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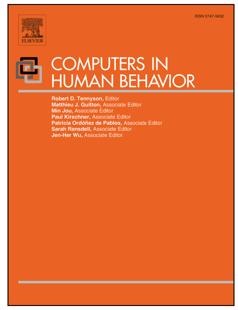

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Technostress in university students' technology-enhanced learning: An investigation from multidimensional person-environment misfit

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Technostress in university students' technology-enhanced learning: An investigation from multidimensional person-environment misfit

Abstract

This study investigated technostress among university students in technology-enhanced learning (TEL) from a multidimensional person-environment misfit perspective: technostress on the dimensions of person-organization (P-O) misfit, person-TEL (P-TEL) misfit, and person-people (P-O) misfit, respectively. A research model was created to examine how the three dimensions of technostress were related to one another and how they predicted students' burnout, persistence in TEL, and perceived performance. It was validated by 740 university students from three public universities in China. The findings show that P-O misfit of technostress strongly predicted technostress on both P-TEL misfit and P-P misfit dimensions. P-P misfit of technostress predicted P-TEL misfit of technostress. The three dimensions of technostress were positively associated with students' burnout, which negatively affected their perceived performance in TEL. Moreover, P-O misfit of technostress demonstrated the most salient effect on students' burnout. Additionally, group comparisons based on gender and grade levels indicate that females and lower-grade students were more susceptible to burnout associated with P-P misfit of technostress than others. And female students' performance tended to be more negatively affected by burnout than males. This study has important implications for disentangling factors affecting students' wellbeing and academic success in TEL and developing effective solutions to technostress.

Keywords: technostress; multidimensional person-environment misfit; university students; technology-enhanced learning

1. Introduction

With universities worldwide continually increasing investment on the use of technology to transform conventional education, technology-enhanced learning (TEL), which broadly refers to any form of learning that is facilitated by technology, is gaining momentum in higher education (Dunn & Kennedy, 2019). TEL comes in varied forms, including mobile learning, blended learning, and massive online open courses, facilitated by new technology such as learning analytics, intelligent tutoring systems, and various learning applications (e.g., Cho & Byun, 2017; Nistor & Hernández-Garcíac, 2018). Undoubtedly, TEL could provide substantial benefits to university students such as flexibility, convenience, and widened access to quality learning resources. Nevertheless, due to changed requirements and expectations, demands of more time and effort, and increased request for higher self-learning and time management capabilities, TEL could also cause technostress for university students (Jung, Kudo, & Choi, 2012; Qi, 2019). Technostress is broadly defined as a maladaptation problem resulting from individuals’ failure in coping with technology and changing requirements related to the use of technology (Brod, 1984; Jena, 2015; Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008).

Prior studies on technostress across different fields have reported a variety of negative consequences for individuals and their organizations (e.g., Joo, Lim, & Kim, 2016; Tarafdar, Tu, & Ragu-Nathan, 2010), for instance, anxiety, fatigue, dissatisfaction with jobs, decreased productivity, and even intentions to quit jobs. In a similar vein, technostress among university students in TEL may incur problems such as burnout, decreased learning engagement, reduced performance, and intentions to quit TEL (Jena, 2015; Qi, 2019).

Despite negative consequences associated with technostress, there has been a paucity of research on this issue in the field of education, particularly in higher education. Even among the limited number of studies on technostress (e.g., Al-Fudail & Mellar, 2008; Jena, 2015; Joo et al., 2016), attentions have predominantly been given to teachers at different school levels. It seems that university students are often assumed to be tech-savvy and therefore, to be free from technostress; as a result, university students' psychological responses and adaption to TEL, which are critical for the success of TEL, are neglected (Qi, 2019).

As technostress is a psychological reaction to the misfit between individuals and the environment (Cooper et al., 2001; Ragu-Nathan et al., 2008), person-environment (P-E) fit theory has been considered essential in research on this issue (Al-Fudail & Mellar, 2008; Ayyagari, Grover, & Purvis, 2011; J. R. Edwards, Caplan, & Harrison, 1998). P-E fit theory appreciates the complex characteristic of technostress by arguing that it does not arise from the person nor the environment alone but from the interaction of both (Ayyagari et al., 2011; Chuang, Shen, & Judge, 2016). According to P-E fit theory, the environment is multidimensional, including organizations where individuals belong to, organizational culture, task requirements, and other people around the individuals (J. A. Edwards & Billsberry, 2010). Thus, individuals are nested in multiple dimensions of the environment concurrently (Jansen & Kristof-Brown, 2006). They often need to work with others to perform tasks and meet organizational requirements at the same time. Nevertheless, prior studies using P-E fit theory have predominantly focused on the fit between individuals and a single dimension of the environment (Chuang et al., 2016), for instance, solely focusing on the side of technology when investigating technostress (e.g., Ayyagari et al., 2011; Qi, 2019). Although these studies have enriched our understanding of technostress, they may not provide a holistic understanding of the complexity of technostress, thereby possibly falling short of informing the development of effective solutions to this issue.

Therefore, this study aims to bridge this gap by investigating technostress among university students in TEL from a multidimensional P-E misfit perspective: technostress on the dimensions of person-organization (i.e., university; P-O) misfit, person-TEL (P-TEL) misfit, and person-people (P-P) misfit. Furthermore, this study also examines how the multiple dimensions of P-E misfit of technostress affect university students' perceptions of TEL. In addition, as gender and experience in the use of technology have been considered important factors predicting differences in individuals' interactions with technology and there have been continuing discussions on the two factors regarding how technostress may vary (Huffman, Whetten, & Huffman, 2013; Marchiori, Mainardes, & Rodrigues, 2019; Ragu-Nathan et al., 2008), this study aims to continue these discussions by investigating possible differences related to gender and experience in the use of technology (i.e., grade levels) among university students. Specifically, this study is guided by the following research questions:

(1) How do the multiple dimensions of P-E misfit of technostress interact with one another?

(2) How do the multiple dimensions of P-E misfit of technostress collectively predict university students' burnout, persistence in TEL, and perceived performance?

(3) Are there differences between male and female students and differences among students of different grade levels in experiencing technostress in TEL?

