collecting numerical data that are analyzed using mathematically based methods, particularly using statistics. Quantitative research emphasizes objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques (Mujis, 2011).

It focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon (Babbie, 2010). The overarching aim of a quantitative research study is to classify features, count them, and construct statistical models in an attempt to explain what is observed (Singh, 2015). Babbie (2010) also opined that the goal of conducting a quantitative research study is to determine the relationship between one thing (an independent variable) and another (a dependent or outcome variable) within a population. This study used this approach to be able to test the hypotheses and give answers to the research questions stated in the study, but particularly, determine the relationship between technology-related stress and academic productivity.

3.3 Research Design

Research design is a framework and the process for research that cover decisions from extensive assumptions to in-depth procedures for the collection and analysis of data (Creswell, 2013). It refers to the overall strategy and analytical approach that is chosen to integrate, coherently and logically, the different components of the study, thus ensuring that the research problem is thoroughly investigated (De Vaus, 2001). It constitutes the blueprint for the collection, measurement, and interpretation of information and data (De Vaus, 2001). According to Bryman and Bell (2015), a research design indicates the methods through which the research questions and objectives will be answered, which will include the source of data collection, the limitation and ethical issues that might appear during the research. De Vaus (2001, p. 9) also posited that "the function of a research design is to ensure that the evidence obtained enables the researcher to answer the initial question as unambiguously as possible". He further went on to say that obtaining relevant evidence entails specifying the type of evidence needed to answer the research question, to test a theory, to evaluate a programme or to accurately describe some phenomenon.

According to Marczyk et al. (2005), although, there are endless ways of classifying research designs, they usually fall into one of these three (3) general categories: experimental, quasi-experimental, and nonexperimental (i.e., descriptive and correlational designs). This study adopted descriptive and correlational quantitative research designs. A descriptive correlational design because the study is nonexperimental, and there is neither intentional manipulation nor random assignment, no multiple groups or multiple waves of measurement, but only an observation of existing situations in their natural context (Bedford & Miller, 2013; Marczyk et al., 2005). This is what Singh (2015, p. 5) said about descriptive research designs:

> "Descriptive research, as the name suggests, enumerates descriptive data about the population being studied and does not try to establish a causal relationship between events. This is also one of its major limitations as it cannot help determine what causes a specific behaviour or occurrence. It is used to describe an event, or a happening or to provide a factual and accurate description of the population being studied. It provides the number of times something occurs and helps in determining the descriptive statistics about a population, that is, the average number of occurrences or frequency of occurrences. In a descriptive study, things are measured as they are, whereas, in an experimental study, researchers take measurements, try some intervention and then take measurements again to see the impact of that intervention."

A correlational study measures the variables involved and seeks to understand and determine the relationship between the variables (Marczyk et al., 2005), and establish whether the relationship is positive or negative. This study described and measured the variables, technostress and academic productivity, the way participants perceive it, and also tried to determine the relationship between them, i.e., whether technostress negatively affects students' academic productivity.

Also, under descriptive research design, Singh (2015) further identified the following types: case study, case series study, cross-sectional study, longitudinal change, and retrospective study. This study adopted the cross-sectional survey study. This is because, in a cross-sectional survey, data is collected and investigated in a single moment and a single time (Cohen, Manion & Morrison, 2002). Cross-sectional studies portray a snapshot of the prevalent situation, and variables of interest in a sample are assessed only once to determine the relationships between them (Singh, 2015). The study asked participants questions about how they felt about online learning and their academic productivity only once at one point in time.

3.4 Population

The population for the study were students of the University of Education, Winneba (UEW). UEW operates from two (2) campuses: the College of Languages Education, located at Ajumako, and the Winneba Campus located in Winneba, where the main administration is located. The Winneba Campus is made up of three learning centres which are the North, South and Central campuses. Among the student population of UEW, the study targeted undergraduate students between levels 200 – 400 and postgraduate final-year students, studying on the North, South, and Central campuses, excluding the Ajumako Campus. Level 100 undergraduate students were excluded from the study at the time of data collection, and this is because, during the 2020/2021 academic year, they were not admitted into the university, and therefore had no experience with the online learning approaches adopted by the university amid the

COVID-19 pandemic. UEW's online learning approach to education due to the pandemic was fully operational in the year 2021, and students who experienced online learning were appropriate to study, considering the phenomenon (technostress) the researcher is investigating.

3.5 Sample Size and Sampling Technique

A sample can be defined as a finite part of a statistical population whose properties are used to make estimates about the population as a whole (Webster, 1985). When dealing with people, it can be defined as a set of target respondents selected from a larger population for a survey (Singh, 2015). The sample size for this study was determined using the sample size determination formula by Cochran (1977). The formula is suitable for finding the sample size for a large population (Cochran, 1977), and in this case, we assume the student population is large, with a maximum variability of 0.5, 95% confidence level and 5% level of precision. The formula is given below:

$$n_0 = \frac{Z^2pq}{e^2}$$

According to Cochran (1977), n_0 is the sample size; Z is the Z-score of α-level of significance for a 2-sided test, which is 1.96 for a 95% confidence level or 5% significance level; p is the estimated proportion of an attribute that is present in the population, and in this case, because we don't know the variability in the proportion, we use 0.5, which is maximum variability; q is $(1 - p)$ which is $1 - (0.5) = 0.5$; e is the desired level of precision, which is 5%.

$$n_0 = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2}$$

$$n_0 = 385$$

Therefore, the sample size (*N*) used for the study is 385 undergraduate and graduate students. These students were recruited from all three study centres that constitute the Winneba Campus using the non-probability convenience sampling technique.

Sampling can be defined as the process or technique of selecting a suitable sample, representative of the population from which it is taken, to determine parameters or characteristics of the whole population (Mugo, 2002). There are two types of sampling: probability sampling and non-probability sampling. In the case of probability sampling, the probability or chance of every unit in the population being included in the sample is known due to the randomization involved in the process (Singh, 2015). The different units or persons in the population have equal chances of being chosen. Unlike probability sampling, a non-probability sampling technique does not give equal opportunity to each person in the population to be a part of the study (Kumar, 2011). The convenience sampling method is an example of a non-probability sampling technique, where sampling units are selected out of convenience (Singh, 2015). Participants who took part in this study were selected because of convenience. Though the non-probability convenience sampling method employed in this study does not produce randomisation, it fits the overall characterisation of students in the university (Essel et al., 2020).

