

The Impact of Technological Pedagogical Knowledge, Technostress on Work Performance in Chinese University: The Moderating Role of Extraversion

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Abstract

How do different educational contexts (rural vs. urban universities, public vs. private institutions) affect the relationship between TPK, technostress, and work performance? Understanding this can help tailor interventions based on specific institutional needs. The objectives of this research were 1) To study the Impact of Technological Pedagogical Knowledge, Technostress on Work Performance in Chinese University: The Moderating Role of Extraversion.

This research were collected through self-report surveys utilizing a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). This approach facilitated the measurement of variables related to technostress and academic performance. To enhance relevance to the target demographic, the Chinese Version of the Organization Big Five Scale (ORG-B5) was utilized to assess personality traits, particularly focusing on extraversion, which is central to the study.

The research results were found as follows; The Technological Pedagogical Knowledge (TPK) dimension in Technological pedagogical content knowledge (TPACK) is one of the important types of knowledge that teachers should have in the process of integrating technology. In the context of digital transformation of education, because technology integration reshapes the educational process, teachers' work performance is naturally affected by educational technology. Technology integration into teaching inevitably brings about technostress among teachers. Therefore, this study aimed to investigate the relationship between TPK, technostress and work performance of teachers in Chinese undergraduate colleges and universities. The results show that 1) TPK has an effect on technostress and work performance 2) technostress has an effect on work performance 3) extraversion moderates the relationship between TPK and technostress. The results of the study provide reference suggestions for enhancing work performance, relieving technostress, and having management of teachers in higher education in the context of digitalization.

Keywords: Technological Pedagogical Knowledge; Technostress; Work Performance; Moderating Role of Extraversion

Introduction

Higher education institutions around the world are actively utilising information communication technology (ICT) and pedagogical techniques such as flipped classrooms, massive online open courses, etc. for pedagogical innovation and enhanced learning (Joo, & Kim, 2016). The digital transformation of education is an inevitable change that is taking place in the shape of education (UNESCO-ICHEI & Institute of Education Tsinghua University, 2022). The success of digital transformation in higher education depends largely on the technological skills and knowledge of teachers (Al-Ali & Marks, 2022; Marks & Al-Ali, 2020). Teachers need to spend a significant amount of time learning and integrating new technologies, which may affect their instructional preparation and other professional development activities (Gurung & Schwartz, 2011). The digital transformation of education, the changes in teaching and learning processes, teachers' roles, teaching practices and job requirements caused by the use of information technology and pedagogical techniques, and the increased time and effort they have to spend on adapting to these changes are putting university teachers under increasing pressure (Jena, 2015). As a result, university teachers may feel overwhelmed, anxious and stressed (Skaalvik & Skaalvik, 2017), which is not only related to their health issues, but also to the management of HEIs (Hung, & Lin, 2015), their organisational commitment and work performance may be negatively affected (Al-Fudail & Mellar, 2008).

Challenges such as lack of faculty support and an overemphasis on the technology itself can hinder the effective use of instructional technology in higher education (Garrison & Akyol, 2009). Therefore, teachers' technology-integrated teaching skills should also evolve in order to maximise student learning. Individual factors are important factors that affect work performance, such as knowledge possessed by the individual, cognitive ability, job competence, etc. (Cai & Lin, 2003). Technical knowledge, pedagogical knowledge, and content knowledge are important factors that affect job performance. Technological, pedagogical and content knowledge (TPACK) as a kind of knowledge that teachers need to have significantly affects the quality of teaching and work performance of teachers. Certain teaching technologies may not be suitable for all subjects or programmers, leading to teachers facing difficulties in selecting and using these technologies (Kirkwood & Price, 2014), which requires teachers to have the knowledge to integrate technology into their teaching, which is the Technological Pedagogical Knowledge (TPK) dimension of TPACK.

According to the Conservation of Resource Theory (COR), it is known that TPK serves as a resource that can help reduce stress and enhance work performance. COR suggests that stressors are determinants of stress perception, and that the same stressor constitutes a roughly similar stress perception for different individuals. At the same time, according to Cognitive Appraisal Theory (CAT), it is known that there are differences in cognition between different people, and it is worth exploring whether people with personality traits will have different levels of response to stress and anxiety, such as technostress as a stressor, but for some people it is a challenge, but instead, it will have a positive effect (Brulé & Morgan, 2018). Specific questions for this study include: how does TPK affect technostress and teacher work performance? How does technostress mediate the relationship between TPK and work performance? Do individuals who exist with varying degrees of extraversion experience different effects when faced with the same stressor due to different perceptions?

