The mediating effects of student satisfaction on technostress–performance expectancy relationship in university students

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Nurul Nadia Abd Aziz
Faculty of Business and Management,
Universiti Teknologi MARA Pahang Raub Campus, Raub, Malaysia, and
Mohd Amar Aziz and Noor Amira Syazwani Abd Rahman
Faculty of Administrative Science and Policy Studies,
Universiti Teknologi MARA Pahang Raub Campus, Raub, Malaysia

Abstract

Purpose – This study aimed to explore the technostress effects on the students' expectancy in their academic performance. Three main factors were used as predictors, namely techno-complexity (TC), techno-insecurity (TIS) and techno-overload (TO), to measure the students' performance expectancy via the mediating effects of student satisfaction (SS).

Design/methodology/approach – A total of 234 survey-based online questionnaires were filled by students from Universiti Teknologi Mara (UiTM). Based on the data, the hypothetical model was tested statistically using the Partial Least Square–Structural Equation Modelling (PLS-SEM), specifically the Smart Partial Least Square (SmartPLS) version 3.3.2.

Findings – The results indicated that SS mediated the relationship between TC, TIS and performance expectancy. Nevertheless, the two predictors (TC and TIS) negatively affected SS, whereas SS positively affected the performance expectancy. The findings further revealed that reducing TC and TIS could increase SS and their expectancy to achieve better academic performance.

Practical implications – This study proposed that higher learning institutions provide an innovative and user-friendly platform for the online learning environment. Consequently, this improvement could increase SS with the online learning experience and motivate them to expect better academic achievement.

Originality/value – This study also contributed to the existing literature by building and testing a technostress model and articulating the inter-relations between SS and performance expectancy.

Keywords Techno-complexity, Techno-overload, Student satisfaction, Performance expectancy

Paper type Research paper

Introduction

Performance expectancy refers to the extent to which a person believes that using the system will help them achieve success in job performance (Venkatesh *et al.*, 2003). In the context of this study, performance expectancy is conceptualised as the extent to which the students expect that using technology in online learning could help them achieve better academic performance. Presently, the coronavirus disease (COVID-19) pandemic had significantly impacted the academic world and teaching-learning methods. Students unexpectedly had to change their learning patterns and adapt to the lecturers' learning methods through online technology (Michael *et al.*, 2020). Since most university students are from Generation-Z (Gen Z), the university management has placed high expectations on their online learning ability. Unfortunately, there could be an unintentional disregard for the stress caused by technology in the students' learning process. Most significantly, the failure to identify the levels and

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types of stress students face due to technology usage in teaching and learning could affect their academic performance.

Therefore, based on the problem, this study applied the Person–Environment Fit (P-E Fit) as the underpinning theory to investigate the phenomenon. In principle, P-E fit occurs when one's personal factors (e.g. needs, skills and abilities) are compatible with environmental factors (e.g. supply, demand and value), resulting in life satisfaction and well-being. On the other hand, a P-E Misfit occurs when one's personal factors do not match the environmental factors, causing stress and affecting individual performance and well-being. Based on the P-E fit theory, stress does not solely arise from personal factors or environmental factors but due to the incompatibility of both (Wang *et al.*, 2020). In other words, the P-E Misfit theory describes a situation when stress is a result of a mismatch between one's personal factor and the environmental factor simultaneously, ultimately affecting productivity. In the current study, the researchers predicted that the misfit between students' ability (i.e. their skills using information communication technology (ICT)) and the new learning environment (i.e. using online learning) has caused technostress and eventually affected performance expectancy.

Generally, technostress happens when people are exposed to a load of information when they are in constant contact with digital devices. Hence, it creates stress or develops an unusual reaction with signs in the cardiocirculatory, psychological and neurological levels (Brod, 1984). Although there is widespread digital device usage in the academic world, few studies have examined technostress occurrence and its impact on students (Upadhyaya and Vrinda, 2020). Furthermore, Rolón (2014) stated that most technostress research applied to workers, not students. Dunn and Kennedy (2019) also mentioned that limited studies had been conducted on technostress among students, particularly university students. Hence, the first objective of this study was to predict how the technostress affected the student performance expectancy.

Nevertheless, several studies have highlighted the negative effects of technostress on academic performance (Pritchard and Wilson, 2003; Samaha and Hawi, 2016); thus there should be an intervention to reduce students' stress caused by technology. Furthermore, student satisfaction (SS) with using technology in online learning should be analysed. Notably, limited research had focussed on mediation analysis linking technostress and academic performance, and it is more challenging to find a chaining mediation analysis on performance expectancy. Although numerous studies have linked SS with academic performance (Dhaqane and Afrah, 2016; Martirosyan *et al.*, 2015; Sinclaire, 2014), past research failed to consider the mediating role of SS in the relationship between technostress and performance expectancy. Therefore, the second objective was to predict how SS could be a mediator variable on technostress, which could affect the performance expectancy.