3.6 Instrument

The study adopted a survey questionnaire developed to measure technostress among students by Abd Aziz and Abu Yazid (2021). This means that the study measured technostress among the UEW student population using the technostress creator questionnaire developed by Abd Aziz and Abu Yazid (2021) to collect primary data. The technostress creator questionnaire developed by Abd Aziz and Abu Yazid (2021) is a 22-item instrument divided among four (4) main computer-related factors identified as causing stress (technostress creators), suitable for measuring technostress in the educational context, especially among students. The four (4) factors or dimensions are as follows: techno-overload, caused by an overload of information (9 items); techno-complexity, caused by the inability to deal with the complexity associated with technology (6 items); techno-insecurity, caused by technology-induced work insecurity (4 items); and techno-uncertainty, caused by the uncertainty associated with technology (3 items). All items were measured on a five-point Likert type. However, the study adopted the five-point Likert scale and their corresponding scoring range from Sözen and Güven (2019), as shown in Table 3.1 below:

Table 3.1: Scoring range of the Likert scale of the survey

	Value	Range
Strongly Disagree (SD)	1	1.00 – 1.80
Disagree (D)	2	1.81 – 2.60
Undecided (UD)	3	2.61 – 3.40
Agree (A)	4	3.41 – 4.20
Strongly Agree (SA)	5	4.21 – 5.00

Source: Sözen and Güven (2019)

Also, the researcher measured academic productivity with a four-item scale self-developed to collect primary. All items were also measured on the five-point Likert scale shown in Table 3.1 above. Overall, the study used a structured questionnaire to collect participants' responses on technostress and academic productivity. The questionnaire is divided into three (3) parts, and part one (1) collected participants' demographic information such as age, gender, academic level, and knowledge of ICT; part two (2) collected information on technostress; and the final part, which is part three (3) collected participants' responses on their academic productivity.

3.7 Reliability and Validity

Reliability refers to the consistency or dependability of a measurement technique (Andrich, 1981; Leary, 2004). More specifically, reliability is concerned with the consistency or stability of the score obtained from a measure or assessment technique over time and across settings or conditions (Anastasi & Urbina, 1997; White & Saltz, 1957). If a measurement is reliable, it means there is less chance that the obtained score is due to random factors and measurement error. Reliability is usually expressed as a correlation coefficient, which is a statistical analysis that tells us something about the relationship between two sets of scores or variables. The most common method used to determine reliability is Cronbach's Alpha (α), and adequate reliability exists when the correlation coefficient is 0.70 or higher (Cronbach, 1951; Marczyk et al., 2005).

Although reliability is an essential consideration when selecting an instrument or measurement approach, it is not sufficient in and of itself. Validity is another critical aspect of measurement that must be considered as part of an overall measurement strategy. Whereas reliability refers to the consistency of the measure, the concept of validity refers to what the test or measurement strategy measures and how well it does so (Anastasi & Urbina, 1997). Conceptually, validity seeks to answer the following question: "Does the instrument or measurement approach measure what it is supposed to measure?". If so, then the instrument or measurement approach is said to be valid because it accurately assesses and represents the construct of interest. Like reliability, validity is determined by considering the relationship, either quantitatively or qualitatively, between the test or measurement strategy and some external, independent event (Groth-Marnat, 2003). The most common methods for demonstrating validity are referred to as content-related, criterion-related, and construct-related validity (Campbell, 1960).

To determine the reliability of the technostress instrument adopted from Abd Aziz and Abu Yazid (2021) and the academic productivity instrument self-developed, the researcher loaded the primary data collected from the field using the instrument into SPSS to analyse the correlation coefficient using Cronbach's Alpha (α). The results show α= 0.851 (22 items) for the adopted technostress instrument and α= 0.805 (4 items) for academic productivity measurement. Overall the instrument recorded a Cronbach's Alpha (α) value of 0.818 (26 items), which is considered adequate reliability because the α values are greater than 0.70 (Cronbach, 1951). However, the technostress scale developed by Abd Aziz and Abu Yazid (2021) generated a Cronbach's alpha coefficient above α = 0.70, indicating acceptable internal consistency reliability (Abd Aziz & Abu Yazid, 2021; Bahkia et al., 2019). The reliability coefficients of the subfactors or dimensions of the technostress scale were reported as techno-overload (α = 0.94), techno-complexity (α = 0.93), techno-insecurity (α = 0.88), and techno-uncertainty (α = 0.89).

For validity, some scholars have argued that validity and reliability are interconnected concepts (Sullivan & Feldman, 1979), and that reliability, or consistency, is therefore a hallmark of validity (Marczyk et al., 2005). That is to say: If you have a test that is not reliable, how can it accurately measure the construct of interest? So, the researcher concludes that the instrument is valid and reliable to measure the variables studied. Also, the Exploratory Factor Analysis (EFA) procedures for validity, reliability, and obtaining the genuinely feasible items for the measurement of technostress constructs for university students described in the study by Abd Aziz and Abu Yazid (2021), showed that the extracted components with their respective items are appropriate and reliable to measure the technostress construct.

Abd Aziz and Abu Yazid (2021) adopted and adapted the technostress creator questionnaire developed by previous researchers and validated the construct using

Exploratory Factor Analysis (EFA). The original technostress creators questionnaire scholarly found in the technostress literature was proposed and developed by Tarafdar et al. (2007), and it has five (5) factors, namely: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. However, the technostress creators questionnaire developed by Tarafdar et al. (2007) was developed for the organization setting, and so, therefore, to have a technostress scale that measures technostress in the educational setting, especially among students, Abd Aziz and Abu Yazid (2021) proposed the five (5) dimensions of technostress, and adopted and adapted 22-items technostress construct from Wang et al. (2020), but after the EFA, the only two (2) items belonging to techno-invasion were found to be overlapping with another construct, which is techno-overload. But because the two (2) items under techno-invasion recorded a high factor loading over 0.70, Abd Aziz and Abu Yazid (2021) decided to retain the items and included them among the techno-overload constructs. This explains why the technostress creator scale adopted from Abd Aziz and Abu Yazid (2021) has four (4) factors as mentioned earlier: techno-overload, techno-complexity, techno-insecurity, and techno-uncertainty.

3.8 Data Analysis

The data collected from the survey were analyzed using the Statistical Package for Social Sciences (SPSS) 26 and SmartPLS data analysis tools. To answer the research questions, set out in the study, the data analysis tools were used to calculate descriptive statistics (such as mean and standard deviation) and inferential statistics (such as independent sample t-test and structural equation modelling) to make sense of the data. The research instrument used to collect data is in three (3) parts as stated earlier. In the first part, which collected data on participants' demographic profiles (age, gender, academic level and knowledge of ICT), SPSS was used to extract the frequency tables and the corresponding percentages of each demographic profile in the data set.

