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Examining the adoption of technology-enhanced learning in universities and its effects on student performance, satisfaction, and motivation

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ABSTRACT

The integration of technology in Higher Education has witnessed substantial growth in recent years. While extensive research has explored the collective educational implications of Technology-Enhanced Learning (TEL) at universities, there remains an incomplete understanding of its effects on individual students when viewed through the lens of Person-Environment misfit theory and technostress. This paper aims to fill this gap by examining the impact of student and university misfit when adopting TEL and technostress on students' performance, satisfaction, and motivation. Utilizing a quantitative survey, we gathered data from a sample of 332 Higher Education students in the UK. The results reveal the significant influence of student and university misfit in adopting TEL on academic performance, satisfaction, and motivation. Moreover, the findings highlight the mediating role of technostress in these intricate relationships. Our research indicates that technostress stems not from the use of technology itself but from the misfit between students and the university learning environment. To address this, universities should enhance students' sense of belonging by offering additional pastoral and academic support. Moreover, providing training to boost students' digital confidence and skills is crucial. Creating a psychologically healthy technology-enhanced learning environment will ensure a more pleasant learning experience, alleviating student technostress.

1. Introduction

Recent research in the academic sector has focused on the impact of Technology Enhanced Learning (TEL) [1,2]. There is no doubt that introducing technology into education has had a profound impact on the processes of teaching and learning [3]. Research has demonstrated that students generally have a positive attitude towards the use of technology in online learning [4]. As stated by Cheng [5], online learning can overcome many of the limitations of traditional classroom learning. However, recent studies are highlighting challenges concerning student learning experience from the rapid adoption of online learning and teaching [6].

While TEL provides numerous benefits to students compared to traditional face-to-face learning, including added convenience, flexibility, and access to quality learning materials, many students have been adversely affected by the shift from face-to-face learning to online platforms [7]. The integration of technology may pose challenges for students who find themselves grappling with the rapid pace of technological advancements. When a student feels that they do not fit seamlessly into the learning environment at universities, especially in terms of acquiring proficiency with technology tools, it becomes imperative to explore how this sense of misalignment influences their academic learning. The reliance on technology in teaching and learning processes may inadvertently contribute to technostress among students. This technostress can arise due to the evolving criteria and expectations associated with technological tools, heightened demands for time and

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effort, and the escalating requirements for enhanced self-learning and time management skills.

Consequently, understanding the nuanced ways in which students perceive and adapt to these technological changes is crucial for a comprehensive examination of the impact on students. Despite many research studies examining student and university misfit and technostress, there has been limited research discussing the relationships among them and considering the effects of Person and Environment (P-E) misfit theory in universities while adopting TEL, more specifically. Similarly, very limited research focus has examined student and university misfit impacts on student academic performance, student satisfaction and study motivation through technostress in a sample of students in UK context adoption TEL.

Therefore, to address this gap, the aim of this research is to investigate the relationships among (P-E misfit theory, technostress, and student outcomes in the context of TEL adoption in higher education, specifically focusing on academic performance, satisfaction, and motivation among UK university students.

The objectives of this study are as follows:

1. To examine the impact of P-E misfit theory on student academic performance, satisfaction, and motivation of TEL adoption.
2. To assess the role of technostress among the relationship between P-E misfit and student outcomes in TEL environments.
3. To investigate the effects of technostress on student academic performance, satisfaction, and motivation in the context of TEL adoption.
4. To explore the interplay between student-university misfit and technostress in influencing student outcomes in TEL environments.
5. To provide theoretical and practical insights into the holistic student experience in technology-enhanced learning, with a focus on addressing challenges related to P-E misfit and technostress.

This study proposes a framework that investigates the relationships between P-E misfit in higher education, technostress, academic performance, student satisfaction and study motivation. Based on the research findings from 332 survey samples, we argue that academic performance, student satisfaction and study motivation are significantly influenced by student- university learning environment misfit while adopting TEL and experiencing technostress. In addition, technostress is hypothesized to have a mediating role, and the increased technostress effects would cause poor academic performance, dissatisfaction and demotivation when relying on too much technology. This investigation illuminates the dynamic interplay between the learning environment, technological demands, and the resulting technostress, providing valuable insights into the holistic student experience in the context of technology-enhanced online learning.

Our study makes several distinctive contributions to the existing literature on technology enhanced learning, particularly in the operationalization and measurement of student-university learning environment misfits and technostress. Firstly, unlike previous research that often focuses on broad conceptualizations of either misfit or technostress, our study adopts a comprehensive approach by integrating Person-Environment (P-E) misfit theory, which offers a systematic framework for understanding the interplay between individual student and learning environmental factors. This theoretical lens allows us to delve deeper into the specific dimensions of misfit within the university learning environment and their impact on student outcomes. Importantly, our study reveals that technostress plays a mediating role between misfit of students and universities with TEL impacting student performance, satisfaction, and motivation. This novel finding highlights the importance of considering technostress as a crucial mechanism through which misfit impacts student experiences and highlights the need for tailored interventions to mitigate its effects. Additionally, we employ a subtle set of measurements tailored to capture the multifaceted nature of student and university misfit in adopting Technology Enhanced Learning, technostress, academic performance, student satisfaction and study motivation. By utilizing these refined measurements, we provide statistical analysis of the complexities surrounding misfits and technostress within TEL environments, thereby offering novel insights and advancing the scholarly discourse in this area. Our research contributes valuable insights to both the theoretical framework of P-E misfit theory and practical strategies for improving the student experience in TechnologyEnhanced Learning environments.

2. Literature review

2.1. Person-Environment (P-E) fit theory

Person-Environment (P-E) fit theory is the congruence between the person and environment [8]. P-E fit occurs when there is a match between personal factors (i.e., personalities and abilities) and environmental factors (i.e., organisations, tasks, people). It often leads to positive outcomes such as improved performance, satisfaction, and motivation [9].