2. Theoretical framework

2.1. Extant research on technostress

Technostress is a relatively new and understudied topic (Brooks & Califf, 2017; Tarafdar et al., 2010). It has been reported by individuals using a variety of technology, including mobile computing devices (Hung, Chen, & Lin, 2015; Qi, 2019), corporate management systems (Ragu-

Nathan et al., 2008), collaborative tools (Jena, 2015), and social media (Brooks & Califf, 2017). With regard to the population suffering from technostress, there have been studies on employees from government and industry sectors (e.g., Ayyagari et al., 2011; Ragu-Nathan et al., 2008), teachers and academicians in the field of education (e.g., Joo et al., 2016), and aged adults (e.g., Nimrod, 2018). However, there has been very limited research on technostress among students, especially university students who often have higher exposure to technology than students in other school levels due to the widespread adoption of TEL in higher education (Dunn & Kennedy, 2019).

Previous studies have reported that excessive technostress could lead to a wide range of consequences to individuals, negatively affecting their physical and psychological health and social relationships (Al-Fudail & Mellar, 2008; Salanova, Llorens, & Cifre, 2013). For example, Al-Fudail and Mellar (2008) investigated school teachers' technostress when using technology in the classroom. After analyzing a series of data from nine teachers, including direct observation, classroom videotapes, and interviews, they found that the teachers indeed suffered from technostress. The occurrence of technostress was attributed to a variety of causes, for instance, extra time needed in using technology for class preparation, unexpected errors and low reliability of technology, and lack of effective training to improve their skills in using technology. As a result, they demonstrated a variety of negative symptoms, such as headaches, tiredness, annoyance, and nervousness. In addition, technostress has significant adverse impacts on individuals' professional lives and the success of organizations (Fuglseth & Sørebø, 2014; Tarafdar et al., 2010). For instance, Tarafdar et al. (2010) examined the issue of technostress among 233 technology users from two public-sector organizations in the United States through modelling the relationships among technostress and users' satisfaction with technology and their work performance. The found that technostress was strongly associated with users' dissatisfaction with the use of technology and negatively affected their work performance.

However, current research on this issue has been mostly conducted in industry and government sectors (e.g., Hwang & Cha, 2018; Marchiori et al., 2019). There has been very limited research on technostress in the field of education, most of which focused on the teacher population. For instance, Joo et al. (2016) investigated the effects of technostress on secondary teachers' intention to use technology in South Korean. Jena (2015) examined technostress experienced by Indian academicians in ICT-enabled collaborative learning environment and found that technostress was negatively associated with their job satisfaction and job performance.

In spite of the dearth of studies on technostress in educational fields and considering the vast investment on TEL in higher education (Dunn & Kennedy, 2019; Lai, 2011), the pervasiveness and gravity of technostress among university students, who are main users of new technology for learning in higher education, are likely to be no less notable than those in other fields like government and industry sectors (Qi, 2019; Verkijika, 2019).

2.2. Multidimensional P-E misfit of technostress in TEL

P-E fit theory has played a significant role in explaining the formation and consequences of stress of different forms (J. R. Edwards et al., 1998; Qi, 2019). P-E fit happens when personal factors (e.g., needs, skills, and abilities) are compatible with environmental factors (e.g., supplies, demands, and values; K. Y. T. Yu, 2016), promoting individuals' wellbeing and life satisfaction. Whereas P-E misfit generates stress and decreases individuals' wellbeing and performance (Jiang & Jiang, 2015).

According to P-E fit theory, stress does not emerge from a person nor from the environment alone, but from the misfit between the two. However, different from previous P-E fit approaches that examine single dimensions of the environment, the multidimensional P-E fit theory emphasizes the significance of the multiple dimensional characteristics of an environment, as individuals are simultaneously inhibiting multiple dimensions of an environment (J. A. Edwards & Billsberry, 2010). A variety of dimensions of P-E fit has been investigated, for instance, person-vocation (P-V) fit, person-job (P-J) fit, person-organization (P-O) fit, and person-people (P-P) fit (for details, see Chuang et al., 2016; Jansen & Kristof-Brown, 2006). As such, stress or satisfaction arises from misfit or fit between a person and the multiple dimensions of the environment concurrently (Jansen & Kristof-Brown, 2006).

In line with the multidimensional P-E fit theory, university students are simultaneously nested in multiple dimensions of TEL-related higher education environments. On the one hand, they need to adapt to changed learning practices, pedagogy, and requirements of TEL (Jung et al., 2012). On the other hand, they also need to cope with universities' requirements of TEL (i.e., the dimension of organization), such as evaluation of TEL and requirements of scores and credits for graduation (Cho & Byun, 2017; Wallace, 2007). Meanwhile, their attitudes toward and behaviors in TEL are often influenced by others (i.e., the dimension of people), for instance, social support from and interactions with their peers in TEL (A. Y. Yu, Tian, Vogel, & Kwok, 2010).

Therefore, investigating technostress only from a single dimension of P-E misfit may be inconsistent with how students interact with TEL in higher education in an imbalanced way which generates technostress. In addition, as different dimensions of P-E misfit have been found to have varying effects on people's attitudes, behaviors, and wellbeing, focusing on a single dimension of P-E misfit may generate a limited understanding of how technostress arises in TEL (Chuang et al., 2016; Jansen & Kristof-Brown, 2006).

As such, based on the multidimensional P-E fit theory and the definition of technostress which argues that technostress is not only related to technology itself, but also to changing requirements due to the use of technology, this study examined technostress on three dimensions of P-E misfit at the same time: P-TEL misfit of technostress, P-O misfit of technostress, and P-P misfit of technostress.

In addition, the P-E fit is operationalized in two ways: (a) abilities-demands (A-D) fit, referring to a situation where individuals' abilities and skills meet demands of an environment; and (b) needs-supplies (N-S) fit, referring to a scenario where individuals' needs are satisfied by supplies of an environment (J. R. Edwards et al., 1998; Kristof-Brown, Zimmerman, & Johnson, 2005). Therefore, in line with the operationalization of P-E fit, the three dimensions of P-E misfit of technostress are defined as the technostress that arises from the misfit between university students (e.g., abilities, time, and needs) and TEL itself (e.g., requirements and resources), university environments related to TEL (e.g., requirements and support related to TEL), and other people around university students in TEL (e.g., support and help), respectively.