In order to provide the systematic process of analysis, this study has been divided into seven parts. The introduction presents the phenomenon's context, the study's significance and understanding of the study's purpose. The second part is the literature review, which discusses the findings of the latest studies on technostress, SS and performance expectancy. The third part is the methodological design of the research, describing how the results were generated. The fourth part presents the results obtained, divided into two sections: assessment of the measurement model and evaluation of the structural model. The fifth part is the discussion and implication, followed by the sixth part, the limitation and recommendation for future research. The list of works cited in this study is in the last part under the bibliographic references.

Literature review

Technostress and student satisfaction

In 1984, technology stress or technostress was identified for the first time (Brod, 1984). Brod (1984) defined technostress as a modern illness of adjustment caused by a low ability to

survive new technology healthily. This fact was verified by Ragu-Nathan *et al.* (2008), who proposed technostress as the stress caused by an overload of knowledge and transmission. Besides, Tarafdar *et al.* (2019) described technostress as the stress that a person experiences from information systems usage. They argued that when people experience technostress, they either strive to accept technology or depend on it.

The most cited author in technostress defined it as the combined factors of techno-overload (TO), techno-complexity (TC), techno-insecurity (TIS) and techno-uncertainty (Tarafdar *et al.*, 2010; Tu *et al.*, 2005; Wang *et al.*, 2008). Moreover, studies on technostress and SS are vital since technostress is often related to technology, and students are technologically savvy (Jena, 2015). The issue is whether there is a significant difference between each effect of the technostress element on SS. Therefore, this study highlighted all these elements and their relationship with SS.

Techno-overload

In general, TO is one of the technostress categories. Tarafdar *et al.* (2010) defined TO as the situation where people feel that they need to do extra work in less time and difficulty. This elaboration is supported by Rolón (2014), indicating that TO occurs when people have to work extra with additional difficulty under the false assumption of thinking that technologies will assist them in completing their tasks. In other words, TO verifies the sense that people have when technology requires them to work extra in less time. Working extra relates to too much information to read in less time, requiring multitasking to complete it. Hence, people resort to using technology devices as they need to accomplish the task faster. Ayyagari *et al.* (2011) submitted that TO results from people feeling they have problems with memory issues, work overload, computer anxiety and information overload. Tarafdar *et al.* (2011) further added that people feel that they have wasted their time pointlessly needing to dig through volumes of information during TO. Furthermore, Ragu-Nathan *et al.* (2008) and Tarafdar *et al.* (2007) studied the effect of information overload due to technology and discovered its harmful influence on the user.

In higher education, the increased technology utilisation has forced students to complete all their academic assignments using technology (Upadhyaya and Vrinda, 2020). For students, technology has shifted the way of working and studying by keeping people always linked. Nevertheless, this connection has harmed them, continuously flooding them with information at one time through email, phone calls, text messages and others (Rolón, 2014). As a result of TO, being alerted at all times significantly reduces their resting time. TO also affects the students by causing them to feel the stress of deadlines, workload and feelings of insecurity with new technologies (Rolón, 2014). A student must work speedily, do extra work within severe time limits, fit modern technologies and manage commanding assignments (Tarafdar *et al.*, 2007). These circumstances negatively impact them as they need to work overtime and usually face technology interruptions during family days or vacations (Rolón, 2014).

Himma (2007) also mentioned that the volume of information has expanded over the last 40 years. Consequently, it is not easy to reduce the amount of information the users want to limit. It could be observed that people suffering from TO may also suffer headaches, musculoskeletal anxiety, exhaustion and computer anxiety. The mixed warning signs could result in health problems (Rolón, 2014). In an academic environment, Samaha and Hawi (2016) found a significant influence of mobile technology obsession on students' learning performance and life satisfaction. Besides, Pritchard and Wilson (2003) claimed that technology overload could harmfully impact students' academic performance, resulting in technostress. Based on the previous findings, the present study predicted a significant relationship between TO and SS. Therefore, the following hypothesis is proposed:

H1. There is a negative relationship between TO and SS.

Techno-complexity

Tarafdar *et al.* (2007) classified TC as the conditions where the complexity connected with technology makes users feel insufficient of their abilities, forcing them to spend time and energy understanding and recognising various technological aspects. Meanwhile, Rolón (2014) described TC as the incompetence of understanding or learning new technology and its complexity. Additionally, TC illustrates the complexity associated with the use of software or applications (Tarafdar *et al.*, 2007). Commonly, users often spend time and effort learning how to use ICT software or applications. Some users find various software, applications and functions intimidating and challenging to understand, eventually resulting in a feeling of inadequacy and inability to perform the task (Ayyagari *et al.*, 2011).