Person- environment fit theory in higher education was studied under different aspects, such as students' fit with tutors, other students, or the accommodation they live in Pervin [10] firstly investigated P-E fit, examining student perceptions of themselves and their universities. Since then, many studies conducted in a higher education context reveal that P-E fit has a positive influence on students' wellbeing, success and engagement [11]. Better P-E fit was related to increases in self-esteem, satisfaction, and performance (achieving higher grades) [12,13]. Good fits lowers student stress levels and reduces the chances of withdrawal. Thus, in the pursuit of a university degree it is important that students choose a university that is a good fit for them [14]. However, there is a dearth of studies in the higher education sector focusing on P-E misfits [15]. There is need to gain a better understanding of the effects of misfit between student and universities, specifically, the discrepancies between students' needs and how their university provides an environment that meets their needs. In this study, our focus and discussion are student misfit with university while adopting TEL learning environment. P-E theory reveals that stress does not emerge from the person nor the environment, but from misfits between the two. Misfit causes an individual stress and reduces their performance [16]. Though it can be argued that misfit results in negative outcomes, it is not clear how university students react to and cope when a misfit takes place, particularly while learning using technology. Similarly, it is not clear how students' academic performance, satisfaction and study motivation are impacted through student and university misfit in adopting TEL.

2.2. Technostress

Technostress was first introduced by Brod in 1984, in his book titled 'The Human Cost of the Computer Revolution'. It defined technostress as: "A modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner" [17]. Chiappetta [18] categorised the most common technostress symptoms into physical and mental symptoms, for example, physical symptoms include headaches, fatigue and sweating, whereas mental symptoms can include depression and anxiety. Technostress creators are perceptions of elements that are likely to produce stress [19]. They categorised technostress creators into five stress-producing dimensions: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. Techno-overload describes situations where ICTs force users to work faster and longer. Techno-invasion is the ability of technology to invade a student's personal life, by causing an imbalance in their work-life balance, often referred to as a result of being "always connected" [18]. Arguably, this is the most influential technostress creator, as students are avid technology users, and they may struggle to escape their university work. Techno-complexity refers to the complex features of technology that can make a student feel inadequate and lead to an

increase in time spent learning how to use the technology required for online learning. Techno-insecurity is a feeling of worry and a threat of being replaced by someone with better skills. Techno-uncertainty describes when students feel the upgrades in technology mean they are constantly learning and adapting to the changes [19].

2.3. Academic performance, satisfaction, and motivation

Academic performance is used as one of the most important indicators presenting students' success in universities [20]. It generally shows students' overall academic abilities, such as problem-solving, university assessments/tasks and academic affairs [21]. Academic performance could be influenced by many factors such as students' creativity, critical thinking, motivation, learning independence and social environment.

Student satisfaction is defined as "a short-term attitude resulting from an evaluation of students' educational experience, services and facilities", and it is a multi-dimensional process that can be affected by many factors [22]. The investigation of student satisfaction has received scant attention over the last decade [23]. Westermann et al. [24] identified a scale to measure the students' study satisfaction that includes 1. Satisfaction with the study content. 2. Satisfaction with study conditions and 3. Satisfaction with the way they are coping with study burdens. The students' satisfaction could result from the value congruence, which is the match between an individual's basic beliefs and systems' existing cultural patterns [25].

Motivation can be described as the "psychological regulatory mechanism that refers to the dynamics of behaviour, the process of initiation, support and direction of an individual's activities", moreover, it can be further sub-categorised into extrinsic (performing an action to fulfil the expectations of someone who exerts power) and intrinsic (a determinant of action which evolves from a personal interest) [26]. The education literature ([13,27];) has discussed interest as a form of motivation during online learning and student motivation is the element that leads their attitudes towards the learning process.

2.4. Summary of the literature on technostress and misfit theory in higher education sector

The growing adoption of technology-enhanced learning (TEL) in higher education has sparked considerable interest in understanding its effects, particularly concerning technostress among students. Several recent studies explore various dimensions of technostress and its impact on students and educators in technology-enhanced learning settings. Qi [28] explores the dual effects of mobile devices in education, revealing that while they boost academic performance, their excessive use does not inherently cause technostress but significantly impacts when it occurs. The study by Wang and Li [29] highlights the misfit between university teachers' ICT skills and educational demands, contributing to technostress and impacting job performance and satisfaction. Wang et al. [30] examine technostress among university students in technology-enhanced learning by analysing misfit across three dimensions: person-organization, person-technology, and person-people, their study reveals that misfit in these areas strongly predicts technostress, leading to increased student burnout which negatively impacts perceived performance. Zhao et al. [31] reveal the crucial role of university support systems in mitigating technostress and burnout, emphasizing the importance of administrative and peer support.

In addition, Upadhyaya and Vrinda [4] note that technostress significantly lowers academic productivity among university students, indicating a need for educational strategies to mitigate these stressors. Research conducted by Wang et al. [30] also find that technostress creators such as techno-complexity, techno-insecurity, and techno-uncertainty significantly contribute to students' burnout, which negatively impacts their self-regulation, learning agency, and persistence in technology-enhanced learning environments. The study also highlights that these negative effects are stronger among male students and those less willing to engage in technology-enhanced learning, suggesting a need for targeted institutional support strategies to mitigate these impacts. Schettino et al. [32] focus on the validation of a technostress scale in an Italian university context, revealing that technostress is a significant negative factor impacting students' well-being, highlighting the need for preventive interventions. Moreover, a study detailed in Abd Aziz et al. [33] investigates how student satisfaction mediates the relationship between technostress factors—like techno-complexity and techno-insecurity—and academic performance, suggesting that reducing these stressors can improve student satisfaction and performance expectations. Recently, Sharma and Gupta [16] explore how technostress affects student learning in higher education, focusing on the rapid adoption of technology-enhanced learning due to COVID-19. Their study finds that negative appraisals of technostress led to emotion-focused coping, which lowers learning satisfaction, while positive appraisals encourage problem-focused coping, enhancing satisfaction. A detailed summary of our recent literature review has been presented in Appendix A.