2.3. Hypothesis development

Prior research on multidimensional P-E fit (e.g., Chuang et al., 2016; Jansen & Kristof-Brown, 2006) has indicated that the multiple dimensions of P-E fit/misfit are interdependent with one another, collectively affecting individuals' wellbeing and performance. In this study, TEL and other people in TEL (e.g., peers) are nested in universities (i.e., organizations). When students perceive university environments related to TEL as being supportive and amicable, they are likely to demonstrate behaviors and meet requirements that are aligned with those stipulated by universities. Conversely, when university environments become demanding and fall short in providing support for students' TEL, students may form negative perceptions toward their learning endeavors, and their relationships with other people in TEL may also be disrupted (Huang & Fisher, 2011; Sommet, Quiamzade, Jury, & Mugny, 2015). Therefore, technostress on the dimension of P-O misfit is likely to cause technostress on the dimensions of P-TEL misfit and P-P misfit. In a similar vein, as students' learning endeavors are often influenced by their peers (Thomas, Parsons, & Whitcombe, 2019; A. Y. Yu et al., 2010), technostress on the P-P misfit dimension may also lead to technostress on the P-TEL misfit dimension. Based on this reasoning, the following hypotheses are developed:

H1a. P-O misfit of technostress is positively associated with P-TEL misfit of technostress.

H1b. P-O misfit of technostress is positively associated with P-P misfit of technostress.

H1c. P-P misfit of technostress is positively associated with P-TEL misfit of technostress.

As has been reported by prior studies on technostress across different fields (e.g., Hwang & Cha, 2018; Jena, 2015), technostress could incur a variety of negative effects on individuals' wellbeing (e.g., exhaustion and depression) and professional performance (e.g., decreased commitment and performance).

In TEL, university students often need to multitask and deal with huge amounts of information generated by different learning applications, other learners, and instructors (Jung et al., 2012; Qi, 2019). They are compelled to work faster to cope with increased processing requirements set by transformed courses and their universities. As a result, students often encounter problems such as lack of time management skills, cognitive overload, insufficient academic and technical support, and poor self-management (Qi, 2019). Some may feel uncomfortable with TEL due to new instructional methods and changed requirements (Jung et al., 2012). Consequently, technostress on the dimensions of P-TEL misfit, P-O misfit, and P-P misfit may cause for university students frustration, exhaustion, and depression (i.e., burnout;

Kristensen, Borritz, Villadsen, & Christensen, 2005), which further adversely affect their intentions to persist in TEL and performance (Qi, 2019; Wu & Chen, 2017). However, given the lack of access to participants' academic scores in TEL, this study decided to use students' perceived performance, which is related to students' perceptions of how TEL facilitates their academic performance and has been considered a reasonable substitute for actual performance (Abbasi & Zamani-Miandashti, 2013). Therefore, the following hypotheses are proposed:

H2a. P-TEL misfit of technostress is positively associated with university students' burnout.

H2b. P-O misfit of technostress is positively associated with university students' burnout.

H2c. P-P misfit of technostress is positively associated with university students' burnout.

H3a. P-TEL misfit of technostress is negatively associated with university students' persistence in TEL.

H3b. P-O misfit of technostress is negatively associated with university students' persistence in TEL.

H3c. P-P misfit of technostress is negatively associated with university students' persistence in TEL.

H4a. P-TEL misfit of technostress is negatively associated with university students' perceived performance.

H4b. P-O misfit of technostress is negatively associated with university students' perceived performance.

H4c. P-P misfit of technostress is negatively associated with university students' perceived performance.

H5a. University students' burnout is negatively associated with their persistence in TEL.

H5b. University students' burnout is negatively associated with their perceived performance.

H6. University students' persistence in TEL is positively associated their perceived performance.

In line with the analysis above, a theoretical model of multidimensional P-E misfit of technostress among university students in TEL is illustrated in Figure 1.

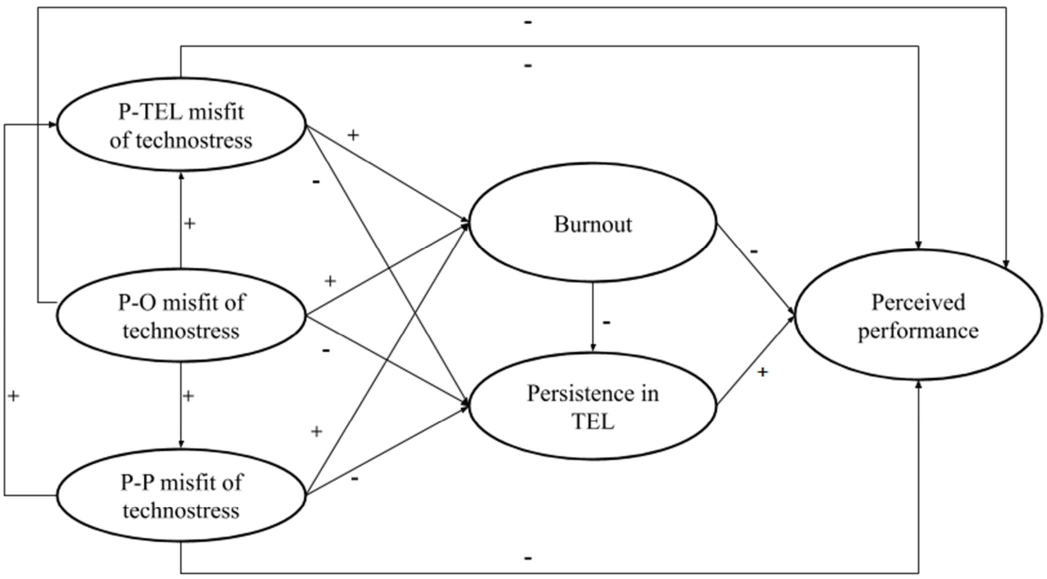

Figure 1. The proposed multidimensional P-E misfit of technostress in TEL.

3. Methodology

3.1. Participants

The participants of this study were recruited from three public universities in China using convenience sampling. With the help of the universities' offices of information technology, we approached 800 students by email containing a survey link, which is powered by wjx.cn (an online survey provider). The students were informed that their participation was voluntary and anonymous and that they stood a chance to win a gift offered by the online survey provider once they completed the survey. Finally, we obtained valid responses from 740 students with their informed consent. There are 222 males and 518 females. They were aged between 17-22 years. There were 345 students in Year 1; whilst, there were 308, 81, 5, and 1 students in Years 2, 3, 4, and postgraduate studies, respectively. The participants came from different disciplines, including psychology, educational science, material sciences, computer science, and electronic engineering.