The research problems identified for further exploration revolve around the impact of Technological Pedagogical Knowledge (TPK) on technostress and work performance, specifically how TPK influences technostress levels among university teachers and whether higher TPK correlates with reduced stress and improved job effectiveness. Additionally, it raises questions about the mediating role of technostress in the relationship between TPK and teaching efficacy, as well as how personality traits, particularly varying degrees of extraversion, affect individuals' experiences of technostress in the face of technological challenges. The need for effective support structures and professional development initiatives to help teachers manage technostress while integrating technology is crucial, alongside identifying barriers that hinder the effective use of instructional technology in higher education. Addressing these issues is essential for facilitating a smoother digital transformation in education, ultimately enhancing both teacher experiences and student learning outcomes.

Research Objective

To study the Impact of Technological Pedagogical Knowledge, Technostress on Work Performance in Chinese University: The Moderating Role of Extraversion

Literature Review

This section outlines the core concepts of the study, reviews the relevant literature and outlines the theoretical underpinnings that underpin the relationships explored. A hypothesized conceptual model is also presented.

TPK

Subject matter pedagogical knowledge for integrating technology (TPACK) refers to a teacher's understanding of the interplay between subject matter content, pedagogy, and technology, and is considered to be the framework of knowledge that teachers need to make pedagogical decisions about integrating digital technology and using it as a learning tool that is pedagogical knowledge for the 21st century, TPACK is the foundation for effective teaching and learning using technology and is a new form of knowledge in which teachers creatively integrate three key types of knowledge: technology, pedagogy, and subject content, and go beyond all three, as shown in Figure 1. This framework consists of seven elements: three foundational elements, three composite elements, and a most complex core element (Mishra & Koehler, 2006) .

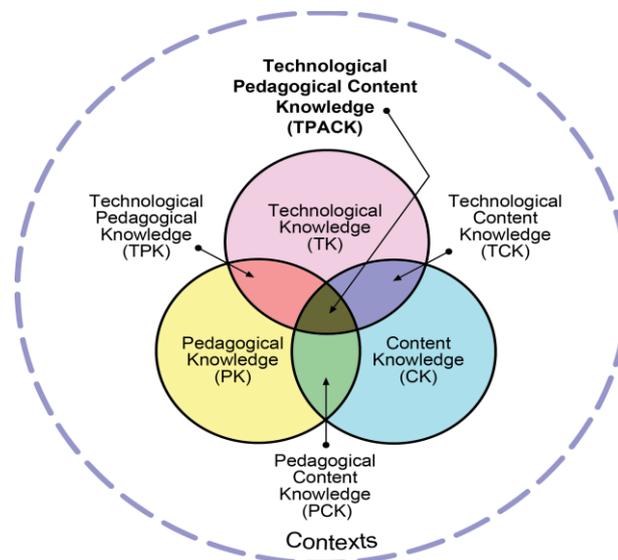


Figure 1 Technological pedagogical content knowledge .
Source: <http://tpack.org>

Technological Pedagogical Knowledge (TPK) is the result of the combination of TK and PK and refers to how various technologies are used and how teachers use them to deliver content. Teachers need to understand the pedagogical functions of technology tools and develop or apply educationally orientated information technology to enhance student understanding and optimise teacher instruction (Munyengabe, Yiyi, Haiyan, & Hitimana, 2017)

Technostress

Brod (1984) was one of the first to suggest that computer technology could lead to user stress, introducing the term "technostress" to label psychological reactions to negative experiences with computers. He defined technostress as "a modern adaptive disorder resulting from the inability to cope with new computer technology in a healthy way" (Brod, 1984).

As ICTs have brought new opportunities and challenges to the learning and teaching environment, universities around the world have been advancing ICT-enabled educational processes such as mobile teaching, blended learning, e-learning, and virtual reality-based instruction. These changes can benefit learners, but they can also put more technostress on university teachers, some of whom are not well versed in these technologies (Hatlevik & Hatlevik, 2018) .