Despite considerable research on technostress in the context of higher education, a significant research gap persists in understanding the role of technostress in the relationship between person-environment misfit and academic outcomes. Many studies have explored the individual components of student and university misfit, as well as the manifestation of technostress within educational settings. However, there is a marked deficiency in empirical research specifically examining the interplay among these elements—particularly through the lens of Person-Environment (P-E) misfit theory in the adoption of Technology-Enhanced Learning in universities. This gap is especially evident in the context of UK higher education, where further studies are needed to explore the misfit between student expectations and university offerings. Moreover, research should examine the role of technostress in these relationships, including its potential as a mediating factor between misfit in the student and university learning environment while adopting TEL and crucial academic outcomes such as academic performance, student satisfaction, and study motivation. While many researchers have discussed the negative impacts of technostress on students, previous studies have not adequately explored whether technostress could play a mediating role when adopting technology-enhanced learning. Addressing these gaps could provide valuable insights into developing more effective educational strategies and support systems that better align with student needs and reduce the adverse effects of technostress, thereby enhancing the overall educational experience in technology-rich learning environments.

2.5. The development of hypotheses

P-E misfit in Higher Education occurs when the personal factors of a student are not compatible with the study environment that the student is immersed in [34]. Recent years have seen an increase in TEL, the diverse levels of technological proficiency, rapid technological changes, and varying learning styles contribute to a sense of misfit. The lack of uniform training and support, coupled with societal and institutional pressure to conform to digital norms, can exacerbate feelings of inadequacy and frustration. Inconsistencies in the integration of technology across courses and perceived expectations tied to academic success further add to the challenge. The simultaneous demand to master course content and adapt to evolving technological tools may create a delicate balancing act, potentially leading to technostress. This may suggest that online learning creates a P-E misfit for students, which has implications for functioning and wellbeing [35]. Furthermore, student and university misfit were highlighted as the most influential contributor to technostress [34]. The following hypothesis will be tested to predict how student and university misfit in adopting TEL affects Technostress.

H1. ***The higher Student and University misfit in adopting Technology***

Enhanced Learning, the higher perceived Technostress will be.

The extant literature mainly focuses on P-E fit and its outcomes in the higher education sector [11,13,36]. For example, Westerman et al. [37] examined how P-E fit (personality, value, classroom environment congruences) affected the performance and satisfaction of undergraduate management students in the USA. And Suhlmann et al.'s [13] study shows that strong P-E effect on German university students enhanced academic motivation. Students with high dignity self-construal and who believe the university norms to be highly independent expressed the greatest sense of belonging to the university, increasing their academic motivation. It is assumed that P-E fit results in positive outcomes whereas P-E misfit result in negative outcomes, for example, Wang et al. [15] found out that person-people, person-TEL and person-organization were negatively related with academic performance of Chinese students. When students feel disconnected or unequipped to navigate the technological landscape of their academic journey, it often translates into diminished academic performance. The added stress of adapting to technology, alongside mastering course content, can erode motivation and enthusiasm for learning. Moreover, a perceived lack of support or inadequate training in technology may lead to frustration and dissatisfaction, further undermining the overall student experience. The evolving criteria and expectations associated with technology in education can create a sense of ambiguity, potentially hindering students' ability to meet academic standards. By investigating these dynamics, thus, we proposed that:

H2a. ***Student and University misfit in adopting Technology Enhanced Learning is negatively associated with student academic performance.***

H2b. ***Student and University misfit in adopting Technology Enhanced Learning is negatively associated with student satisfaction.***

H2c. ***Student and University misfit in adopting Technology Enhanced Learning is negatively associated with student motivation.***

Research on technostress is increasingly common in the higher education sector. Recent research has highlighted a connection between technostress and students [4,38,39], while some studies have focused on educators too [26,40]. These studies have highlighted the importance of considering technostress when studying. While TEL provides increased access to education, research has also demonstrated that it can be challenging for students: they may lack sufficient support for their work and wellbeing, leading to increasing rates of drop out [1]. Additionally, using technology in learning has related to higher levels of stress, isolation, and negative moods, alongside decreased concentration, motivation, and performance [41]. Conrad et al., [42] argued that when students believe learning online requires a high level of tech skills, they are likely to perceive online learning to be more difficult. Although TEL has many benefits, for example, it has the potential to reduce costs in the long run by reducing the time instructors spend planning and delivering courses [43], it was revealed that the use of technology in learning pushes students to accomplish more in less time, resulting in the techno-overload dimension of technostress [44]. We argued that student academic performance, satisfaction and study motivation are significantly impacted by technostress in universities while learning online.

Therefore, the following hypotheses have been formulated:

Hypothesis 3a. ***Technostress has a negative and significant relationship with student academic performance.***

Hypothesis 3b. ***Technostress has a negative and significant relationship with student satisfaction.***

Hypothesis 3c. ***Technostress has a negative and significant relationship with student motivation.***

2.5.1. The role of technostress as a mediator

In the previous section, it was discussed that Technostress is an important outcome of student Person-Environment misfit in Higher Education, as well as an antecedent to student poor academic performance, dissatisfaction, and demotivation. Therefore, this study puts forward the idea that technostress can mediate the impact of a Person-Environment misfit in Higher Education in adopting TEL on poor academic performance, student dissatisfaction and study demotivation. It suggests that when technostress increases, the relationship between student and university misfit in adopting TEL and poor performance, dissatisfaction and demotivation will become more positive. While studies have examined technostress [18,45], there is a paucity of research that examined the role of technostress as a mediator between students' Person-Environment misfit in education in adopting TEL and their poor academic performance, dissatisfaction, and demotivation. This study addresses this critical knowledge gap by testing these underlying relationships.

As a result, we proposed:

Hypothesis 4a. ***Technostress plays a mediating effect in the relationships between Student and University misfit in adopting TEL and student academic performance.***

Hypothesis 4b. ***Technostress plays a mediating effect in the relationships between Student and University misfit in adopting TEL and student satisfaction***

Hypothesis 4c. ***Technostress plays a mediating effect in the relationships between Student and University misfit in adopting TEL and student motivation***

2.6. Proposed research framework

The conceptual framework of this study is displayed in the form of a hypothesised research model (Fig. 1), and it will be validated through empirical analysis. Fig. 1 below depicts the model and the associated hypotheses based on the theoretical arguments discussed above (dotted lines representing the mediation hypotheses).