In universities, TC is best defined as the conditions where complicated technology systems force the students to spend more time understanding and knowing how to utilise new technology and upgrade their abilities to use technology. In 2014, Tarafdar *et al.* described TC as when people encounter failure to multitask or difficulty completing tasks. This type of technostress impacts productivity, in which Tarafdar *et al.* (2015) revealed that technology's complex and distressing systems negatively affect organisations and people's social lives. This fact is supported by Tarafdar *et al.* (2015), who presented an inverse connection between productivity and TC. This situation occurs due to stress when users confront their failure to deal with multiple, conflicting responsibilities or the difficulty and complexity of tasks at hand (Tarafdar *et al.*, 2007).

Elie-Dit-Cosaque *et al.* (2011) stated that employment requirements nowadays has become extra complex, whereby workers must be technologically competent to perform excellently in their office. In the academic world, the current generation of students is frequently described as digital natives since they enjoy technology confidently from being familiar with the latest technology (Prensky, 2007). Hence, the students might not suffer from TC as technology must be used in their education. Technology also becomes part of their lives since they already conquered and use it in their daily lives.

Prensky (2007) mentioned that the modern generation had created productive learning patterns, multitasking and teamwork. Therefore, they have adequate technology skills and could adjust to technology changes (Joo *et al.*, 2016). This argument is in line with Hauk *et al.* (2019), who found that compared to younger adults, older adults face greater difficulty in applying technology, which involves considerable intellectual skills and physical conditions. Based on the above arguments, students who experience TC could be less satisfied with online learning. In contrast, students who experience less TC could be more satisfied with online learning. Thus, the following hypothesis is proposed:

H2. There is a negative relationship between TC and SS.

Techno-insecurity

The other type of technostress is TIS. Tarafdar *et al.* (2007) expressed that TIS arises when technology users feel that they could lose their position to other people who have a better knowledge of advanced technology instruments. Presently, technology usage keeps increasing daily, causing organisations to prefer employing people who can use technology well. Hence, employers will consider recruiting younger candidates with familiarity and high technical skills in technology.

Nevertheless, workers could encounter insecurity, leading to stress and tension. As technology continually upgrades and changes, users are required to constantly learn new skills and systems (Ayyagari *et al.*, 2011). As a result, some users find this situation troubling, feeling anxious and discouraged as their knowledge becomes outdated (Ayyagari *et al.*, 2011). Stress also happens when users feel frightened about losing their careers from being replaced by technology or someone with better technological skills.

Currently, universities implement more and more technological products as devices in teaching programmes, which could improve students' learning atmosphere. Admittedly, technologies could enhance students' capabilities in an educational society. One of the university's objectives is to train students for their future lives and occupations. Lindsey (2017) submitted that once they graduate, they will enter a work market whereby employees in various fields are expected to master technology to sustain their work. Unfortunately, the inability to cope with the latest technology causes dissatisfaction, which worsens when their friends can cope with the said technology. Hence, the students will feel insecure because their friends are better than them.

Brynjolfsson and McAfee (2014) verified that today's graduate students in the labour force are affected by technological innovation and continuous advancement that require workers to be technically proficient. Hence, if students fail to cope with the technology, they cannot prepare for the future working environment. From the above discussion, students who experience TIS have lower satisfaction towards online learning. Therefore, the following hypothesis is submitted:

H3. There is a negative relationship between TIS and SS.

Student satisfaction and performance expectancy

Students' academic performance in higher education is influenced by various factors such as socioeconomic, emotional and surrounding. Therefore, these elements allow the administrator to evaluate the usefulness of their teaching methods and simultaneously provide an indicator of SS (Kader *et al.*, 2020; Martirosyan *et al.*, 2015). Besides, Njoroge *et al.* (2012) defined satisfaction as a concept that has been used in the technology ground, adding that it is frequently linked with the acceptance or rejection of technology. Martirosyan *et al.* (2015) stated that when students are satisfied, it enhances their academic performance and outcomes. Additionally, Dhaqane and Afrah (2016) found that satisfaction promotes academic achievements and student retention. Nevertheless, Tang and Austin (2009) revealed that although technology is a useful teaching device, its use in classrooms does not guarantee increased SS or performance. The above findings imply that SS is essential, and thus crucial attention should be directed to their performance-related issues (Suldo *et al.*, 2015).

According to Sinclaire (2014), SS results from the learning process, and it is a condition for a successful education at the tertiary level. Thus, SS improves academic performance, motivates them to work more and improves their class performance. This fact is supported by Lo (2010), claiming that higher SS requires challenging instructional techniques that will trigger their thinking and learning. Moreover, Winberg and Hedman (2008) stated that identifying SS is vital to ensure students' academic performance. This study posited that students who are more satisfied with online learning have high expectations of their academic performance. Hence, it is proposed that:

H4. There is a positive relationship between SS and student performance expectancy.