The universities under study were similar in many aspects including their sizes, teaching quality, and degree offerings and have been advancing TEL for years. For instance, they have accredited massive open online courses (MOOCs) and adapted them into their own curricula. Every student is required to complete a minimum of two credits of MOOCs. They have also implemented flipped classroom in many departments to transform conventional teacher-centered classroom. Meanwhile, instructors are also encouraged to experiment with new technology for mobile learning and game-based learning so as to enhance students' participation in and commitment to their courses. Consequently, students in these universities need to adapt to the new learning modes and cope with changing requirements associated with TEL.

3.2. Instrumentation

The original survey instrument contained six constructs with 45 items (see Appendix A): P-O misfit of technostress, P-TEL misfit of technostress, P-P misfit of technostress, burnout, persistence in TEL, and perceived performance. They were adapted from established studies on technostress and TEL in higher education. The items measuring the three dimensions of P-E misfit of technostress initially came from Chuang et al. (2016), Qi (2019), and Tarafdar et al. (2010), with reported Cronbach's alpha values ranging from 0.81 to 0.89. They were then adjusted in accordance with the operationalization of P-E fit: A-D fit and N-S fit (J. R. Edwards et al., 1998; Kristof-Brown et al., 2005).

In this line of reasoning, P-TEL misfit of technostress and P-O misfit of technostress were operationalized in both forms of A-D misfit and N-S misfit. For instance, in P-TEL misfit of technostress, there are items "*I feel stressed to adapt to technology-enhanced learning*" and "*I feel stressed as technology-enhanced learning is not useful in meeting my needs for better academic performance*". In P-O misfit of technostress, there are such items as "*I feel stressed to meet the high demands of university policies regarding technology-enhanced learning*" and "*I am stressed as my university does not provide me with ample support to effectively participate in technology-enhanced learning*". However, regarding P-P misfit of technostress, considering the operationalization of A-D misfit is not very relevant as individuals have no privilege to demand others for anything, only N-S misfit was adopted. There are such items as "*I feel stressed as I do not have much support from my classmates for technology-enhanced learning*".

Burnout was modified from Kristensen et al. (2005), with a reported Cronbach's alpha value of 0.87. The items measuring university students' persistence in TEL were adapted from Wu and Chen (2017); the value of Cronbach's alpha was reported to be 0.94. Finally, the construct of perceived performance was adapted from Jena (2015) and Tarafdar et al. (2010), with a reported Cronbach's alpha value ranging from 0.81 to 0.91.

To improve the clarity of the survey items, ten participants were approached to test their understanding of the wording of the items. Subsequently, items with potentially confusing descriptions were refined to express more explicit ideas of technostress in TEL. Moreover, as the original survey was in English, a back-translation procedure was performed to ensure minimal differences between the English and the Chinese versions.

Before the statistical modelling, a number of rounds of exploratory factor analysis were conducted first to refine the original survey instrument. Principal component analysis was used. Eventually, seven items were removed from the original survey instrument, generating a final survey with 38 items (see Appendix A). The Cronbach's alpha values of the final scale used in the current study were all above 0.70 and were reported in detail later in Section 4.1. In addition, Harman's single-factor test was conducted to examine possible common method bias (Podsakoff, MacKenzie, & Podsakoff, 2012) as this study mainly used self-report data. When all variables were entered into an exploratory factor analysis to evaluate the un-rotated factor solution, the single largest factor explained 22.65 % of the variance, which is far below the threshold of 50%. Therefore, the validity of this study was not undermined by this issue.

3.3. Data analysis

This study used partial least squares structural equation modelling (PLS-SEM) to validate the proposed research model. PLS-SEM is prediction-oriented with the aim of maximizing the variance explained for the latent dependent variables (Chin, 1998; Hair, Hult, Ringle, & Sarstedt, 2014). The exploratory characteristic of PLS-SEM fits the objective of this study. The PLS-SEM package (Sanchez, 2013) embedded in the R language was used to perform the calculation.

4. Results

A two-step procedure was followed to conduct the data analysis: the measurement model and the structural model (Hair et al., 2014). Then, the whole dataset was split based on gender and students' grade levels. Comparisons between males and females and between students of different grade levels were performed to examine whether there were any significant differences related to gender and students' grade levels in the relationships among multiple dimensions of P-

E misfit of technostress and university students' burnout, persistence in TEL, and their perceived performance.

4.1. Measurement model

The measurement model was evaluated in terms of the item reliability, convergent validity, and discriminant validity. Specifically, item reliability is obtained by the assessing the loading of the items with their respective latent factors, which should be above 0.70 (Hair et al., 2014). As indicated in Table 1, all items' loading coefficients exceeded 0.70.

Convergent validity evaluates the degree to which items of an instruments that are theoretically related to one another are in fact related (Hair, Ringle, & Sarstedt, 2011). It is examined in terms of two criteria: (a) the composite reliability of a latent construct should be higher than 0.70; (b) the minimum value of a latent construct's average variance extracted (AVE) should exceed 0.50 (Fornell & Larcker, 1981). As shown in Table 1, both the composite reliability and AVEs of the latent variables satisfied the criteria.

Table 1

Cronbach's alpha, composite reliability, average variance extracted (AVE), and factor loadings of the constructs and items in the research model.