3. Methods

3.1. Data collection

To evaluate the research model and to examine the desired relationship among study constructs, this study used a quantitative approach. Data was collected using a self-administrated online 5-point Likert scale questionnaire. This was selected as it has many advantages, such as low cost, no geographical boundary and easy for respondents to control their time [46]. The online questionnaire was created using Qualtrics and administered via social media, such as Facebook/messenger, Instagram and Twitter, to attract UK higher education students by using convenience sampling. The target population is higher education students in the UK, who are undertaking to learn using technology. Convenience sampling has limitations, as it may not capture students with varying levels of previous experience with technology-enhanced learning or differences in technology readiness. It also might not fully represent the entire student population, as those more accessible or willing to participate in online surveys may differ in technology proficiency, motivation, and stress levels from the broader student body [47]. This can introduce selection bias, leading to an overrepresentation of individuals who are comfortable with digital platforms, which may skew results toward lower perceived technostress [48]. To mitigate these challenges, the study employed measures such as diverse recruitment strategies and ensuring a balanced sample across different demographics and academic disciplines, aiming to enhance the representativeness and generalizability of the findings.

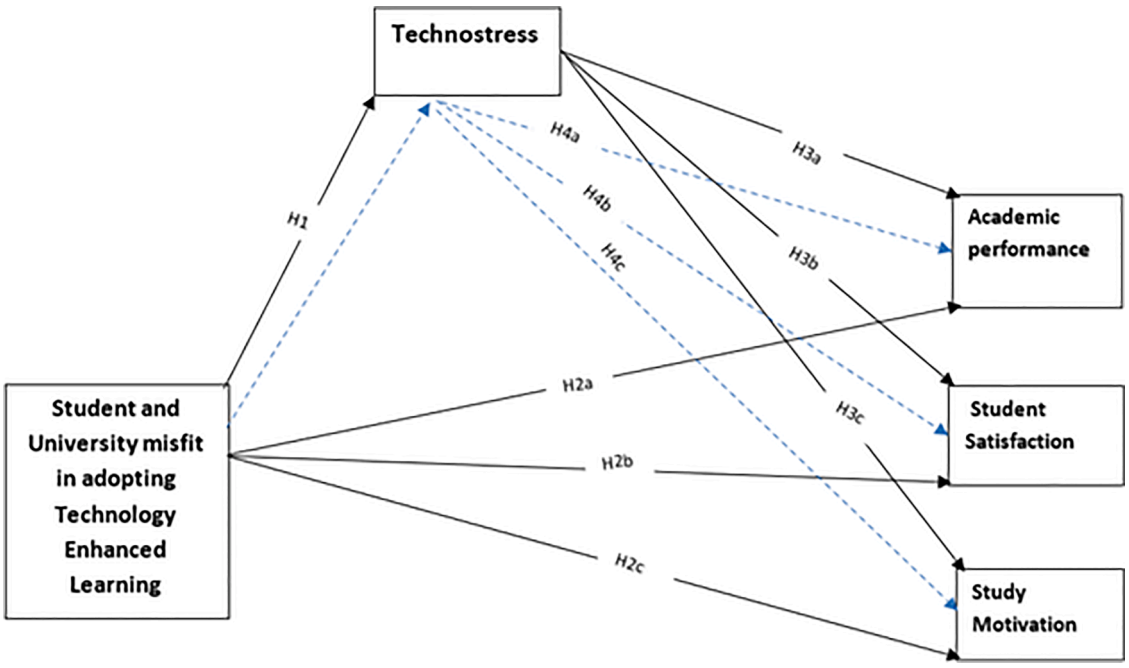

Fig. 1. Proposed research framework.

Subsequently, all participants were required to consent to take part, by reading a covering letter beforehand explaining the purpose of the study and remained anonymous and had the right to withdraw their participation at any point. The questionnaire included a screening question at the outset: "Are you a current UK higher education student?" Participants who responded "no" were automatically opted out and redirected to the end of the survey, preventing them from proceeding further. Only those who answered "yes" were allowed to continue with the remaining questions. This method ensured that all respondents were indeed students enrolled in UK higher education institutions. Anonymity was guaranteed by not including personal questions; however basic demographic questions (regarding age, gender, university, course etc.) were included and only answered if the participant felt comfortable doing so. After piloting 45 questionnaires to assess the accuracy and consistency of the responses, some amendments were made. A total of 343 responses was obtained, however, after removing the uncompleted responses, 332 valid responses were used for further analysis.

3.2. Measures

The items used to measure the constructs in this study are adapted from various studies. Technostress was measured by adapting items from Wang et al. [15,34]; Qi [28]; Tarafdar et al. [19], Misfit was measured by adapting items from [25]; Lauver and Kristof-Brown [49]; [11]; Academic performance was measured by adapting items from Mehrvarz et al. [50]; Yu et al. [21]; EI Ansari et al. [51]. Student satisfaction was measured by adapting items from Yu et al. [21]; Rode et al. [52]. Study motivation was measured by adapting items from Panisoara et al. [26]; Fernet et al. [53].

After consolidating the measurement items from several studies, a pilot test was conducted with 45 participants, representative of the target population, to ensure the reliability and validity of the instrument. Reliability was assessed using Cronbach's alpha to check internal consistency, with any items not meeting the acceptable threshold ($\alpha > 0.70$) being removed. Test-retest reliability was also evaluated by administering the questionnaire twice to a subset of participants. To ensure validity, content validity was confirmed by expert review, while construct validity was tested using exploratory and confirmatory factor analyses to verify proper item loading. Additionally, convergent and discriminant validity were examined to ensure that the measures correlated appropriately with related constructs and were distinct from unrelated ones.

In our study, the initial scale comprised 20 items measuring various aspects of technostress, student-university misfit with TEL, academic performance, student satisfaction, and motivation. Following the pilot study, five items were removed due to their low item-total correlations, which negatively impacted the reliability of the scale. The removed items were: 'I regularly experience feelings of mental fatigue and exhaustion caused by the use of technology in my learning'; 'Technology enhanced learning increases my workload, as I have to learn how to understand the technology in addition to the course content'; 'I have to spend more time adapting and learning how to use the technology, which leaves less time for studying'; 'My technological competency is not sufficient to feel satisfied with my course'; and 'The excessive use of technology in my online learning does not motivate me.' The results of the pilot test indicated that the instrument was both reliable and valid, providing confidence in its use for the main study. The finalized measurement items were then used in the full survey, as presented in Table 1.