Student satisfaction as mediator

Tarafdar *et al.* (2010) stated that the ICT end users who are dissatisfied with the stress level caused by technology could limit their ICT use to the lowest possible levels. Hence, their productivity and innovation for tasks that require the use of ICT become low. Additionally, Varmosi *et al.* (2004) interviewed students to determine satisfaction with different learning delivery modes. In this interview, the students had to report their effectiveness and comfort level in using technology. In a study on SS with Internet-based Master of Public Administration courses, Arbaugh (2000) used a survey method that obliged students to report their perceived level of satisfaction using the Internet as a delivery method. Students

with higher self-reported grade point average (GPAs) had lower expectations for projectors used as teaching aids (Tang and Austin, 2009).

These findings proved that although technology can be a helpful teaching tool, its use in classrooms does not guarantee improved SS or performance and could even affect their disengagement from the content taught in classrooms (Tang and Austin, 2009). Therefore, this study identified whether SS with online learning could improve their academic performance. In this current study, SS mediated the influence of technostress dimensions on performance expectancy. Therefore, the following hypotheses are presented:

H5. SS mediates the influence of TO on performance expectancy.

H6. SS mediates the influence of TC on performance expectancy.

H7. SS mediates the influence of TIS on performance expectancy.

Methodology

Research framework

Based on the literature, a research model was developed to examine the influence of technostress on SS and its indirect relationship with performance expectancy through SS. Figure 1 shows the conceptual framework of the current study.

This study proposed a conceptual framework for a specific model designed to explain the relationship between technostress, SS and performance expectancy. This study also presented a theoretical framework created to analyse the stress experienced by university students due to the implementation of online learning. This framework was then used to determine how this variable could impact SS and performance expectancy. The hypothetical framework illustrates the essential constructs included in this study to guide further discussions. Furthermore, it is posited that SS towards online learning mediates the relationship between the three dimensions of technostress and performance expectancy.

Research design

This study applied a quantitative cross-sectional research design. Several scholars have argued that the cross-sectional design might not be an appropriate method to study the causal connection (see, e.g. Katz, 2001). Nonetheless, this study analysed the cross-sectional data to understand the causal effect of technostress on student performance expectancy. Subsequently, the criteria suggested by Wunsch *et al.* (2010) and Spector (2019) were considered before choosing a cross-sectional design as a choice method for data collection analysis. The mentioned criteria highlighted by Spector (2019) are (1) exploratory research,

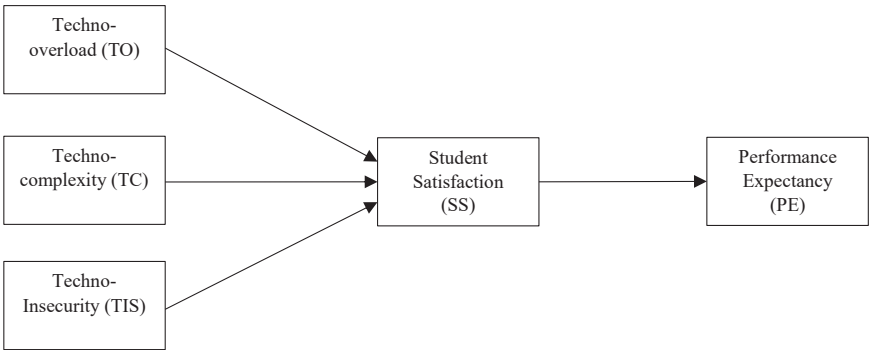

Figure 1.
Conceptual framework

(2) not knowing the exact timeframe and (3) examining the natural effects on students. Thus, the cross-sectional design became the appropriate method of choice applied in this study.

Instrument

The questionnaire was adopted from previous researchers (Aziz and Yazid, 2021; Aziz *et al.*, 2021; Li and Wang, 2020), consisting of 39 items that measure seven variables and ten questions on demographic factors. Three dimensions of technostress, namely TO, TC and TIS, were measured in 22-items with a ten-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (10). Meanwhile, seven items measured SS, and seven items measured performance expectancy using the ten-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (10). The other ten items were related to personality traits using the ten-point Likert scale ranging from "not at all like me" (1) to "extremely like me" (10). Although the original Li and Wang (2020) used the five-point Likert scales, however, this study changed it to the ten-point scales. As recommended by Chyung *et al.* (2017, p. 20), "the 10-point scales score best, followed by the 7-point and 9-point scales". Wu and Leung (2017, p. 5) also stated, "increasing the number of Likert scale points will bring the scale closer to the underlying distributions with lower values of Kolmogorov–Smirnov (KS) statistics". Apart from that, increasing the number of points also will bring the scales closer to the continuous distribution (Hodge and Gillespie, 2007; Leung, 2011; Wu and Leung, 2017). Therefore, it is reasonable to use ten-point scales for this study and its analytical tool. As supported by Dawes (2008), 5, 7 or 10-point scales are all comparable for analytical tools such as structural equation models.