The second part of the research instrument collected data on technostress, and the purpose is to help the researcher answer the first research question (RQ1) which is to ascertain the levels of technostress among the student population of UEW. SPSS was used to generate the frequency table, the mean and standard deviations of participants' responses to the items that measure technostress levels. However, to interpret the mean results, the researcher adopted a 5-level mean score scale designed by Ahmad and Amin (2012) to ascertain technostress levels. The original scale designed by Ahmad and Amin (2012) was designed to fit a seven-point Likert scale, but to be consistent with the Likert scale type used in this study, the researcher adapted the scale to fit the scoring range for a five-point Likert scale adopted from Sözen and Güven (2019), as shown in Table 3.2 below:

Table 3.2: A 5-level mean score scale of technostress levels

Value	Mean	Level of Technostress
1	1.00 – 1.80	Very Low
2	1.81 – 2.60	Low
3	2.61 – 3.40	Moderate
4	3.41 – 4.20	High
5	4.21 – 5.00	Very High

Source: Ahmad and Amin (2012)

The second research question (RQ2) which is to investigate whether there is a statistically significant difference in technostress among UEW students based on age, gender, academic level, and knowledge in ICT, was answered by using the functions in SPSS to calculate independent samples t-test values (t-statistics and probability values) to either accept or reject the hypotheses stated in the literature review. Then finally, in the literature review, the researcher stated a hypothesis concerning the third research question (RQ3) which is to determine the effect of technostress on students' academic productivity. Through the hypothesis, the researcher developed a model to explain the relationship between technostress and academic productivity. The results presented in chapter 4 were possible because the researcher tested the model by using the SmartPLS software to run a structural equation modelling (SEM) to determine the effect of technostress on students' academic productivity.

3.9 Ethical Issues

The questionnaire used in the data collection contained an opening introductory letter, where the researcher identified himself and the purpose of the survey. The letter assured participants of their protection and stated that participants had the authority to refuse or to accept to participate in the study. Students who accepted to give answers to the questions on the questionnaire were assured of the confidentiality of the information they will provide. They were assured that the study findings will not be used for any other reason than for only academic purposes.

CHAPTER 4

DATA ANALYSIS, RESULTS AND DISCUSSION OF FINDINGS

4.0 Introduction

This chapter presents and discusses the findings of the study generated from the data gathered through the instruments administered to students in UEW. The relevant statistics that will help the researcher explain and make meaning out of the data set were presented in a tabular form. Diagrams that will further help to establish the relationships between variables understudied, and explain concepts were also presented in this chapter. Finally, the chapter is arranged logically, in the sense that, there are two parts: the first part presented information on participants' (students) demographic characteristics, while the second part presented the answers to the research questions the study proposed to answer.

4.1 Demographic Characteristics of Participants

The participants' demographic data collected include age, gender, academic level and knowledge in ICT.

Table 4.1: Age Distribution of Participants

Age	F	%
Below 25 years (18 – 24)	185	48.1
25 years and above (25 – 52)	200	51.9
Total	**385**	**100**

Source: Fieldwork (2022)

Note: F = Frequency; % = Percentage.

The ages of participants (students) were categorized into two age groups, which are below 25 years (18 – 24) and 25 years and above (25 – 52). From Table 4.1 above, the results reveal that 185 (48.1%) of students fell between the ages of 18 -24 years and 200 (51.9%) between 25 – 52 years.

Table 4.2: Gender Distribution of Participants

Gender	**F**	**%**
Male	242	62.9
Female	143	37.1
Total	**385**	**100**

Source: Fieldwork (2022)

Note: F = Frequency; % = Percentage.

The results in Table 4.2 above indicate that 242 (62.9%) of the participants studied were male students, and 143 (37.1%) were female students.

Table 4.3: Academic Level Distribution of Participants

Academic Level	**F**	**%**
Undergraduate	338	87.8
Postgraduate	47	12.2
Total	**385**	**100**

Source: Fieldwork (2022)

Note: F = Frequency; % = Percentage.

Table 4.3 above shows that the participants studied belong to two academic levels: undergraduate and postgraduate. 338 (87.8%) were undergraduates and 47 (12.2%) were postgraduate students.

Table 4.4: Participants' Knowledge in ICT Distribution

Knowledge in ICT	**F**	**%**
Basic	105	27.3
Intermediate	231	60.0
Advance	49	12.7
Total	**385**	**100**

Source: Fieldwork (2022)

Note: F = Frequency; % = Percentage.

Table 4.4 above gives information about participants' knowledge in ICT. 105 (27.3%) of participants indicated they have basic knowledge in ICT, 231 (60.0%) adjudged their knowledge in ICT intermediate, and 49 (12.7%) have advanced knowledge in ICT.

Table 4.5: Summary of Demographic Characteristics of Participants (N= 385)

Variable	**M**	**SD**	**F**	**%**
Age	25.90	5.175		
18 – 24			185	48.1
25 – 52			200	51.9
Gender				
Male			242	62.9
Female			143	37.1
Academic level				
Undergraduate			338	87.8
Postgraduate			47	12.2
Knowledge in ICT				
Basic			105	27.3
Intermediate			231	60.0
Advance			49	12.7

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; M = Mean; SD = Standard Deviation; F = Frequency; % = Percentage.

4.2 Analysis of Research Questions

Research Question 1: *What is the level of Technostress among students in a technology-enhanced learning environment during the COVID-19 pandemic?*

In this study, to measure the technostress levels among the students, we must look at the extent to which participants agreed and disagreed with the items of technostress constructs under each of the dimensions that measured students' technostress levels. The frequency table, mean and standard deviations of each item of the technostress construct are, therefore, presented as follows:

Table 4.6: Frequencies of participants' response to items on the technostress scale and descriptive statistics of their responses (N= 385)

Statements	SD F (%)	D F (%)	UD F (%)	A F (%)	SA F (%)	M	SD
Techno-overload							
TO1: I have to do more work than I can handle due to the implementation of online learning.	61 (15.8)	82 (21.3)	63 (16.4)	127 (33.0)	52 (13.5)	3.07	1.310
TO2: I have to work with very tight time schedules due to the implementation of online learning.	43 (11.2)	93 (24.2)	55 (14.3)	129 (33.5)	65 (16.9)	3.21	1.288
TO3: I have to change my study habit to adapt to online learning.	38 (9.9)	38 (9.9)	47 (12.2)	126 (32.7)	136 (35.3)	3.74	1.302
TO4: I have a higher workload because of the increased complexity of online learning.	62 (16.1)	105 (27.3)	68 (17.7)	96 (24.9)	54 (14.0)	2.94	1.314
TO5: I have less free time due to the implementation of online learning.	68 (17.7)	105 (27.3)	61 (15.8)	97 (25.2)	54 (14.0)	2.91	1.337
TO6: I have to be in touch with my work even during vacation because of online learning.	44 (11.4)	55 (14.3)	53 (13.8)	141 (36.6)	92 (23.9)	3.47	1.305
TO7: I have to work much faster due to the	39 (10.1)	54 (14.0)	64 (16.6)	133 (34.5)	95 (24.7)	3.50	1.279