3.3. Demographic profile

Table 2 elaborates sample characteristics of the respondents.

4. Analysis and findings

The data analysis for this study was conducted using AMOS 28. Structural equation modelling (SEM) was used to evaluate the measurement model and structural model. It is argued that using SEM technique is a powerful tool to analyse structural relationships. This technique is a combination of factor analysis and multiple regression analysis, and it is used to analyse the structural relationship between measured variables and latent constructs [54].

4.1. Measurement model

Confirmatory factor analysis was conducted first to determine the unidimensionality and causal relationship between items and

Table 1
Measurement.

Constructs	Items0
Technostress	I struggle to adapt and learn how to use new technology.
	I feel inadequate as I do not understand the complex features of technology.
	I get overwhelmed with the upgrades and changes in technology.
Misfit	I do not have the right technology skills and abilities for learning online.
	My abilities misfit the demands of learning via technology.
	My values prevent me from fitting into the university environment that I am required to learning use technology.
Performance	The complex features of technology used in my online learning means I avoid completing my work to the best of my ability.
	I do not think I will perform as well learning online as the technology requires me to be constantly changing and upgrading my skill set, which means I have less time to focus on my exams/assignments.
	My academic performance is impacted by the use of technology, as I struggle to cope with technology in a healthy way.
Satisfaction	The excessive use of technology in my learning leaves me feeling unsatisfied with my course.
	The use of technology in my learning makes me feel stressed, which means I am not satisfied with my progress.
	Learning of using technology requires me to work faster or longer which means I am not satisfied with my work-life balance.
Motivation	I find the technology used for learning too stressful, so I struggle to motivate myself to attend university.
	The technology used to complete my assignments are complex which I find de-motivating as I have to work much harder.
	Technology usage makes me anxious, leading to an overall lack of motivation in my everyday life.

Table 2
Demographic profile.

Variables	Number	Percentage
Gender		
Male	171	51.5
Female	161	48.5
Age (years)		
18–24	143	43.1
25–29	103	31.0
Over 30	86	25.9

constructs. Hair et al. [55] suggested to examine the reliability and validity of the constructs, thus Cronbach's α coefficients, composite reliability (CR) and average variance extracted (AVE) were calculated (see Table 3). The measurement model comprises 5 latent factors (technostress, misfit, academic performance, student satisfaction and study motivation) and 15 observed variables. In this study, the factor loadings ranged from 0.788 to 0.924, they are higher than the recommended threshold of 0.5 [56]. The Cronbach's α values are all above 0.8,

Table 3
Reliability and confirmatory analysis.

Constructs	Items	Factor loading	Cronbach's alpha	CR	AVE
Technostress	Tec1	.822	.896	.897	.744
	Tec2	.903			
	Tec3	.861			
Misfit	Pemisfit1	.838	.883	.883	.716
	Pemisfit2	.883			
	Pemisfit3	.816			
Performance	per1	.800	.868	.869	.689
	per2	.841			
	per3	.849			
Satisfaction	sat1	.858	.889	.893	.737
	sat2	.924			
	sat3	.788			
Motivation	mov1	.817	.867	.867	.686
	mov2	.840			
	mov3	.827			

all of which are higher than threshold of 0.7 [57]. All constructs attained an acceptable degree of reliability with CR scores greater than 0.8, which were exceeded minimum value of 0.7 [58]. The AVE values varied between 0.686 and 0.744, hence above the cutting point of 0.5 [59]. In this research, the discriminant validity test requirement was satisfied (shown in Table 4), as the square root of AVE of all constructs was higher than the correlation between the constructs, which indicates good discriminate validity [58].

According to Hair et al. [55] and Kline [60] the overall measurement model fitness indices: $\chi 2$, ratio of $\chi 2$ values to the degrees of freedom ($\chi 2/df$), goodness of fit index (GFI), comparative fit index (CFI) and root mean square error of approximation (RMSEA), need to meet satisfaction values ($\chi 2/df$ less than 5, GFI and CFI are above 0.9, RMSEA of 0.08 or less). In this study, the fit index of measurement model is sufficient ($\chi 2 = 220.84$, $\chi 2/df = 2.753$, RMSEA = 0.073, GFI = 0.915, CFI = 0.962).

4.2. Structural model

A structural equation model generated through AMOS 28 was used to test the relationships. A good fitting model is accepted if the fitness indices have met the requirements ($\chi 2/df$ less than 5, GFI and CFI are above 0.9, RMSEA of 0.08 or less) based on the studies from; Hair et al. [55] and Kline [60]. The fit indices for structural model of this study fell within the acceptable range: $\chi 2 = 245.36$, $\chi 2/df = 3.067$, RMSEA = 0.079, GFI = 0.904, CFI = 0.955). To specify and test the proposed hypotheses, we used structural equation modelling (SEM). The estimates were calculated with the maximum likelihood estimation method. The hypotheses testing results are presented in Table 5.

4.3. Mediation analyses

The bias-corrected Bootstrap method [61] with 5000 resamples was used in AMOS 28 to test the mediating effect of technostress between the relationships between student and university learning environment misfit of using TEL in higher education and academic performance, student satisfaction and study motivation. The bootstrap method was conducted as a preferred approach for mediation analysis since it has been widely used in empirical studies [62].

The statistical power of the SEM analysis in this study is implicitly supported by the model achieving good fit indices and employing a robust bias-corrected bootstrap method with 5000 resamples. This approach enhances the reliability of the mediation analysis, ensuring that findings regarding the mediating role of technostress are robust despite the complexity of the model and the indirect paths involved [62]. Using bootstrap not only compensates for potential power issues related to the sample size but also strengthens the confidence in the generalizability and accuracy of the mediation effects identified in the study.Our results revealed significant indirect effects of the impact of student and university misfit in adopting TEL on academic performance, student satisfaction and study motivation. These effects were negative and significant, furthermore, the direct effects of P-E misfit on academic performance and satisfaction were not significant, which means technostress had fully mediated relationships between P-E misfit and academic performance & study motivation, therefore H4a and H4b were supported. Lastly, the technostress is a mediator for the relationship between student and univeristy misfit in adopting TEL in higher education and study motivation, the direct effects were significant, offering partial support to H4c. The mediation effects are presented in Table 6. Fig. 2 provides a visual model of all significant paths as derived from this research.