Fernández-Batanero et al. (2021) found that teachers display high levels of anxiety or technostress when using educational technology in the classroom. The technostress faced by teachers is defined as the stress caused by the use of technology and the skills and knowledge needed to integrate it effectively in teaching practice. The negative consequences of technostress can be physical, psychological, social and organisational that negatively affect people's work performance . Therefore, the issue of technostress deserves a great deal of attention from academics, policy makers, and other stakeholders in higher education institutions (Li & Wang, 2021).

Work Performance

Work performance has an impact on productivity, employee engagement, etc. Work performance is also an important concern for organisational managers as it determines why some organisations perform better than others (Li & Wang, 2021). The importance of work performance also applies to higher education settings (Wæraas & Solbakk, 2009). As a type of organisation, the work performance of its members, i.e. the teachers in higher education, is also a matter of concern. Teachers' work performance refers to the effect of teachers' behaviours in order to accomplish the educational goals of the school, and is an important measure of whether teachers are effective in undertaking their educational and teaching work (Cheng & Zhu, 2023). Teachers' performance has a significant impact on students. Teacher performance in higher education has a significant impact on student achievement, educational quality, and institutional success. Teacher performance directly affects the quality of student learning. Teacher performance directly affects the quality of student learning and educational output. Research into the factors affecting teachers' work performance in higher education not only improves teachers' performance and well-being, but also informs organisational resource allocation (Li & Wang, 2021).

Extraversion

McCrae and Costa (1985) building on previous scholarly research and based on their own theoretical conceptualisations, focusing on the combination factor analyses to finalise the NEO-PI scale to measure the Big Five personality factors. revised the NEO-PI-R scale, which is now recognised as a standardised measure of the Big Five personality traits. The Big Five are Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.

Extraversion describes the extent to which an individual is active, confident, energetic, enthusiastic, outgoing, and talkative. In their study, they found that people with significant personality traits of extraversion and agreeableness showed higher work performance in those jobs that involved dealing with people. Teaching in higher education requires good communication skills, and teacher-student interaction is also an important part of teachers' interpersonal interactions (Jiang et al., 2017).

Hypotheses Development

From the perspective of COR, when individuals have an abundance of resources, it improves their morale and therefore their performance. One study found that organisational support and TPACK are important antecedents of teacher performance in online environments. In addition, Tosuntaş et al. (2021) showed that technology integration through TPACK can improve teacher performance and student achievement, highlighting the potential impact of TPACK on overall educational outcomes. Raste examined teachers' coping mechanisms, TPACK, and burnout in the COVID-19 pandemic and concluded that TPACK may play a role in reducing burnout and supporting teacher well-being, which, in turn, may affect teacher work performance. Therefore, the following hypothesis is proposed:

Hypothesis 1: There is a positive effect of TPK on Work performance.

According to the COR, TPK is considered as one of the resources, and when resources are reduced, negative emotions such as stress are generated (Hobfoll, 1989). Among the studies in the literature revealing the interrelationship between TPACK and technostress, it has been found that the improvement of teachers' TPACK competence reduces the technostress associated with the use of technological devices in the educational process, found also TPACK as a variable that affects the reduction of teachers' technostress levels. conducted

a correlational study on TPACK-SAMR digital literacy, technostress and teaching performance of English lecturers. Whilst this study did not directly address the relationship between TPK and technostress, it provided valuable insights into the wider context of digital literacy skills and their potential impact on technostress and teaching performance. Based on the above theory and literature, the following hypotheses are proposed:

Hypothesis 2: There is a negative effect of TPK on technostress.

COR implies that stress reduces employee resources, which in turn leads to negative outcomes at work (Hobfoll, 1989). In general, high levels of technostress are associated with lower job satisfaction and work performance (Tarafdard et al., 2014). Rapid advances in information technology have led to technostress among university teachers, causing them to feel powerless and overwhelmed, which negatively affects their work performance (Al-Fudail & Mellar, 2008; Shedletsky & Aitken, 2001). The literature confirms how technostress can negatively affect teachers' work performance. Li and Wang (2021)'s study found that technological complexity and technological insecurity have a significant negative impact on college teachers' work performance. Based on this, the following hypothesis is proposed:

Hypothesis 3: There is a negative effect of technostress on teachers' work performance.