implementation of online learning.							
TO8: I have to sacrifice my vacation and weekend time to keep current on the updates and new requirements of online learning.	58 (15.1)	86 (22.3)	52 (13.5)	118 (30.6)	71 (18.4)	3.15	1.361
TO9: I feel my personal life is being invaded by online learning.	110 (28.6)	90 (23.4)	73 (19.0)	59 (15.3)	53 (13.8)	2.62	1.394
Techno-complexity							
TC1: I often find online learning too complicated for me to understand it well.	76 (19.7)	106 (27.5)	68 (17.7)	76 (19.7)	59 (15.3)	2.83	1.361
TC2: I often find online learning too complicated for me to use it effectively.	80 (20.8)	130 (33.8)	52 (13.5)	78 (20.3)	45 (11.7)	2.68	1.320
TC3: The high complexity of online learning causes me to doubt its usefulness and practicality in education.	63 (16.4)	109 (28.3)	67 (17.4)	77 (20.0)	69 (17.9)	2.95	1.363
TC4: I do not have adequate knowledge of online learning to complete my homework satisfactorily.	111 (28.8)	117 (30.4)	45 (11.7)	83 (21.6)	29 (7.5)	2.49	1.309
TC5: I need to spend a considerable amount of time and effort to use online learning effectively.	39 (10.1)	90 (23.4)	53 (13.8)	130 (33.8)	73 (19.0)	3.28	1.289
TC6: I do not find enough time to study and upgrade my technology skills to meet the needs of online learning.	63 (16.4)	112 (29.1)	83 (21.6)	82 (21.3)	45 (11.7)	2.83	1.265
Techno-insecurity							
TIS1: I am threatened by peers who have more vital online learning skills.	89 (23.1)	119 (30.9)	60 (15.6)	72 (18.7)	45 (11.7)	2.65	1.330
TIS2: I do not share my knowledge regarding online learning with my peers for fear of being accused of cheating.	112 (29.1)	89 (23.1)	55 (14.3)	83 (21.6)	46 (11.9)	2.64	1.402
TIS3: I am threatened by peers who know more about online learning than I do.	98 (25.5)	115 (29.9)	58 (15.1)	65 (16.9)	49 (12.7)	2.62	1.361
TIS4: I am threatened by peers who quickly adapt to the online learning environment than I do.	98 (25.5)	121 (31.4)	49 (12.7)	79 (20.5)	38 (9.9)	2.58	1.327

Techno-uncertainty							
TUC1: There are frequent upgrades in online learning we use in our university.	60 (15.6)	84 (21.8)	71 (18.4)	104 (27.0)	66 (17.1)	3.08	1.340
TUC2: There are constant changes to the functionalities in online learning we use in our university.	57 (14.8)	82 (21.3)	78 (20.3)	109 (28.3)	59 (15.3)	3.08	1.304
TUC3: Our university regularly replaces one teaching and learning method with another.	76 (19.7)	83 (21.6)	80 (20.8)	88 (22.9)	58 (15.1)	2.92	1.354

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; SD = Strongly Disagree; D = Disagree; UD = Undecided; A = Agree; SA = Strongly Agree; M = Mean; SD = Standard Deviation; F = Frequency; % = Percentage; TO = Techno-overload; TC = Techno-complexity; TIS = Techno-insecurity; TUC = Techno-uncertainty.

From Table 4.6 above, the evaluation items related to technostress reveal that, in general, the average obtained is moderate, indicating that the problem appears to be relevant in the opinion of the population being studied. For example, the highest mean is detected in the construct of techno-overload, which is M = 3.74 (TO3), followed by M = 3.50 (TO7) and M = 3.47 (TO6). The university students stated that they had to change their habits to adapt to online learning; work much faster due to the implementation of online learning; they have to be in touch with their work even during vacation because of online learning. The degree of discrepancy in the responses to these three items was SD = 1.302, SD = 1.279, and SD = 1.305 respectively. Also, the results of the techno-uncertainty construct suggest that university students face stress due to frequent upgrades in online learning (M = 3.08, SD = 1.340), and constant changes to the functionalities in online learning (M = 3.08, SD = 1.304).

Similarly, university students did report facing some difficulties with the complexity of online learning. Among the items that compose the construct, what stands out is that they need to spend a lot of time and effort to use online learning effectively (M = 3.28, SD =

1.289). In contrast, the item with the lowest impact was the opinion that they do not have enough knowledge of online learning to complete their homework satisfactorily (M = 2.49, SD = 1.309). Thus, the opinion of Wang and Li (2020), who said the younger generation is tech-savvy, may not be accurate because it contradicts the population under study, in which quite many few students studied are teenagers from the Z Generation.

Finally, the techno-insecurity construct presents the lowest mean among the four technostress constructs. That is, the university students stated that they are threatened by peers with better online learning skills (M = 2.65, SD = 1.330). Another statement students slightly considered is the opinion that university students do not share their knowledge regarding online learning with peers for fear of being accused of cheating (M = 2.64, SD = 1.402).

Table 4.7: Level of technostress

			Technostress level (*N*= 385)									
Dimension	**Mean**	**SD**	**Very Low**		**Low**		**Moderate**		**High**		**Very High**	
			F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Techno-overload	3.178	0.743	16	4.2	73	19.0	136	35.3	127	33.0	33	8.6
Techno-complexity	2.843	0.900	41	10.6	115	29.9	129	33.5	70	18.2	30	7.8
Techno-insecurity	2.621	1.075	100	26.0	111	28.8	75	19.5	58	15.1	41	10.6
Techno-uncertainty	3.028	1.012	50	13.0	70	18.2	129	33.5	82	21.3	54	14.0
Overall	**2.92**	**0.681**										

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; M = Mean; SD = Standard Deviation; F = Frequency; % = Percentage.

Table 4.7 above shows the overall level of technostress as well as the level for every four dimensions of technostress among students of UEW. While 3.1% (n = 12) of the respondents showed very low-level technostress, 31.2% (n = 120) demonstrated low-level technostress, 43.9% (n = 169) exhibited moderate-level technostress, 15.8% (n =

61) demonstrated high-level technostress, and 6.0% (n = 23) were very high-level technostress. The findings show that the overall technostress level is at a moderate level. A mean score of M = 2.92 (SD = 0.681, range: 2.61 – 3.40) presented evidence of a moderate prevalence of technostress among the students of UEW. This suggests that the technostress experienced by students in UEW was not quite severe, and this finding aligns with previous studies (Ahmad & Amin, 2012; Essel et al., 2021; Upadhyaya & Vrinda, 2021) who also found technostress levels to be moderate among students and staff members of the university. The finding suggests that students had a positive perception of the role of technology in improving their academic productivity, although they do feel that using online learning contributes to some amount of stress they experience. They might be looking at it as a new challenge, believing that online learning is there to help them to continue learning anywhere, and also help them to effectively carry out their academic tasks with ease, especially during an era of a global COVID-19 pandemic.