5. Discussion

Using the theoretical lenses of P-E misfit theory and technostress in the Higher Education sector, this study proposed and empirically tested a framework based on 332 valid survey responses to assess the

Table 4
Correlation matrix, reliability, and AVE square root.

	Constructs	*M* (SD)	CR	AVE	1	2	3	4	5
1	Technostress	2.832 (1.129)	.897	.744	**.863**				
2	Misfit	3.515 (0.860)	.883	.716	.326	**.881**			
3	Performance	3.186 (1.079)	.869	.689	.597	.380	**.830**		
4	Satisfaction	3.575 (1.031)	.893	.737	.407	.322	.704	**.859**	
5	Motivation	3.212 (1.113)	.867	.686	.613	.300	.786	.763	**.828**

Table 5
Hypothesis Testing.

Hypotheses	Standardized coefficient	P Value	Result
H1: Misfit→Technostress	.530	<0.001	Supported
H2a: Misfit→Performance	−0.429	<0.001	Supported
H2b: Misfit→Satisfaction	−0.330	<0.001	Supported
H2c: Misfit→Motivation	−0.344	<0.001	Supported
H3a: Technostress→Performance	−0.957	<0.001	Supported
H3b: Technostress→Satisfaction	−0.917	<0.001	Supported
H3c: Technostress→Motivation	−1.114	<0.001	Supported

influencing relationships between the student and university learning environment misfit with TEL and technostress, student academic performance, satisfaction, and motivation, four key findings have been identified and illustrated according to the hypotheses.

Based on our first hypothesis, the findings showed that person-environment misfit has a positive effect on technostress in the higher education sector. Our outcomes are in line with previous findings that student -university misfit in adopting TEL impacts technostress – specifically, student and university learning environment misfit, the finding reflects the discussion that misfit was seen as a negative, unwanted, and unpleasant condition akin to a disorder such as stress or anxiety [63]. When a student perceived himself/herself misfit with university learning environment, being overwhelmed by large amounts of technology tools on learning could cause technostress, this finding is consistent with the study by Wang and Li, [29] and Wang et al., [34].

Table 6
Mediation effects (Bootstrap analysis).

Hypothesis	Total effect	Indirect effect	Direct effect	Bias-corrected 95 % confidence interval (Bootstrap results)		Result
				Lower	Upper	
H4a: Misfit→Technostress →Performance	−0.429***	−0.507***	.078(NS, $p = 0.352$)	−0.705	−0.330	Full mediation (Supported)
H4b: Misfit→Technostress →Satisfaction	−0.330***	−0.590***	.155(NS, $P = 0.155$)	−0.705	−0.312	Full mediation (Supported)
H4c: Misfit→Technostress →Motivation	−0.344***	−0.486***	.246** $P = 0.008$)	−0.832	−0.379	Partial Mediation (Supported)

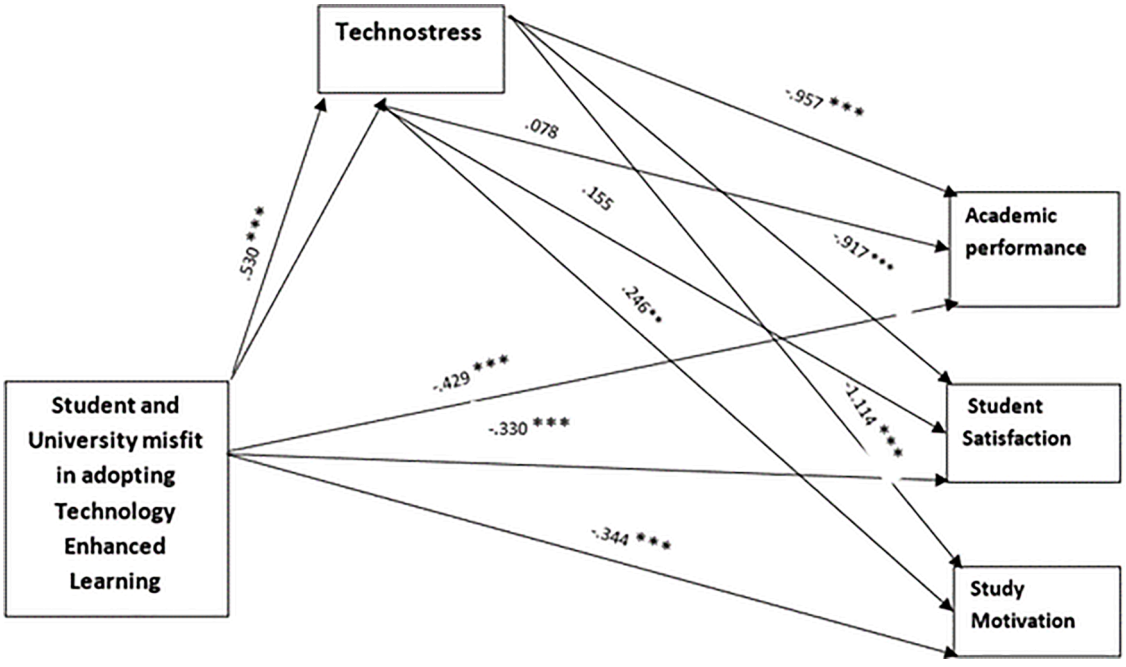

Fig. 2. Summary of the standardized path coefficients for the full structural mode.
*$p < 0.050$; **$p < 0.010$; ***$p < 0.001$

Regarding our second (H2a, b, c) hypotheses, the findings demonstrated negative and significant relationships between student and university misfit in adopting TEL and student academic performance, satisfaction, and motivation. In the sense that the higher misfit the student perceived in the university when adopting TEL, the poorer academic performance, satisfaction, and motivation will be presented. Although previous studies revealed P-E fit and its impact on academic achievement, engagement, and satisfaction [11,13,28,37], our research explored the consequence outcomes when students perceive misfit with learning by technology tools in universities, will result a negative and significant impact on their academic performance, satisfaction, and motivation.