Sampling procedure

In this study, 400 online questionnaires (using Google Forms) were randomly distributed to UiTM students experienced with open distance learning (ODL) processes in order to assess the developed model and test the hypotheses. The 400 students were selected based on systematic random sampling from the list of students in the Faculty of Business Studies, UiTM Pahang branch, Raub campus. Based on this sampling method, it was expected that all the students had an equal chance to be randomly selected as a respondent in this study. Out of 400 questionnaires, 245 students responded, and only 234 of the returned questionnaires were useable for analysis. This number is considered adequate since the G*Power application suggested that 129 minimum samples are required based on four predictors in the model with a 0.05 estimated probability of error. Therefore, 234 samples are moderately higher than the minimum number required and adequate for further analysis. These 234 random samples then became a generated set of samples, which was resampled using the bootstrapping procedure in PLS-SEM. A resampling of 5,000 samples was used in the bootstrapping procedure following Hair *et al.* (2017). Using larger number of bootstrap replicates is advisable because it will make the estimates of confidence interval more robust and stable as the number of bootstrapping samples increases (Hair *et al.*, 2017).

Participants

The sample of this study is based on 234 diploma students in UiTM. Gender distribution indicated the dominance of female respondents with 109 (46.6%) being male respondents and 125 (53.4%) being female respondents. All of the students are at the diploma level from UiTM Pahang Branch Campus. During the implementation of ODL, they were in their hometowns due to the Malaysian government's Movement Control Order (MCO). Thus, 45% of the students pursued ODL from suburban areas, 41% pursued ODL from urban areas, while 14% were in ODL from rural areas. The three most widely used ODL teaching methods are the Learning Management System (e.g. Google Classroom, U-Future, Microsoft Team), video

conference applications (e.g. Hangouts, Meet, Zoom, Webex, Whatsapp video, Microsoft Team) and social media/Web 2.0 technologies (e.g. Facebook, Instagram, Youtube, Twitter, WhatsApp, Telegram).

Data analysis and results

In this study, PLS-SEM was used to assess the research model and operation using the SmartPLS version 3.3.2 application (Ringle *et al.*, 2015). PLS-SEM was chosen since it can identify the effect of technostress on SS and performance expectancy. The analysis comprises a two-staged approach: (1) the assessment of the measurement model and (2) the assessment of the structural model (Hair *et al.*, 2017). The model was confirmed as valid and reliable in the first stage (measurement model) and then proceeded to the second stage (structural model) for hypothesis testing.

Assessment of measurement model

The measurement model was conducted to assess the validity and reliability of the construct in the model. In this stage, several aspects must be evaluated to ensure the model's validity, namely the indicator loadings, internal consistency reliability, convergent validity and the model's discriminant validity. Firstly, the indicator loadings were examined in the analysis process, whereby the recommended acceptable threshold for indicator loading should be above 0.70. However, according to Hair *et al.* (2017), loading below 0.70, between 0.40 and 0.70, should only be considered for removal if it increases the internal consistency or the convergent and discriminant validity above the threshold value. In this particular study, four indicators (TIS5, TIS6, TIS7 and TIS2) under the TIS construct were omitted orderly from it due to the loadings of the indicators reaching below the recommended threshold, which affected the internal consistency and reliability. Meanwhile, the remaining indicators had loadings above the recommended threshold, as shown in Table 1.

Next, the internal consistency reliability and the convergent validity of the model were assessed. The internal consistency reliability was calculated using the composite reliability (CR), while the convergent validity used the average variance extracted (AVE). In Table 1, both measure indices (CR and AVE) were higher than the evaluation criteria, which were above 0.70 for CR and 0.50 for the AVE index (Hair *et al.*, 2017), specifying that the model had reliable internal consistency and convergent validity.

Furthermore, the discriminant validity was assessed using the heterotrait–monotrait ratio of correlations (HTMT). It should be noted that the HTMT is a robust and alternative method for evaluating the discriminant validity compared to the Fornell–Larcker criterion and cross-loadings method (Hair *et al.*, 2017; Henseler *et al.*, 2014). The acceptable HTMT discriminant validity threshold was achieved when the HTMT value fell below 0.90 in a liberal HTMT approach (Henseler *et al.*, 2014). Therefore, Table 2 illustrates that all the values were below 0.90 indexes, considering that it does not have any discriminant validity issue.

Assessment of structural model

After the measurement model was confirmed as valid and reliable, the structural model was assessed. In this stage, the hypotheses were tested to explore the significance of the structural model relationships. Before examining the model's significant relationship, it is first ensured that the model does not have any collinearity issues between the predictor constructs. In order to detect any collinearity issues among constructs, the variance inflation factor (VIF) method was used to measure the collinearity index. When the VIF values of the constructs are below 5.0, the model does not have any collinearity issues. However, when the value is higher than 5.0, then the construct should be considered for removal (Hair *et al.*, 2017). Table 3 shows that