Constructs/Items	*Cronbach's alpha*	*Composite reliability*	*AVE*	*Factor loadings*	*M (SD)*
P-O misfit of technostress	0.95	0.96	0.71		
PO1				0.81	1.86 (1.05)
PO2				0.85	1.94 (1.07)
PO3				0.82	2.03 (1.07)
PO4				0.82	2.02 (1.07)
PO5				0.84	1.88 (1.06)
PO6				0.86	1.82 (1.03)
PO7				0.88	2.04 (1.07)
PO8				0.87	2.04 (1.07)

PO9				0.85	1.74 (1.05)
P-TEL misfit of technostress	0.94	0.95	0.68		
PT1				0.78	1.89 (1.02)
PT2				0.84	1.92 (1.03)
PT3				0.83	1.94 (1.03)
PT4				0.86	1.91 (1.04)
PT5				0.82	1.80 (1.06)
PT6				0.81	1.87 (1.07)
PT7				0.84	1.87 (1.06)
PT8				0.84	1.85 (1.04)
PT9				0.81	1.89 (1.06)
P-P fit	0.85	0.90	0.70		
PP1				0.88	1.66 (1.01)
PP2				0.86	1.54 (1.00)
PP3				0.87	1.66 (1.01)
PP4				0.70	1.81 (1.06)
Burnout	0.95	0.96	0.79		
BN1				0.87	1.96 (0.98)
BN2				0.90	1.86 (1.00)
BN3				0.92	1.70 (1.00)
BN4				0.87	1.88 (1.01)
BN5				0.91	1.72 (0.98)
BN6				0.87	1.74 (1.01)
Persistence in TEL	0.93	0.95	0.77		
PERS1				0.84	2.49 (0.87)
PERS2				0.87	2.47 (0.90)
PERS3				0.91	2.50 (0.89)
PERS4				0.88	2.45 (0.88)
PERS5				0.89	2.46 (0.86)
Perceived performance	0.92	0.94	0.77		
PERF1				0.86	2.26 (0.90)
PERF2				0.89	2.29 (0.89)
PERF3				0.89	2.45 (0.89)
PERF4				0.87	2.46 (0.89)
PERF5				0.88	2.47 (0.90)

The discriminant validity of the research model was examined according to two standards. (a) The square root of each latent factor's AVE should be higher than the correlations between that and other latent factors (Chin, 1998). (b) The survey items should load more on the latent factors that they expect to measure than on other latent factors (Chin, Marcolin, & Newsted, 2003). Table 2 and Appendix B show that the two standards were met and hence, the discriminant validity was substantiated.

Table 2

Discriminant validity of the research model.

Constructs	1	2	3	4	5	6
1. P-O misfit of technostress	**0.84**					
2. P-TEL misfit of technostress	0.82	**0.82**				
3. P-P misfit of technostress	0.75	0.65	**0.83**			
4. Burnout	0.68	0.64	0.61	**0.89**		
5. Persistence in TEL	-0.17	-0.15	-0.14	-0.10	**0.88**	
6. Perceived performance	-0.16	-0.13	-0.14	-0.15	0.70	**0.87**

Note. The bold values in the diagonal row are the square roots of the average variance extracted for the constructs in the research model.

4.2. Structural model

The structural model of this study was assessed through the significance levels of the path coefficients in the research model and the explanatory power (R^2) of the endogenous factors. As PLS-SEM does not rely on distributional assumptions, parametric approaches are not suitable to evaluate the path coefficients' significance levels. Thus, the bootstrapping technique is suggested for this purpose (Hair et al., 2014; Sanchez, 2013). The bootstrapping validation outcomes of the structural model are presented in Table 3 and are illustrated in Figure 2.

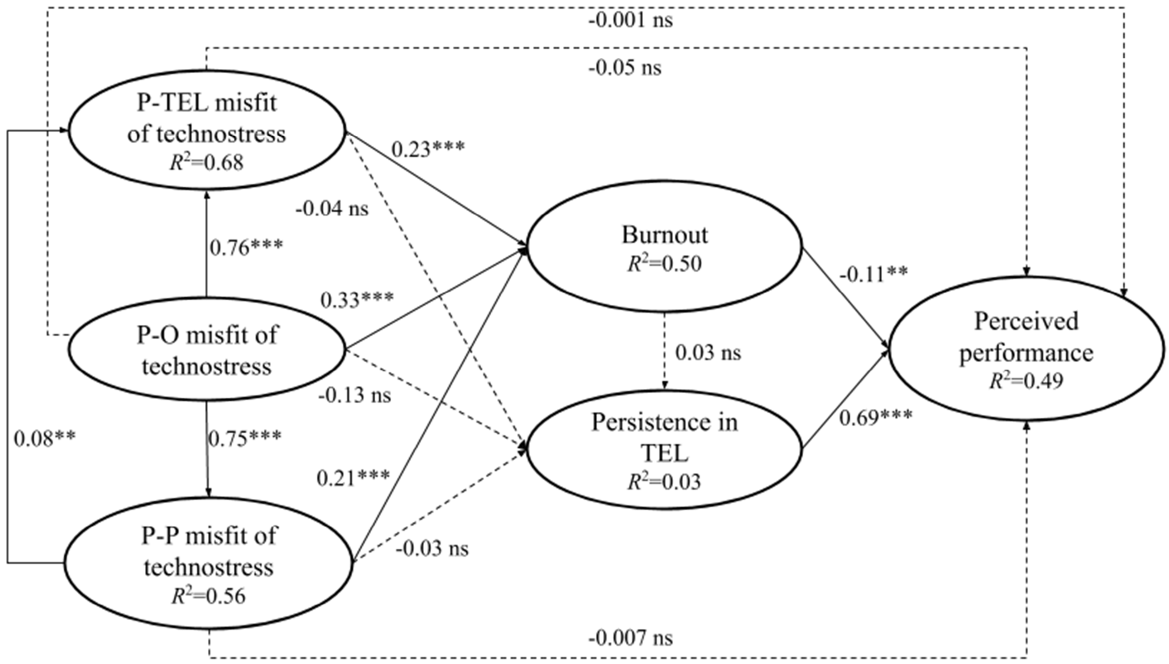

Figure 2. The validated multidimensional P-E misfit of technostress in TEL (*N*=740).
Note. ** *p*<0.01; *** *p*<0.001; ns=nonsignificant; dotted lines are nonsignificant paths.

Table 3

Validation outcomes for the research model.