Similar to previous research, the results of this study confirmed our third (H3a, b, c) hypotheses, indicating that when students' technostress is higher, their academic performance is getting poorer, satisfaction is decreasing, and they report feeling demotivated. This finding was supported by the work of Tarafdar et al. [45] who found that technostress creators impaired the productivity (performance) of participants. In addition, this finding is supported by Upadhyaya and Vrinda [4] whose results indicated the negative impact of technostress on academic performance. This result substantiated the studies conducted earlier that an increase in technostress could decrease satisfaction ([64,65]; Sharma and Gupta, 2022). Furthermore, our research contributed a new finding that students will be demotivated to study when perceive high technostress.

Finally, the outcomes of hypotheses (H4 a, b, c) showcase that technostress plays a mediating role between student and university learning environment misfit in adopting TEL and academic performance, satisfaction, and motivation. The outcome was found that the mediation effect of technostress was fully toward the relationship between student and university misfit with TEL and academic performance and student satisfaction, and partial mediating the relationship between misfit and study motivation. Previously, researchers have analysed technostress and its impact on the higher education sector [4,16,29,38]. In this study, technostress was found to perform the role of a mediator between P-E misfit in higher education in adopting technology enhanced learning and student academic performance, satisfaction, and motivation. Therefore, these findings offer an extensive and unique contribution to the existing literature that lacks empirical investigation.

5.1. Theoretical contributions

Prior studies have predominantly examined technostress within industry and government sectors [15], with limited focus on the higher education sector (e.g., [4,29]). This scholarly work advances the literature by emphasizing the relevance of Person-Environment (P-E) Misfit theory in understanding the impact of technostress on student academic performance, satisfaction, and motivation. Our study uniquely positions technostress as a mediating mechanism linking student-university learning environment misfits to these academic outcomes, thereby filling a notable gap in the literature [11,13,37]. Although this research did not control for additional variables such as previous experience with technology-enhanced learning and individual technology readiness, these factors are acknowledged as important considerations in the limitations section for future studies. This comprehensive approach not only enriches the existing body of work on P-E Misfit in higher education but also extends the understanding of technostress as a mediator, a relatively unexplored area in university settings [33]. Consequently, this study provides valuable insights and significant contributions to the fields of technostress and P-E Misfit theory, presenting new avenues for future research in Technology Enhanced Learning environments.

5.2. Practical implications

It is critical that universities understand how their students are affected by adopting Technology Enhanced Learning, from a wellbeing perspective; to enhance student engagement; experience and ultimately their study performance. The overall outcomes of this study highlighted several implications for university decision-makers. Our findings indicated that students perceived misfit with university learning environment by using technology tools significantly impacts their academic performance, satisfaction, and study motivation. Although technology's integration in education seems to be an innovative learning method, the negative effects of technostress cannot be ignored. Our research findings suggest that technostress is not caused by using technology but related to the misfit between students and the university learning environment. This study demonstrates to universities the importance of understanding technostress and enabling a sufficient support system is in place for students. Universities should create a psychologically healthy TEL environment and ensure students have a more pleasant online learning experience. The delivery of online classes should be designed in ways that are less stressful for students and more conducive to learning, lecturers should consider the pedagogy behind why using certain tools online and the negative impact of TEL. Students should be provided with training to increase their digital confidence and skills, enabling them to better deal with technostress. To sum up, this research will have long-term value, as it is expected that universities could develop appropriate strategies on how to increase student performance, satisfaction, and motivation by implanting TEL effectively by reducing negative technostress consequences in the learning environment.

6. Limitations and suggestions for future research

Despite the research aims being met for this study and the statistical analysis providing evidence to support all hypotheses outlined, there are limitations to this research that should be considered. Firstly, this research is limited as the sample of the participants was only collected from UK university students. While it is thought that the issues highlighted in this paper are likely to have global relevance, future research could be extended by conducting a cross-cultural study to generate the international perspectives of addressing the issue of the misfit and technostress among university students while adopting TEL, to explore how their academic performance, motivation and satisfaction are impacted. Secondly, possible subject courses differences among university students in experiencing technostress in online learning should be accounted for, as students with different courses subject knowledge, such as Computer Science, Business Management, Art & Design or Biological Science, often have different exposures to TEL. Future research is suggested to distinguish different student backgrounds. Furthermore, technostress was employed as a mediator in this study, however, for future research, other variables could be advised to play the role of mediator to enrich the knowledge of understanding student perspectives towards TEL.

Data available on request from the authors

The data that support the findings of this study are available from the corresponding author, [Yan Liang], upon reasonable request

CRediT authorship contribution statement

Dr. Yan (Danni) Liang: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Dr. Shujie Chen:** Writing – review & editing, Methodology, Investigation, Formal analysis, Conceptualization. **Dr. Ruwan Abeysekera:** Writing – review & editing, Project administration, Conceptualization. **Dr. Helen O'Sullivan:** Writing – review & editing, Validation. **Dr Jeff Bray:** Writing – review & editing, Validation, Supervision. **Izzy Keevill-Savage:** Writing – original draft, Resources.

Declaration of competing interest

We declare that we have no conflicts of interest related to this research study. We affirm that the findings and interpretations presented in this manuscript are unbiased and based solely on the data collected and analysed. Furthermore, we confirm that no external funding or competing financial interests have influenced the design, conduct, or reporting of this study. All authors have reviewed and approved the final version of the manuscript for submission.