Construct	Indicator	Loadings	CR	AVE
Techno-overload	TO1	0.843	0.956	0.708
	TO2	0.852		
	TO3	0.804		
	TO4	0.893		
	TO5	0.789		
	TO6	0.890		
	TO7	0.862		
	TO8	0.814		
	TO9	0.819		
Techno-complexity	TC1	0.902	0.951	0.766
	TC2	0.911		
	TC3	0.918		
	TC4	0.863		
	TC5	0.796		
	TC6	0.856		
Techno-insecurity	TIS1	0.792	0.904	0.613
	TIS3	0.712		
	TIS4	0.719		
	TIS8	0.823		
	TIS9	0.851		
	TIS10	0.790		
Student satisfaction	SS1	0.921	0.969	0.819
	SS2	0.892		
	SS3	0.909		
	SS4	0.916		
	SS5	0.926		
	SS6	0.879		
	SS7	0.893		
Performance expectancy	PE1	0.910	0.972	0.833
	PE2	0.943		
	PE3	0.920		
	PE4	0.937		
	PE5	0.917		
	PE6	0.910		
	PE7	0.851		

Table 1.
Measurement model assessment result

	TO	TC	TIS	SS	PE
Techno-overload (TO)					
Techno-complexity (TC)	0.742				
Techno-insecurity (TIS)	0.776	0.829			
Student satisfaction (SS)	0.578	0.621	0.639		
Performance expectancy (PE)	0.540	0.597	0.581	0.883	

Table 2.
Discriminant validity using HTMT ratio

all the model constructs had VIF values below 5.0, providing confidence that the developed model was not affected by the collinearity.

Next, a bootstrapping procedure was conducted to analyse the significant relationship between the model based on hypothesis testing. A resampling of 5,000 samples was used in the bootstrapping procedure based on Hair *et al.* (2017). Table 3 shows that only three hypotheses' relationships (H2, H3, and H4) indicated significant results. For H2 and H3, TC and TIS were negatively significant to SS with ($\beta = -0.239$, $p < 0.05$) and ($\beta = -0.332$,

$p < 0.01$), respectively. These negative relationships signified that increasing the TC and TIS reduces SS with online learning. However, TC ($f^2 = 0.38$) and TIS ($f^2 = 0.62$) only produced a small effect size on SS when the f^2 value was between 0.02 and 0.34 (Hair *et al.*, 2017). This result indicated that increasing the TC, such as whether the students would need to use sophisticated or less user-friendly application in open-distance learning, would reduce the SS on the learning process. The same implication also occurred for the TIS, such as if the students needed to register to use insecure application or portal for the process of learning; this action would reduce their satisfaction. On the other hand, H4 had a large positive effect ($f^2 = 1.361$) on performance expectancy with ($\beta = 0.793$, $p < 0.01$), proving that SS is an important factor toward student performance expectancy. Therefore, this study provided the evidence that the instructors or lecturers needed to create a conducive remote-learning environment in order to increase the level of students' satisfaction or online learning (see Figure 2).

In terms of indirect effect, the mediation analysis method was applied based on Preacher and Hayes (2004, 2008) and Hayes (2018). The indirect effect for mediation was tested by performing a bias-corrected bootstrapping procedure, and this method is considered powerful in detecting the mediation. Thus, Table 4 shows that the two hypotheses (H6 and H7) posited significant results, whereby SS mediated the relationship between TC and

Hypothesis	Relationship	Coefficient	Std.dev	*p*-values	f^2	VIF	Support
H1	TO → SS	−0.141	0.089	0.115	0.014	2.556	NO
H2	TC → SS	−0.239	0.099	0.016*	0.038	2.649	YES
H3	TIS → SS	−0.332	0.088	0.000**	0.062	3.125	YES
H4	SS → PE	0.793	0.048	0.000**	1.361	1.744	YES