Hypotheses		Path coefficients	Standard error	Percentile 0.025	Percentile 0.975	Results
H1a	**P-O misfit -> P-TEL misfit**	**0.76*** **	**0.03**	**0.71**	**0.82**	**Support**
H1b	**P-O misfit -> P-P misfit**	**0.75*** **	**0.02**	**0.70**	**0.79**	**Support**
H1c	**P-P misfit -> P-TEL misfit**	**0.08** **	**0.04**	**0.02**	**0.15**	**Support**
H2a	**P-TEL misfit -> Burnout**	**0.23*** **	**0.07**	**0.09**	**0.33**	**Support**
H2b	**P-O misfit -> Burnout**	**0.33*** **	**0.07**	**0.19**	**0.49**	**Support**
H2c	**P-P misfit -> Burnout**	**0.21*** **	**0.06**	**0.10**	**0.34**	**Support**
H3a	P-TEL misfit -> Persistence	-0.04 ns	0.06	-0.18	0.07	Not support
H3b	P-O misfit-> Persistence	-0.13 ns	0.08	-0.27	0.007	Not support
H3c	P-P misfit -> Persistence	-0.03 ns	0.05	-0.15	0.05	Not support
H4a	P-TEL misfit -> Performance	0.05 ns	0.05	-0.06	0.13	Not support
H4b	P-O misfit -> Performance	-0.001 ns	0.07	-0.12	0.12	Not support
H4c	P-P misfit -> Performance	-0.007 ns	0.04	-0.08	0.08	Not support
H5a	Burnout -> Persistence	0.03 ns	0.06	-0.08	0.12	Not support

H5b	**Burnout -> Performance**	**-0.11****	**0.05**	**-0.19**	**-0.02**	**Support**
H6	**Persistence-> Performance**	**0.69*****	**0.03**	**0.62**	**0.75**	**Support**

Note. * p<.05; ** p<.01; *** p<.001; ns=nonsignificant; Persistence= Persistence in TEL; Performance= Perceived performance; The bold values indicate the hypotheses that were supported.

Specifically, as proposed in the hypothesis section, the multiple dimensions of P-E misfit of technostress were interrelated with one another. P-O misfit of technostress predicted both P-TEL misfit of technostress and P-P misfit of technostress, thereby supporting H1a and H1b. P-P misfit of technostress predicted P-TEL misfit, thus, supporting H1c. Moreover, the three dimensions of P-E misfit of technostress had strong positive associations with university students' burnout, which again was negatively associated with students' perceived performance but was not strongly associated with their persistence in TEL; hence, H2a, H2b, H2c, and H5b were substantiated while H5a was not. In addition, students' persistence in TEL had a strong positive association with their perceived performance, thereby supporting H6. However, the three dimensions of P-E misfit of technostress did not significantly affect students' persistence in TEL and did not directly affect students' perceived performance. Therefore, H3a, H3b, H3c, H4a, H4b, and H4c were not supported.

As PLS-SEM is aimed to maximize the variance explained in all endogenous factors, the R^2 values of the endogenous factors are considered critical criteria of the quality of structural models (Henseler, Ringle, & Sinkovics, 2009). According to Cohen (1988), the R^2 values of 0.02, 0.13, and 0.26 indicate small, medium, and large effect sizes, respectively. As illustrated in Figure 2, the R^2 values of P-TEL misfit of technostress, P-P misfit of technostress, burnout, persistence in TEL, and perceived performance were 0.68, 0.56, 0.50, 0.03, and 0.49, separately, most of which were substantial. Therefore, the explanatory power of the research was quite high.

Based on the global criterion of goodness-of-fit (0<GoF<1) developed by Tenenhaus, Amato, and Esposito Vinzi (2004), which is used to evaluate the overall quality of PLS-SEM, the

GoF values of 0.10, 0.25, and 0.36 suggest small, medium, and large fit, respectively. In this study, the PLS-SEM analysis generated a GoF value of 0.57, which indicates a good fit of the research model.

4.3. Group comparisons based on genders and grade levels

In PLS-SEM, group comparisons are usually performed by comparing differences at structural levels of a research model (i.e., path coefficients; Hair et al., 2014; Sanchez, 2013). The bootstrap *t*-test approach was used for this purpose. As to the gender comparison, the whole dataset was split into two groups based on gender. Then bootstrap samples were performed with replacements for each group. Subsequently, subsamples were compared through *t*-test regarding the standard error estimates of the path coefficients. Regarding the comparison based on grade levels, students in Year 1 were labeled as lower-grade students; those in Years 2, 3, 4, and postgraduate studies were combined and were labeled as higher-grade students. This way of grouping, on the one hand, considers the unequal distribution of participants in different years of study. On the other hand, it considers that Year 1 students just began their university study and that their capabilities in dealing with TEL in new environments could be different from their seniors.

Table 4

Comparison between male and female students.

Path		Global	Group: Females	Group: Males	*diff.abs*	*t*	*df*	*p*
H1c	P-O misfit -> P-TEL misfit	0.76	0.77	0.73	0.04	0.44	738	0.33
H2a	P-O misfit -> P-P misfit	0.75	0.70	0.84	0.14	1.39	738	0.10
H2b	P-P misfit -> P-TEL misfit	0.08	0.09	0.07	0.02	0.30	738	0.38
H2c	P-TEL misfit -> Burnout	0.23	0.28	0.13	0.15	1.09	738	0.14
H3a	P-O misfit -> Burnout	0.33	0..29	0.46	0.17	1.23	738	0.11
H3b	**P-P misfit -> Burnout**	**0.21**	**0.25**	**0.05**	**0.20**	**2.02**	**738**	**0.02**

H3c	P-TEL misfit -> Persistence	-0.04	0.01	-0.10	0.11	0.78	738	0.22
H4a	P-O misfit-> Persistence	-0.13	-0.141	-0.144	0.003	0.24	738	0.41
H4b	P-P misfit -> Persistence	-0.03	-0.01	-0.04	0.03	0.35	738	0.36
H4c	P-TEL misfit -> Performance	0.05	0.03	0.14	0.11	0.99	738	0.16
H5a	P-O misfit -> Performance	-0.001	0.01	-0.02	0.03	0.27	738	0.40
H5b	P-P misfit -> Performance	-0.007	0.02	-0.09	0.11	1.15	738	0.12
H6[#]	Burnout -> Persistence	0.03	-0.12	0.36	0.48	3.83	738	0.0001
H1c	**Burnout -> Performance**	**-0.11**	**-0.20**	**0.13**	**0.33**	**3.26**	**738**	**0.0006**
H2a	Persistence-> Performance	0.69	0.68	0.61	0.07	1.19	738	0.12

Note. diff.abs= absolute difference; The bold rows indicate the paths where male students significantly differed from female students; #=As burnout did not significantly predict persistence in TEL (path coefficient of 0.03) for the whole sample, the two sub-datasets cannot be regarded as significantly different on the path relationship.