Table 4.8: Descriptive statistics of technostress levels with factors

Factor/Dimension	Technostress level (*N*= 385)				
	Very Low M(SD)	Low M(SD)	Moderate M(SD)	High M(SD)	Very High M(SD)
Techno-overload			3.178(0.744)		
Techno-complexity			2.843(0.900)		
Techno-insecurity			2.621(1.075)		
Techno-uncertainty			3.028(1.012)		

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; M = Mean; SD = Standard Deviation.

Again, from Table 4.8 above, all four (4) dimensions of technostress were moderate among students, but students believed that techno-overload slightly contributed more to their stress levels. Upadhyaya and Vrinda (2021) also found technostress levels among university students in India to be high in techno-overload, contrary to the findings of Essel et al. (2021), where they found technostress levels to be highest in techno-invasion. The reason for high levels of techno-overload could be due to higher levels of academic workload for students. Since the application of technology, in this case, online learning, generally pushes individuals to complete a task in a shorter time frame, quite a majority of the participants moderately agreed, due to the implementation of online learning, they had to work faster with tight time schedules, do more work than they can handle, and change their study habit to adapt to online learning, among others. This finding supports the result of Gillespie et al. (2001) who reported that the introduction of new technologies increased the workload and stress among university staff. As a result of the high volumes of academic workload, the students may consistently be working for longer hours, always online, which can further increase techno-overload. Thus, the university should look into this matter carefully to ensure that the online learning platforms used will help their students and not add more burdens to their existing workload.

Also, during the pandemic, because communication is predominantly online, students must always be connected to ICT or smartphones not to miss any vital information, have group discussions, and also receive crucial learning materials for their classes. As a result, students are found multitasking, working under pressure to meet deadlines for assignments and interim assessments, whiles at the same time dealing with a lot of information coming from colleagues and other lecturers teaching other courses. Wang et al. (2020) argued that the expectation for students to provide a reply to people around them, the notifications from social media and mobile marketing apps, not to forget the university matters reminder and information could lead to techno-overload. The way university students could avoid techno-overload is by developing appropriate coping strategies to manage the situations strategically.

Furthermore, On the extreme side, though also moderately reported, the participants believed that techno-insecurity was minimal in explaining their technostress levels. The mean score (M = 2.621; SD = 1.075) indicated low levels of technostress experienced for this dimension compared to the other dimensions. From Table 4.8, techno-insecurity was quite low compared to high levels, but it is still an issue for the university to look at since overall, it is moderate on the technostress levels rating scale. This finding may suggest that some students feel threatened they will be left behind in their studies and may be defeated by their peers who are better at online learning compared to them. This can explain why students do not like taking tests, and examinations online, or performing online activities. They feel those who are ICT-inclined will have the advantage over them to perform better than they will. As a result, students learning new skills to be able to fit into the online learning system, feel it might be a major threat to them because they are unfamiliar with some of the online learning platforms. This finding is contrary to the beliefs of Qi (2019) and Maier et al. (2019), who believe that university students are generally digital natives, who rarely are afraid to learn new skills, especially skills that are related to ICT so that they are not easily replaced or threatened by it. The ways students can overcome or minimize techno-insecurity is to find new ways to always upgrade and acquire new knowledge and skills to keep up with the frequent changes in technology. Then they will feel threatened by new online learning platforms or apps adopted variously the university and lecturers.

Research Question 2: *Is there a statistically significant difference in technostress among UEW students based on age, gender, academic level, and knowledge in ICT?*

To answer the above research question, technostress levels were compared between the different demographic profiles of students. A series of independent sample t-tests were conducted to examine whether there exist significant levels of technostress among students grouped based on age, gender, academic level, and knowledge in ICT. The hypothesis (H1, H2, H3, H4) stated in the literature review were tested. The results are presented in Tables 4.9 and 4.10 below:

Table 4.9: Technostress level among student demographic characteristic groups (N= 385)

Variables	Categories	Technostress level M (SD)	*t*-Test	*p*-Value
Age			0.374	0.709
	18 – 24	2.904 (0.687)		
	25 – 52	2.930 (0.676)		
Gender			1.326	0.186
	Male	2.882 (0.682)		
	Female	2.977 (0.677)		
Academic level			1.899	0.058
	Undergraduate	2.942 (0.678)		
	Postgraduate	2.741 (0.683)		
Knowledge in ICT			0.942	0.347
	Basic	2.930 (0.669)		
	Advance	2.832 (0.761)		

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; M = Mean; SD = Standard Deviation. Significance level (α) = 0.05, so relationships are significant at P < 0.05.

From Table 4.9 above, the median-split method was used to categorize students' ages (continuous variable) into two age categories, and that is below 25 years (18 – 24) and 25 years and above (25 – 52). H1 states that there is a statistically significant difference in the levels of technostress of students with different age groups. The results revealed that there is no statistically significant difference in technostress between students in the younger students' age group (18 – 24-year category) and the older students' age group (25 – 52-year category) (t: 0.374, $p > 0.05$). Hence, H1 was not supported. From Table 4.9, it is evident from the mean scores that technostress levels between students in the 18 – 24-year category (M = 2.904; SD = 0.687) and 25 – 52-year category (M = 2.930; SD = 0.676) were quite the same, which suggest that students in both categories experience the same levels of technology-related stress. However, out of the four technostress dimensions, the results in Table 4.10 below illustrated that students' technostress levels were statistically significant in techno-overload (t: 2.614, $p < 0.009$) only, and the older students age group (M = 3.272; SD = 0.719) experienced higher levels than the younger students age group (M = 3.076; SD = 0.757). Therefore, regarding age groups, the finding demonstrates that there is no difference in students' technostress levels and the various age groups, which finding is contrary to recent findings by Essel et al. (2021), Hauk et al. (2018) and, Upadhyaya and Vrinda (2021) who found older students experienced higher levels of technostress than younger students.

Concerning gender, H2 evaluates whether there is a statistically significant difference in the levels of technostress between male and female students. The results showed that technostress was not statistically significant between male (M = 2.882; SD = 0.682) and female (M = 2.977; SD = 0.677) students (t: 1.326, $p > 0.05$). Therefore, H2 was not supported. The finding was in contradiction to recent findings of technostress studies among students (Broos, 2005; Essel et al., 2021; Qi, 2019; Tekinarslan, 2008; Upadhyaya & Vrinda, 2021). Furthermore, out of the four technostress components, results from Table 4.10 below showed that technostress levels were not found to be higher in males than females, and vice versa, across all the dimensions. Essel et al. (2021) and Upadhyaya and Vrinda (2021) found females recorded higher technology-induced stress in techno-uncertainty and techno-complexity. Ragu-Nathan et al. (2008) and Tarafdar et al. (2014) on the contrary found technostress levels higher in males than female workers in the USA, and Chen (2015) in China.