Note(s): *$p < 0.05$, **$p < 0.01$

Table 3.
Structural relationship and hypotheses testing

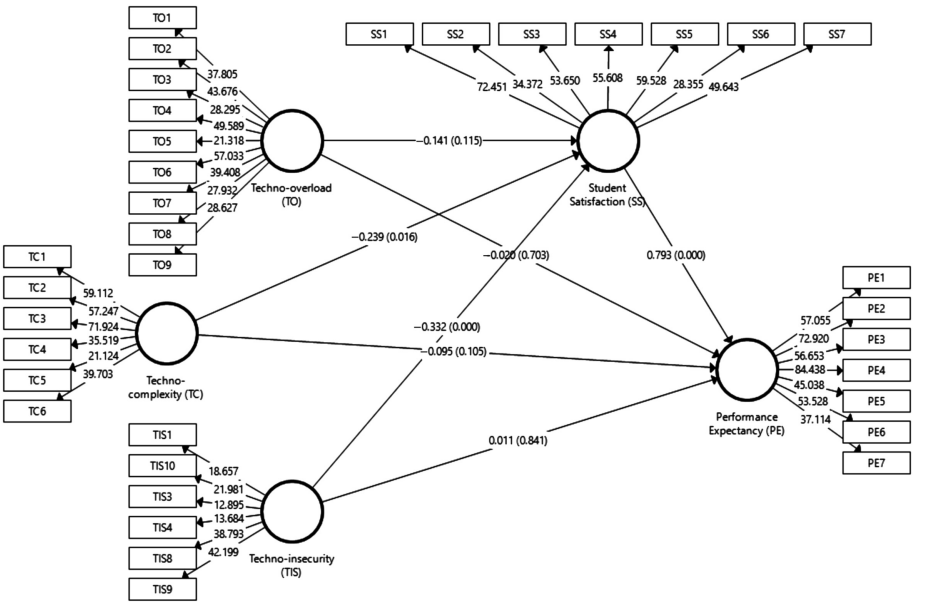

Figure 2.
Result of PLS analysis

performance expectancy and for TIS and performance expectancy with ($\beta = -0.189$, $t > 1.96$, $p < 0.05$) and ($\beta = -0.263$, $t > 2.58$, $p < 0.01$), respectively. The results indicated that the significance of SS in online learning is a factor in mediating the relationship between technostress and student performance expectancy. Therefore, from this result, this article provided a hard evidence for instructors or lecturers to manage the technostress during the remote learning in order to control the level of student satisfaction. This is because, increasing student satisfaction would increase their performance expectancy.

Hence, increasing TC and TIS reduces SS, whereas increasing satisfaction increases the performance expectancy and vice versa. Although the mediation analysis is a full or complete mediation, contemporary literature suggested abandoning this concept since it provides only a small value (Hayes, 2018; Hayes and Rockwood, 2016; Rucker *et al.*, 2011). Besides, claiming a full mediation implies that researchers have explained the completed process, and thus no additional research is needed to explore further mediators. Therefore, this study only reported the indirect effect as statistical evidence for mediation as per Hayes (2018) and Zhao *et al.* (2010).

In addition, the endogenous constructs' predictive power was measured by calculating the coefficient of determination (R^2). The R^2 coefficient value explains the amount of variance from exogenous constructs to the endogenous, whereby according to Hair *et al.* (2017), R^2 values of 0.75, 0.50 and 0.25 for the endogenous construct, respectively, were described as substantial, moderate and weak. The SS construct was explained with 42.7% of variance from the exogenous constructs or the R^2 value of 0.427. This value is considered a weak predictive power from the predictor constructs. Regarding performance expectancy, the R^2 value is 0.735 or 73.5% of variance explained, which is regarded as a moderate predictive power by the predictor constructs.

Besides the model predictive power, Hair *et al.* (2017) suggested that researchers should conduct Stone–Geisser's Q^2 predictive relevance using a blindfolding approach. Blindfolding results with the omission distance of seven have indicated that both constructs' values were above zero, wherein the SS Q^2 value is 0.343 and performance expectancy Q^2 value is 0.604. This result proved that the developed model is predictively relevant.

Discussions and implications

The current study aimed to examine the effect of the three technostress dimensions on SS and performance expectancy. Additionally, the study investigated whether SS positively impacted the relationship between technostress dimensions and performance expectancy. As noted previously, a multitude of research was conducted on the effect of technostress on satisfaction, and the results were relatively consistent. However, few studies have highlighted how to measure the individual impact of the three dimensions of technostress (i.e. TO, TC, TIS) on SS, specifically among university students.

Therefore, this study applied the P-E Fit as the underpinning theory in testing the model of technostress on performance expectancy. The result concluded that P-E Misfit supported the condition of remote-learning environment. Students who were not compatible with the technology felt burdened by the TC and TIS, in turn affecting their satisfaction with the

Hypothesis	Relationship	Coefficient	Std.dev	*t*-values	*p*-values	Support
H5	TO → SS → PE	−0.112	0.072	1.568	0.119	NO
H6	TC → SS → PE	−0.189	0.080	2.444	0.018*	YES
H7	TIS → SS → PE	−0.263	0.073	3.572	0.000**	YES

Note(s): *$p < 0.05$, **$p < 0.01$

Table 4. Mediation effect testing

learning environment. Hence, lecturers or instructors should use a simple and user-friendly application to create an interactive online learning process. However, technology overload did not significantly affect student satisfaction. This means that, in the online-learning environment, the students were able to cope with many tasks; however, the complexity of technology and insecurity affected their satisfaction. Thus, controlling student satisfaction can be managed by using a simple or less complex application and also by increasing the security of the system. Managing the students' satisfaction is important because based on the study, it is a key driver to increase the students' expectancy performance.

The specific result can be seen in Table 3, which indicates that TO has no significant effect on SS. This was possibly because the students were from Gen Z. Due to this fact, they could not have experienced any problems in learning faster and longer due to exposure to technology at a young age (Prensky, 2007). In addition, online learning is more flexible than face-to-face learning, and hence the students are not burdened with a tight lecture schedule. Most lecturers commonly provide lecture slides with voice note attachments before class begins so that students could read and understand the content anytime and anywhere. The findings also proved that the students' personal lives are not affected by online learning, and they still have free time to do other activities.