Appendix. Summary of the literature on technostress and misfit theory of Technology enhanced learning adoption

Authors	Title	Research summary	Research method	Key Findings
[33]	The mediating effects of student satisfaction on technostress–performance expectancy relationship in university students	The study examines how technostress factors impact students' performance expectancy through the mediating role of student satisfaction, suggesting that improving student satisfaction by reducing techno-complexity and techno-insecurity can enhance academic performance in online learning environments. The research also contributes to the existing literature by developing and testing a technostress model.	The methodology involved collecting data through online questionnaires from 234 students at Universiti Teknologi Mara (UiTM), Malaysia	Student satisfaction mediated the relationship between techno-complexity, techno-insecurity, and performance expectancy. Techno-complexity and techno-insecurity negatively affected student satisfaction, while student satisfaction positively influenced performance expectancy. Reducing techno-complexity and techno-insecurity could enhance student satisfaction and academic performance expectations.
[16]	Investigating the role of technostress, cognitive appraisal and coping strategies on students' learning performance in higher education: a multidimensional transactional theory of stress approach	The paper investigates the impact of technology-enhanced learning on students' stress, cognitive appraisal, and coping strategies, highlighting the experience and confidence levels of students in dealing with technostress.	The methodology involved conducting a survey to collect data from 275 undergraduate students, in a public university in the USA in 2020	Students experienced technology-related stress due to ICT use. Different types of cognitive appraisal led to different coping strategies, impacting learning satisfaction. Higher experience, confidence, and lower anxiety help students deal with technostress.
[31]	Exploring the Structural Relationship Between University Support, Students' Technostress, and Burnout in Technology-enhanced Learning	The study explores the relationship between university support, students' ICT competence, technostress, and burnout in technology-enhanced learning, emphasizing the role of administration and peer support, as well as gender differences in the effectiveness of support mechanisms.	The methodology involved surveying 1785 students from three Chinese universities using a self-reported questionnaire.	University students' technostress significantly predicted their learning burnout in technology-enhanced learning. Administration support was crucial in alleviating students' technostress and burnout. Peer support negatively predicted students' learning burnout but did not predict their technostress. Additionally, ICT competence alone did not have significant effects on technostress. Multiple group comparisons based on genders found that females benefited more from administrator support in alleviating learning burnout than males, while males benefited more from peer support in improving their ICT competence than females.
[32]	Technology-Enhanced Learning and Well-being: a Contribution to the Validation of a Measure to Assess University Students' Technostress in the Italian Context.	The paper discusses the impact of COVID-19 on universities adopting technology-enhanced learning (TEL), validates an Italian version of the technostress scale, and provides insights into evaluating and addressing technostress related to TEL.	The methodology involved a sample consisted of 915 Italian students (83.9 % women) aged 18–33 years	The study aimed to validate the Italian version of the technostress scale for university students in TEL, demonstrating its psychometric properties and invariance across different academic courses. The findings showed significant associations between the Italian Technostress Scale and other relevant scales, supporting its validity and reliability. The study highlighted the importance of assessing technostress in university students to prevent detrimental outcomes related to technology-enhanced learning.
[30]	The Achilles Heel of Technology: How Does Technostress Affect University Students' Wellbeing and Technology-Enhanced Learning	The paper investigates the impact of technostress on university students' wellbeing and technology-enhanced learning (TEL) through the stressor-strain-outcome model, highlighting gender differences in the negative associations between burnout and self-regulation, learning agency, and persistence in TEL. The study aims to inform future decisions on	The methodology involved using interviews to inform survey development, collecting data from 796 participants	- Technostress creators were significantly associated with students' burnout in TEL, impacting their self-regulation, learning agency, and persistence. - Male students showed stronger negative associations between burnout and self-regulation, learning agency, and persistence in TEL compared to female students.

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Authors	Title	Research summary	Research method	Key Findings
		implementing TEL in higher education and strategies to support university students' wellbeing, addressing the gap in research on technostress among university students.		- Students from social sciences experienced a greater positive association between techno-complexity and burnout compared to students from engineering and natural sciences.
Wang et al., 2020	Technostress in university students' technology-enhanced learning: An investigation from multidimensional person-environment misfit	The study investigates technostress among university students in technology-enhanced learning from a multidimensional perspective, highlighting the impact on burnout, persistence, and performance, with females and lower-grade students showing higher susceptibility to burnout and negative performance effects.	The methodology involved with 740 university students from two public universities in China.	- P–O misfit of technostress strongly predicted technostress on both P-TEL misfit and P–P misfit dimensions. - The three dimensions of technostress were positively associated with students' burnout, which negatively affected their perceived performance in TEL. - Females and lower-grade students were more susceptible to burnout associated with P–P misfit of technostress, with female students' performance being more negatively affected by burnout than males.
[4]	Impact of technostress on academic productivity of university students.	The paper explores the prevalence of technostress among university students, its impact on academic productivity, and the need to address technostress to improve student performance and reduce the burden on educational institutions.	The methodology involved a survey of 673 university students in Southern India	Increased use of technology in higher education has compelled students to complete all their academic work, including assessments, using technology. Technology-enhanced learning applications such as learning management systems, MOOCs and digital exam devices require students to develop ICT skills.
[29]	Technostress Among University Teachers in Higher Education: A Study Using Multidimensional Person-Environment Misfit Theory	The paper investigates technostress among university teachers in higher education using a multidimensional person-environment misfit framework, develops an instrument to measure technostress, and reveals differences in causes of technostress among teachers of different grade levels. The study emphasizes the significance of organizational management and the suitability of ICT for teachers' work in influencing job performance.	The methodology involved sampling participants from five public universities in mainland China, validated by 343 teachers.	The study emphasizes the negative impact of technostress on university teachers' job performance and the importance of addressing technostress in higher education settings. It was found that university requirements related to the use of ICT and the suitability of ICT for university teachers' work were critical factors affecting their job performance.
[28]	A double-edged sword? Exploring the impact of students' academic usage of mobile devices on technostress and academic performance	The paper explores the impact of students' academic usage of mobile devices on technostress and academic performance, finding that mobile device usage does not lead to technostress but helps enhance academic performance. The study focuses on the academic usage of mobile devices among university students, emphasizing activities like accessing course materials, communicating with peers, and collaborating on projects. The research also delves into the moderating effect of mobile technology self-efficacy on the relationship between mobile device usage and technostress. The study highlights the importance of mobile technology in higher education and its potential benefits for students' academic performance.	The methodology involved data collection from 208 university students	This study developed a theoretical framework to investigate the double-edged effect of students' academic usage of mobile devices. Specifically, compared the positive effect (boost academic performance) with the negative effect (bring technostress) of mobile device usage among university students.

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