Table 4.10: Comparison of the technostress levels related to each technostress dimension among the various student demographic characteristic groups (N= 385)

Variables	TO		TC		TIS		TUC	
	M (SD)	***t*-Test (*p*-Value)**	**M (SD)**	***t*-Test (*p*-Value)**	**M (SD)**	***t*-Test (*p*-Value)**	**M (SD)**	***t*-Test (*p*-Value)**
Age		2.614 (0.009)		0.321 (0.748)		0.810 (0.418)		0.248 (0.805)
18 – 24	3.076 (0.757)		2.859 (0.852)		2.668 (1.103)		3.014 (1.027)	
25 – 52	3.272 (0.719)		2.829 (0.939)		2.579 (1.049)		3.040 (1.000)	
Gender		0.713 (0.476)		1.186 (0.237)		1.414 (0.158)		0.490 (0.624)
Male	3.157 (0.752)		2.802 (0.929)		2.562 (1.051)		3.008 (0.996)	
Female	3.213 (0.729)		2.914 (0.838)		2.722 (1.109)		3.061 (1.041)	
Academic level		1.160 (0.247)		2.826 (0.005)		0.899 (0.369)		2.526 (0.012)
Undergraduate	3.161 (0.749)		2.891 (0.878)		2.640 (1.071)		3.076 (1.009)	
Postgraduate	3.296 (0.696)		2.500 (0.963)		2.489 (1.100)		2.681 (0.972)	
Knowledge in ICT		1.204 (0.229)		2.197 (0.029)		1.203 (0.230)		0.205 (0.838)
Basic	3.160 (0.743)		2.881 (0.885)		2.647 (1.057)		3.032 (0.994)	
Advance	3.297 (0.740)		2.582 (0.947)		2.449 (1.184)		3.000 (1.139)	

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; M = Mean; SD = Standard Deviation; TO = Techno-overload; TC = Techno-complexity; TIS = Techno-insecurity; TUC = Techno-uncertainty. Significance level (α) = 0.05, so relationships are significant at $P < 0.05$.

The third hypothesis, H3 states that there is a statistically significant difference in the levels of technostress of undergraduate and postgraduate students. Comparatively, the results showed that technology-induced stress levels among undergraduates (M = 2.942; SD = 0.678) and postgraduate (M = 2.741; SD = 0.683) students have no significant difference (t: 1.899, $p > 0.058$). Hence, we reject H3. This finding agrees with the findings reported by Shu et al. (2011). However, the finding is inconsistent with recent studies (Essel et al., 2021; Upadhyaya & Vrinda, 2021) carried out on university students amid the COVID-19 pandemic, which revealed that students' level of education and technostress levels was significant, and postgraduate students experienced higher technology-induced stress. Additionally, among the technostress dimensions, results shown in Table 4.10 above revealed that differences in technostress levels and academic levels were significant in techno-complexity (t: 2.826, $p < 0.005$) and techno-uncertainty (t: 2.526, $p < 0.012$), with techno-complexity (M = 2.891; SD = 0.878) and techno-uncertainty (M = 3.076; SD = 1.009) inducing higher levels of stress in undergraduate students. On the contrary, Essel et al. (2021) and Upadhyaya and Vrinda (2021) found postgraduate students exhibited higher stress levels than undergraduates in techno-overload and techno-complexity. The reasons why in this study, undergraduate students experienced higher technostress levels compared to postgraduates might be difficult to explain because, considering that technostress has not been extensively studied among students, there is yet a study to report similar findings. But the reasons could be that, undergraduate students find the various new apps used for online learning during the pandemic difficult to use, and especially found the university's learning management system (LMS) not to be user-friendly because of the frequent crashes of the web-based platform.

Finally, regarding students' knowledge in ICT and technostress levels, H4 evaluates whether there is a statistically significant difference in the levels of technostress of students concerning their knowledge in ICT. Before finding the difference, the median-split method was used to categorize students' knowledge in ICT into basic and advanced knowledge. The results displayed in Table 4.9 showed that the difference in technostress levels between students who have basic and advanced knowledge in ICT was statistically insignificant (t: 0.942, $p > 0.347$). The mean scores in the technostress levels among students who have basic knowledge in ICT (M = 2.930; SD = 0.669) and advanced knowledge in ICT (M = 2.832; SD = 0.761) are quite the same. Therefore, we reject H4 and conclude that there is no statistically significant difference in the levels of technostress of students concerning their knowledge in ICT. The result of this study is consistent with the findings of Qi (2019) but contradicts past research (Essel et al., 2021; Ragu-Nathan et al., 2008; Shu et al., 2011; Upadhyaya & Vrinda, 2021; Zhao et al., 2020), particularly Essel et al. (2021) and Zhao et al. (2020), who found technostress levels decreases with increased knowledge in ICT. However, concerning each technostress factor, Table 4.10 revealed that students with basic knowledge of ICT (M = 2.881; SD = 0.885) experienced significantly higher levels of techno-complexity (t: 2.197, $p < 0.029$). This finding is supported by previous studies (Essel et al., 2021; Ragu-Nathan et al., 2008; Upadhyaya & Vrinda, 2021). The finding in this study could also suggest that students who have basic knowledge in ICT find some online learning platforms, if not the LMS, adopted by the university difficult to either use or spend a lot of time learning how to use them. Students who have many years of experience with ICT or advanced knowledge in ICT are coping well with online learning, and they can depend on technology to enhance their learning, better than students with basic knowledge of ICT.

Research Question 3: *To what extent does technostress influence students' academic productivity in UEW?*

To assess the effect of technostress on academic productivity, the structural model was assessed using SmartPLS. The results are illustrated in Table 4.11 below.

Table 4.11: Results of structural equation model (N= 385)