Table 4 indicates that there were significant differences between male and female students with regard to (a) the path coefficient between P-P misfit of technostress and burnout, implying that technostress on the P-P misfit dimension was more likely to incur burnout for female students than males; and (b) the path coefficient between burnout and perceived performance, suggesting that the experience of burnout might have stronger negative influence on female students' perceive performance than males'.

Table 5

Comparison between university students of different grade levels.

Path		Global	Group: Higher	Group: Lower	*diff.abs*	*t*	*df*	*p*
H1c	P-O misfit -> P-TEL misfit	0.76	0.73	0.79	0.06	0.85	738	0.20
H2a	P-O misfit -> P-P misfit	0.75	0.76	0.71	0.05	1.14	738	0.13
H2b	P-P misfit -> P-TEL misfit	0.08	0.09	0.07	0.02	0.24	738	0.41
H2c	P-TEL misfit -> Burnout	0.23	0.22	0.24	0.02	0.10	738	0.46
H3a	P-O misfit -> Burnout	0.33	0.35	0.30	0.05	0.38	738	0.35
H3b	**P-P misfit -> Burnout**	**0.21**	**0.12**	**0.30**	**0.18**	**1.91**	**738**	**0.03**
H3c	P-TEL misfit -> Persistence	-0.04	-0.10	0.05	0.15	0.91	738	0.18
H4a	P-O misfit-> Persistence	-0.13	-0.01	-0.25	0.24	1.45	738	0.07
H4b	P-P misfit -> Persistence	-0.03	-0.09	0.05	0.14	1.34	738	0.09
H4c	P-TEL misfit -> Performance	0.05	0.10	-0.01	0.11	1.06	738	0.15

H5a	P-O misfit -> Performance	-0.001	0.009	0.004	0.005	0.08	738	0.47
H5b	P-P misfit -> Performance	-0.007	0.007	-0.019	0.026	0.41	738	0.34
H6#	Burnout -> Persistence	0.03	0.24	-0.22	0.46	4.34	738	0.00
H1c	Burnout -> Performance	-0.11	-0.05	-0.14	0.09	0.89	738	0.19
H2a	Persistence-> Performance	0.69	0.66	0.69	0.03	0.42	738	0.34

Note. diff.abs= absolute difference; The bold rows indicate the paths where students of different grade levels significantly differed from each other; #=As burnout did not significantly predict persistence in TEL (path coefficient of 0.03) for the whole sample, the two sub-datasets cannot be regarded as significantly different on the path relationship.

As to the group comparison based on grade levels, a significant difference between university students of different grade levels was observed (see Table 5): the path coefficient between P-P misfit of technostress and burnout, implying that technostress on the P-P misfit dimension might have a stronger association with burnout for students of lower-grade levels than those of higher-grade levels.

5. Discussion

This study examined technostress among university students in TEL from a multidimensional P-E misfit approach: technostress on the dimensions of P-O misfit, P-TEL misfit, and P-P misfit. Specifically, a research model was built to investigate how the three dimensions of technostress were related to one another and how they collectively predicted university students' burnout, persistence in TEL, and perceived performance. There were 740 university students recruited from three public universities in China. The findings indicate that P-O misfit of technostress played a fundamental role, strongly predicting P-TEL misfit of technostress and P-P misfit of technostress. P-P misfit of technostress further predicted P-TEL misfit of technostress. And the three dimensions of technostress were positively associated with university students' burnout, which further negatively affected students' perceived performance in TEL. Moreover, among the three dimensions of technostress, P-O misfit of technostress demonstrated the most salient influence on students' burnout. However, the three dimensions of technostress did not have significant negative associations with students' persistence in TEL, and did not directly affect students' perceived performance. In addition, the group comparison based on genders reveals that female students were more susceptible to burnout associated with P-P misfit of technostress and their performance might be more negatively affected by burnout than male students. The group comparison based on grade levels shows that lower-grade students tended to suffer from burnout related to P-P misfit of technostress more than higher-grade students.

The interrelationships among the three dimensions of P-E misfit of technostress are consistent with the multidimensional P-E fit theory that emphasizes that individuals are concurrently nested in multiple dimensions of an environment (Chuang et al., 2016; Jansen & Kristof-Brown, 2006). In this study, TEL takes place in university environments. As such, students' participation in and their relationships with others in TEL are subject to requirements and regulations of universities. Accordingly, technostress on the dimension of misfit between students' abilities and needs and universities' requirements and resources related to TEL is likely to incur technostress on other dimensions of misfit. In addition, as individuals' experience of TEL is often influenced by others (Thomas et al., 2019; A. Y. Yu et al., 2010), students' experience of technostress on the P-P misfit dimension may also cause the technostress on the P-TEL misfit.

The most salient effect of the P-O misfit of technostress on students' burnout corroborates the findings of Jansen and Kristof-Brown (2006), who pointed out that there is a different salience related to each dimension of P-E fit as each aspect of the environment does not contribute equally to overall P-E fit. In higher education environments, university administrators are often decision-makers regarding how TEL should be evaluated and what requirements and standards should be set (Wallace, 2007). As such, P-O misfit of technostress is likely to be more prominent than other dimensional misfit of technostress, thus exerting a greater influence on university students' burnout.

The multidimensional P-E misfit of technostress not exerting strong negative influence on students' persistence in TEL may be due to two reasons: (a) students' technostress levels were not high enough to discourage them from future engagement; and (b) TEL is obligatory in the universities under study, making it impossible for students to simply quit TEL. It may also be because that TEL is and will continue to be a learning mode which cannot be avoided due to the widespread digitalization of learning and teaching in higher education (Dunn & Kennedy, 2019).

The multidimensional P-E misfit of technostress did not affect university students' perceived performance directly, but indirectly through their burnout in TEL. This finding makes sense as the functioning of stress, including technostress, relies on a process before it affects individuals' cognition (Yaribeygi, Panahi, Sahraei, Johnston, & Sahebkar, 2017). Technostress on multiple dimensions of P-E misfit often firstly causes negative effects on individuals' wellbeing, rendering them feeling frustrated, exhausted, and incapable (i.e., burnout), and subsequently leads to reduced cognition and decreased academic performance (Salanova, Schaufeli, Martínez, & Bresó, 2010).