This study also revealed that TC and TIS were significant to SS. The results implied a negative relationship between TC and SS and between TIS and SS. In other words, the higher the TC and TIS experienced by students, the lower the SS toward online learning. Nevertheless, TC and TIS only produced a small effect on SS. Next, SS had a significant impact on performance expectancy. The results in Table 3 indicated that SS is an essential factor that influenced performance expectancy. The findings in this study were consistent with the findings of previous researchers (Winberg and Hedman, 2008; Sinclaire, 2014), who discovered that SS positively impacted academic performance.

This study also validated the mediating role of SS toward online learning and performance expectancy. It was found that TC and TIS were negatively associated with SS. On another note, SS had a positive relationship with performance expectancy. Hence, the higher the TC and TIS, the lower the SS and the lower the performance expectancy. Essentially, SS impacted performance expectancy by controlling the stress that stems from using technology in online learning. Moreover, improving SS will increase the performance expectancy when dealing with TC and TIS.

As predicted in H6 and H7, SS was a chaining mediator in the path of TC and TIS and performance expectancy. Additionally, TC and TIS affected performance expectancy through direct effects and indirectly influenced performance expectancy through SS. Thus, to increase the performance expectancy, TC and TIS should be controlled at the beginning of the chain. Subsequently, SS is increased, which eventually improved performance expectancy. In a nutshell, this study promoted higher learning institutions to provide user-friendly and innovative platforms that reduce the complex interfaces and enhance security in the online learning process. These innovative platforms could produce a conducive online learning environment, and students could gain an exciting online learning experience, simultaneously stimulating their satisfaction with online learning activities. Based on these findings, increased SS will also increase their performance expectancy. Therefore, an innovative online learning platform could motivate students to perform better in their academic achievement.

Limitations and recommendations for future research

This study has several limitations. Firstly, the respondents were only limited to undergraduate students of UiTM. Therefore, the results of this study should not be generalised as students at other universities in Malaysia also experience technostress. Future researchers should consider the possibility of significant differences in culture and support

systems adopted by other universities in online learning implementation. Secondly, this study was conducted during the first semester of online learning during the COVID-19 pandemic, when Malaysians were under the MCO.

Thus, it is expected that the students' first experience of following online learning could result in cultural shock for some students and cause great concern in their academic performance. The students could also experience stress from using technology in learning and from the lack of support from peers, lecturers and even their family members. Future research could also benefit from specifying the varying effects of technostress dimensions and linking them theoretically with student-related outcomes such as student acceptance and intention to use online learning and student academic performance. Specifically, future researchers should observe how university students and university management overcome technostress challenges. Besides that, future research needs to discuss the arisen behavioural change due to the COVID-19 outbreak. As a result, the possibility of mediating effects could be taken into consideration.

Conclusion

The purpose of this study was to explore the technostress (TC, TIS, TO) effects on the students' expectancy in their academic performance among UiTM students. Because of the dramatic growth of the Internet, other multimedia devices and communication systems, technology usage has accelerated, underlining the necessity to research the relationship between technostress and students' performance. The finding indicated that TC and TIS were significantly correlated with SS. In contrast, TO had no significant effect on SS. These results also suggested that SS mediated the relationship between TC, TIS and performance expectancy. Online methods in recent years have replaced traditional methods of studying and teaching. Online quizzes, PowerPoint presentations and other technology-based learning methods are becoming more popular among students. Consequently, students and educators must be aware of each other's preferred learning styles to improve student academic achievement.

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About the authors

Dr Nurul Nadia Abd Aziz is a senior lecturer in the Faculty of Business and Management at Universiti Teknologi MARA Cawangan Pahang Kampus Raub, Malaysia. She holds a PhD in Business

Management from Universiti Teknologi MARA, Malaysia. Her research interest is related to gender issues. Some studies on gender issues have been carried out, such as women's well-being, financial well-being, domestic violence cases against women, family–work conflicts, women's participation in the workforce and the latest concerning women entrepreneurs. Nurul Nadia Abd Aziz is the corresponding author and can be contacted at: nurul_nadia@uitm.edu.my

Dr Mohd Amar Aziz is a senior lecturer in the Faculty of Science Administrative and Policy Studies at Universiti Teknologi MARA Pahang, Kampus Raub, Malaysia. He received his PhD in Public Administration from School of Government, Universiti Utara Malaysia, and his research interests are mainly focused on issues in institutional development and innovation management in public sectors.

Noor Amira Syazwani Abd Rahman is a lecturer at the Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA Cawangan Pahang Kampus Raub, Malaysia. She completed her degree in Administrative Science at University Technology Mara, Shah Alam. Later she completed a double master in Public Administration at University Malaya and University Technology MARA, respectively. She published several papers in journals and chapters in books and presented various academic and research-based papers at several national and international conferences. Her research interest is related to public administration and public policies.