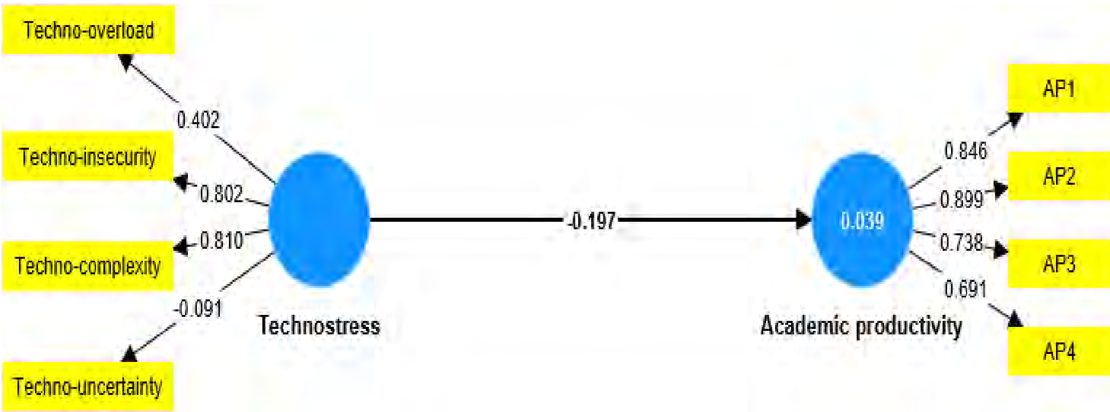
	β	SD	*t*-Test	*p*-Values
Academic productivity <- Technostress	-0.197	0.177	1.109	0.268
Techno-overload <- Technostress	0.402	0.231	1.739	0.082
Techno-complexity <- Technostress	0.810	0.377	2.152	0.031*
Techno-insecurity <- Technostress	0.802	0.380	2.110	0.035*
Techno-uncertainty <- Technostress	-0.091	0.399	0.229	0.819
AP1 <- Academic productivity	0.846	0.251	3.373	0.001*
AP2 <- Academic productivity	0.899	0.265	3.387	0.001*
AP3 <- Academic productivity	0.738	0.224	3.291	0.001*
AP4 <- Academic productivity	0.691	0.237	2.917	0.004*
Model fit indices				
SRMR	0.123			
NFI	0.799			

Source: Fieldwork (2022)

Note: *N* = Total number of Participants; β = Beta Coefficient; SD = Standard Deviation; AP = Academic Productivity; Significance level (α) = 0.05, so relationships are significant at *P < 0.05.

Table 4.11 above shows the results of the structural equation model (SEM). Standardized Root Mean Square Residual (SRMR) and Normed Fit Model (NFI) are popular goodness of fit measure in SEM using SmartPLS, Lower values of badness-of-fit measures of SRMR closer to zero indicates a good model (Kline, 2005). Hu and Bentler (1999) recommended a cut-off value of 0.08 for SRMR and 0.90 and above for NFI. Therefore, the model fit indices for SEM, suggested by Hu and Bentler (1999), which include SRMR (0.123) and NFI (0.799) were found not to be within acceptable cut-off criteria. This means the research should consider working on the constructs to arrive at the acceptable cut-off criteria, but again, some scholars have argued that SmartPLS is not good at estimating model fitness.

Figure 4.1: Structural model



Source: Fieldwork (2022)

The results of the SEM indicated a negative effect of technostress on academic productivity (β = -0.197), but the effect is statistically insignificant (t: 1.109, $p > 0.268$). This means that technostress does not have a direct negative effect on students' academic productivity. Therefore, we reject H4 and conclude that technostress has no statistically significant negative effect on students' academic productivity. The results were not consistent with past studies on technostress on different groups of users (Ayyagari et al., 2011; Hung et al., 2011; Lee et al., 2016; Tarafdar et al., 2007, 2011) This result could mean that students do not think their academic productivity has decreased because of online learning. Although results showed evidence of technostress among the student population of Winneba due to the implementation of online learning during COVID-19, students were also positive about the online learning platforms they used for lectures and academic work. The majority of students agreed their academic productivity has increased nonetheless.

Overall, among the four technostress dimensions that cause technology-related stress, technostress was induced by techno-complexity (t: 2.152, $p < 0.031$) and techno-insecurity (t: 2.110, $p < 0.035$), and among the two dimensions, techno-complexity ($\beta = 0.810$) was the highest contributor to technostress among the student population of UEW. What this means is that techno-complexity and techno-insecurity were the two dimensions that affected students' academic productivity. The contribution of the other two technostress dimensions, techno-overload (t: 1.739, $p > 0.082$) and techno-uncertainty (t: 0.229, $p > 0.819$), to technostress, were statistically insignificant, which means that techno-overload and techno-uncertainty did not have any significant effect on academic productivity. Techno-uncertainty ($\beta = -0.091$) is negatively correlated to academic productivity.

Techno-complexity induced the highest technostress probably because students lack knowledge about certain online learning platforms used in the university, such as the LMS, among other learning platforms that lecturers adopted, which only appeared during the COVID-19 pandemic. Qi (2019) stated that technology-based learning apps that are too difficult for students to understand are the main source of stress, which negatively affects academic productivity. Perhaps also, the university may have failed to offer formal training to educate students on how to use the official learning websites or platforms to be used for online learning; instead, the students are supposed to figure it out on their own. So, in conclusion, although there is a negative correlation between the moderate technostress levels found among students of UEW and their academic performance, the negative correlation was insignificant, suggesting students believe that their technostress levels do not negatively affect their academic productivity.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter is the final chapter, and it presents a summary of the entire study, stating clearly the major findings, drawing conclusions, explaining the implications of the study for the management of higher educational institutions and making recommendations, pointing out some of the limitations of the study, and then finally suggesting areas for further research.

5.1 Summary of Findings and Conclusion

The present study adds to the existing knowledge of technostress by carrying out a study on students' technostress levels in a technology-enhanced learning environment in a higher educational institution in Ghana during the COVID-19 pandemic. The following objectives guided the study: (1) to ascertain the level of technostress among UEW students in a technology-enhanced learning environment during the COVID-19 pandemic; (2) to investigate whether there is a statistically significant difference in technostress among UEW students based on age, gender, academic level, and knowledge in ICT; (3) to determine the extent of influence technostress has on students' academic productivity in UEW. The study adopted the descriptive correlational survey design. The study used a sample size of 385 students, and the non-probability convenience sampling method was used to sample these students. A self-administered structured questionnaire was used in collecting data from the students sampled. The data gathered were analyzed using the Statistical Package for Social Scientists (SPSS) and SmartPLS. Descriptive (frequencies, percentages, mean and standard deviation) and inferential (partial least square structural equation modelling) statistics were used to make sense of the data collected and the results were presented in the form of tables and diagrams.

The study found technostress to be prevalent among the student population of UEW, and overall, the level of technostress was moderate. Among the four dimensions that measure technostress, techno-overload and techno-uncertainty contributed more to students' technology-induced stress, whiles techno-insecurity was the least. The study also discovered that there was no significant difference in the level of technostress experienced by students in UEW, either based on age, gender, academic level, or ICT knowledge. Students belonging to the various demographic characteristic groups (age, gender, academic level and knowledge in ICT) experienced the same level of technology-induced stress. Lastly, the study found students' technostress levels did not influence their academic productivity. Although the results showed a negative correlation between technostress and academic productivity, that negative correlation was insignificant. This means technostress did not have a significant negative impact on students' academic productivity.