With regard to the comparison outcomes between different genders (see Table 4), previous research (e.g., González-Gómez, Guardiola, Rodríguez, & Alonso, 2012) has shown that female students tend to care more about social interactions and relationships with others in TEL than male students. As a result, they are more susceptible to consequences (e.g., burnout) caused by technostress on the P-P misfit dimension due to lack of social support and interactions in TEL than males. In addition, as females have often been reported to handle stress related to the use of technology less competently than males (Huffman et al., 2013; Lin & Huang, 2014), consequences caused by technostress such as burnout tend to have a stronger negative association with their performance than males.

As to the comparison finding of P-P misfit of technostress being more associated with burnout for lower-grade students than higher-grade students (see Table 5), it could be due to adjustment to a new environment among first-year students. The first year at university is often critical in shaping students' attitudes of and experiences toward learning and has an important impact on students' academic engagement and achievement in subsequent years (Ketonen et al., 2016). Also, first-year university students are more likely to be influenced by their peers in developing perspectives toward university life and understanding of learning at university than their seniors as they start to adapt to new environments (Jamelske, 2009). As a result, first-year students who are alienated from their peers in TEL are more likely to end up suffering from technostress and subsequently experience burnout than their seniors.

5.1. Contribution

This study has the following contributions. First, it contributes to extant literature on technostress by extending current research attention to the student population in higher education. Technostress is not only related to employees working in government and industries and teachers in different school levels, it is also closely related to university students who are major users of technology implemented in education, and also primary recipients of benefits and challenges associated with the use of technology. Acknowledging the existence of technostress among university students in TEL is an important step in starting to deal with this issue and contributing to the improvement of pedagogical, technical, and policy designs in TEL.

Second, distinct from previous research on technostress across different fields, this study examined this issue from the multidimensional P-E misfit perspective. Technostress is not simply the problem caused by the usage of technology itself. Instead, it is related to the misfit between students and multiple environment factors, including TEL per se, university administration, and other learners engaged in TEL. In addition, technostress on the P-O misfit dimension may affect the formation of technostress on other misfit dimensions. A more comprehensive understanding of technostress among university students in TEL is critical to develop effective solutions to this issue and to promote students' productive participation in TEL.

Third, this study also contributes to multidimensional P-E fit theory and its application in educational settings by revealing distinct salience associated with different misfit dimensions of technostress. As different environmental factors do not exert equal demands on and provide equal support to university students during TEL (Jansen & Kristof-Brown, 2006), different dimensions of P-E misfit of technostress are likely to cause distinct levels of negative consequences. Fourth, students with different demographic characteristics tend to have distinct perceptions toward and experience with multiple dimensions of higher education environments related to TEL. As a result, the findings of technostress related to differences of gender and students grade levels contribute to extant discussions regarding potential effects of demographic factors on technostress in TEL.

5.2. Implications, limitations, and future research

The findings of this study have implications on future research and practice on technostress in the following ways. First, the model of the multidimensional P-E misfit of technostress could inform the development of solutions to this issue from a more comprehensive perspective. For instance, although improving user interface design may decrease students' technostress levels, it is not likely to address technostress effectively as technostress is not only related to technology itself but also related to changed requirements and academic pressure caused by the university side and the availability of support from peers.

Second, as P-O misfit of technostress predicted other misfit dimensions of technostress and showed the most salient effect on students' burnout, the university dimension (e.g., academic requirements, evaluation, and healthy learning environments) may stand out as a significant factor in causing technostress and other resultantly negative consequences, thus also making the university administration a key stakeholder to address technostress. Besides interventions at individual levels to manage technostress such as ability development and time management, universities could create a psychologically healthy environment for TEL characterized by a good fit between students' abilities and needs and universities' requirements and resources (Grawitch, Ballard, & Erb, 2015). By combing both individual and university levels of interventions, university students may be enabled to deal with technostress in a more effective way.

Third, solutions to technostress should account for demographic differences of students. As lower-grade students and female students are more likely to suffer from consequences caused by technostress on the P-P misfit dimension, social support and learning community should be particularly encouraged for these students to help them form positive attitudes toward and develop pleasurable experience with TEL.

Nevertheless, this study has the following limitations. First, this study used self-report data, which may be subject to report errors. Thus, future research is suggested to triangulate findings from self-report data with interviews and clinical diagnoses to provide stronger argumentation of the issue of technostress among university students during TEL. Second, this study adopted a cross-sectional design, therefore limiting the interpretation of causal relationships. Longitudinal design is needed in future research to further investigate the relationships among multiple dimensions of P-E misfit of technostress and university students' burnout and performance in TEL. For instance, researchers can track the development of technostress among a group of students in TEL using such methods as observation, interviews, and portable electroencephalogram (EEG). Data from portable EEG and observation could reveal students' actual physical and biological responses related to technostress over time while interviews could provide researchers with in-depth information about students' experiences related to technostress.

Third, the findings of this study might be subject to the uneven gender and grade distribution of the participants due to the constraint of the study sites. As such, future research is needed to continually validate the research findings using a balanced number of participants of different genders and grades. Fourth, the use of perceived performance in lieu of actual performance in the research model might pose constraints on the generalization of the research findings. Therefore, researchers in the future may consider obtaining learners' actual performance in TEL to further validate this study. Finally, possible cultural differences among university students in experiencing technostress in TEL should be accounted for, as students from different countries and cultural backgrounds often have different exposures to TEL (Nistor, Göğüş, & Lerche, 2013). Future research is advised to validate the findings related to the multidimensional P-E misfit of technostress in Western universities.

6. Conclusion

As higher education is continually transformed by new technology, ensuring students to adapt to changed landscapes of learning is essential for them to succeed academically. The multidimensional P-E misfit framework for technostress could allow for a more comprehensive understanding of the potentially imbalanced interplay between students' characteristics and environmental factors, which is important in disentangling factors affecting students' wellbeing and academic success in TEL.

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Highlights

- This study investigated technostress among university students in TEL.
- A multidimensional P-E misfit framework was developed to examine technostress.
- Technostress on the dimension of P-O misfit predicted other dimensions of misfit.
- The multiple dimensions of P-E misfit of technostress predicted students' burnout.
- Students' burnout negatively predicted their perceived performance in TEL.