5.2 Managerial Implications of the Study

The findings of the study have several managerial implications for higher educational institutions (HEIs), especially for the University of Education, Winneba (UEW). As the results indicate a higher impact of techno-overload and techno-uncertainty, the university must plan and schedule academic work in a manner that provides adequate time to complete the academic work, and keep students posted and abreast with modification, system updates and changes to online learning platforms used in the university and by lecturers. The university can mitigate the impact of techno-complexity by choosing user-friendly, familiar educational technology, and providing adequate training for the students. They can also further mitigate the effects of techno-insecurity too by further training all students on popular apps and computer software such as MS Word, Excel, PowerPoint, Zoom, and LMS among others so that students can develop confidence over their fear and not feel threatened by ICT and colleagues who have advance IT knowledge.

It was observed that male and female students experienced moderate technostress levels with the implementation of online learning during the COVID-19 pandemic. The results are inconsistent with the results of technostress studies conducted on the student population (Broos, 2005; Qi, 2019). These studies found technostress levels to be higher in female students than the males. The fact that the study found no difference in technostress levels between male and female students does not suggest male and female students are coping with the situation. The researcher recommends that the university takes steps to further investigate and identify students who may be at risk and help them cope with the technostress. As it was also observed that older students, undergraduates, and students with basic ICT knowledge had higher levels of technostress in some of the dimensions that measured technostress levels, the university must identify and train students, with basic knowledge in ICT, during their admission to the university. The university needs to conduct technology orientation sessions to increase the familiarization of technology, that would be used in their academic work. Also, special training sessions for those with basic knowledge in ICT and older students would help mitigate technostress.

Results indicated technostress did not harm academic productivity. The result has not been consistent with the previous studies conducted in organizational contexts (Tarafdar et al., 2011a; Chen, 2015), but most importantly those studies conducted on university students (Essel et al., 2021; Qi, 2019; Upadhyaya & Vrinda, 2021). Comparing the results of this study and previous studies, it is advisable the university further examine the phenomenon by administering the technostress instrument among students, to identify the high-risk students and counsel them to keep technostress at its barest minimum. These can improve students' perception of technology use and online learning, which can translate into good academic performance. Also, if students are found experiencing higher levels of technostress, the university may assign such students to student mentors from their peer group, so that they can improve their confidence in the use of technology.

The results have implications for future employers as well. Results indicate the presence of technostress among the younger population, despite considerably higher ICT experience and popular belief that the younger generation is techno-savvy and has lesser technostress. It is necessary for employers that they do not take this group for granted and provide adequate ICT training for newly recruited employees to reduce burnout. As there are a variety of ICT applications, there is constant pressure to upgrade technical skills. Students also need adequate time to transition from academic to work life

5.3 Limitations of the Study

The study had a few limitations. Firstly, the study only focused on students on the Winneba campus, and because the researcher carried out the study to meet the requirement of a Master of Business Administration (MBA), there was limited time and resources to extend the study to other campuses such as the Ajumako campus. Secondly, the study was a cross-sectional survey, which means the researcher gathered primary data once for the analysis. The results or findings might not reflect the true nature of the variables studied among the student population because to ascertain the phenomenon, the researcher must gather extensive data over some time to reach a much more definite conclusion. Thirdly, the study only examined the effects of technostress on academic productivity. But past studies (Essel et al., 2021; Srivastava et al., 2015) have examined the impact of other variables such as personality traits, digital literacy, and technology dependence among others, on technostress and academic achievements. Then, lastly, the study did not consider finding and suggesting coping mechanisms for technology-induced stress among students during a pandemic, such as COVID-19.

5.4 Suggestions for Future Research

Based on the limitations of the study, the researcher recommends that future studies should consider extending the current study to include students studying on the other campuses of UEW, such as the Ajumako campus. Secondly, future studies should examine the impact of students' personality traits on technostress. Finally, Because the study was a cross-sectional survey, in the future, longitudinal studies are recommended to validate the causal relationships among variables studied across time.

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APPENDIX

UNIVERSITY OF EDUCATION, WINNEBA
SCHOOL OF BUSINESS
DEPARTMENT OF MANAGEMENT SCIENCES

QUESTIONNAIRE

Dear Respondent,

I am a student of UEW conducting research on **"the effects of technostress on students' academic productivity in UEW during the COVID-19 pandemic"**. The research is purely for academic purposes and any information obtained shall remain private and confidential. Your cooperation at providing data is very much appreciated. Thank you.

PART 1: Background Information

1. **Age:**_______________
2. **Gender:** Male [ ] Female [ ]
3. **Academic level:** Undergraduate [ ] Postgraduate [ ]
4. **Knowledge in ICT:** Basic [ ] Intermediate [ ] Advance [ ]

PART 2: Technostress Dimensions

For each of the following statements about technostress (techno-overload, techno-complexity, techno-insecurity and techno-uncertainty), please indicate ***(by ticking)*** *the extent to which you agree with the statements below, using the following scale:* ***1= strongly disagree, 2= disagree, 3= undecided, 4= agree*** *and* ***5= strongly agree.***

S/N	Statements	1	2	3	4	5
	Techno-overload					
1	I have to do more work than I can handle due to the implementation of online learning.					
2	I have to work with very tight time schedules due to the implementation of online learning.					
3	I have to change my study habit to adapt to online learning.					
4	I have a higher workload because of the increased complexity of online learning.					
5	I have less free time due to the implementation of online learning.					
6	I have to be in touch with my work even during vacation because of online learning.					

7	I have to work much faster due to the implementation of online learning					
8	I have to sacrifice my vacation and weekend time to keep current on the updates and new requirements of online learning.					
9	I feel my personal life is being invaded by online learning.					
	Techno-complexity					
10	I often find online learning too complicated for me to understand it well.					
11	I often find online learning too complicated for me to use it effectively.					
12	The high complexity of online learning causes me to doubt its usefulness and practicality in education.					
13	I do not have adequate knowledge of online learning to complete my homework satisfactorily.					
14	I need to spend a considerable amount of time and effort to use online learning effectively.					
15	I do not find enough time to study and upgrade my technology skills to meet the needs of online learning.					
	Techno-insecurity					
16	I am threatened by peers who have more vital online learning skills.					
17	I do not share my knowledge regarding online learning with my peers for fear of being accused of cheating.					
18	I am threatened by peers who know more about online learning than I do.					
19	I am threatened by peers who quickly adapt to the online learning environment than I do.					
	Techno-uncertainty					
20	There are frequent upgrades in online learning we use in our university.					
21	There are constant changes to the functionalities in online learning we use in our university.					
22	Our university regularly replaces one teaching and learning method with another.					

Part 3: Academic Productivity

*For each of the following statements about academic productivity, please indicate (**by ticking**) the extent to which you agree with the statements below, using the following scale: **1= strongly disagree, 2= disagree, 3= undecided, 4= agree** and **5= strongly agree.***

S/N	Statements	1	2	3	4	5
1	I am able to complete my assignments on time					
2	I am able to effectively complete all my assignments					
3	I am able to obtain pass marks in all my courses					
4	I am able to effectively make contributions in class					