Extraversion a personality trait that is an energy resource (Hobfoll, 1989). It is a positive personal trait that can alleviate received shock stress. According to the Cognitive Appraisal Theory of Stress, the positive or negative appraisal of technostress by different individuals is influenced not only by external demands, but also by the internal demands (personality traits) of the individual (Lazarus & Folkman, 1984). Personality may have an impact on the perception of occupational stressors, which may have an impact on the processing of these stressors (Feng et al., 2014). It has also been previously demonstrated that low stress is correlated with. Based on this, the following hypothesis is proposed:

Research Methodology

Participants and Procedures

This study examined the relationship between TPK, technostress and work performance among full-time faculty members in undergraduate colleges and universities in mainland China's data showed that in 2022, there were 1,239 higher general undergraduate Academic HEIs in China, of which there were 1,318,556 full-time teachers Full-time Teachers. The sample size is large, so non-probability sampling was used. According to Taro Yamane's formula, the number of questionnaires was calculated. There are large differences in the number of teachers between regions in China. In sampling, quota sampling was conducted based on the proportion of the number of teachers in each region to the total number of teachers in colleges and universities throughout China.

Instruments

In this study, data were collected through self-report surveys. All items are measured by a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). for the study measuring the effects of social apps on technostress and academic performance. The Chinese Version of the Organization Big Five Scale (ORG-B5) was chosen for this study in order to be more relevant to Chinese teachers. Five.

Data Analysis

Partial Least Squares Structural Equation Modelling (PLS - SEM) was chosen for this study for two reasons. Firstly, PLS - SEM is particularly suitable for exploratory studies , making it well suited to test novel aspects of the model. Second, PLS - SEM effectively tests for mediating and moderating effects and provides a robust analytical framework for assessing the complex relationships in the model.

Hypothesis 4: Extraversion positively moderates the relationship of TPK to technostress
Based on the above hypotheses, a conceptual model was developed (see Figure 2).

Research Conceptual Framework

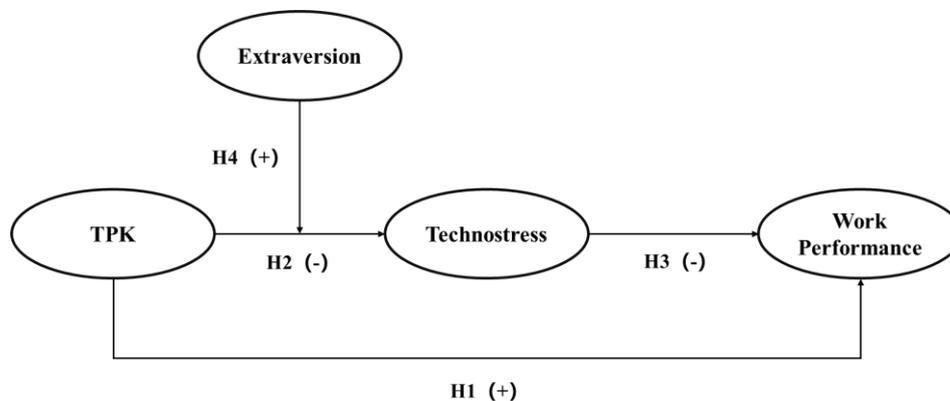


Figure 2 Research Conceptual Framework

Research Results

In accordance with 's analytical procedure, the data were analyzed in two steps. In the first step, the reliability and validity of the measurement model was assessed, which is essential to ensure that the constructs accurately reflect the variables to be measured. The second step assessed the structural model and mediating effects to determine the strength and significance of the hypothesized relationships. Prior to checking for relationships, a check for common methodological bias ensured data completeness due to the self-reported nature of the survey.

Characteristics of the Respondents

The sample provides a diverse overview of the sector's labor force. The age distribution of the survey respondents shows a youthful trend, with 57.47 % aged 21 ~ 30 and 34.16 % aged 31 ~ 40, highlighting the youthful nature of the technology industry. 5.88 % and 2.49 % of individuals aged 41 ~ 50 and around 50 years old, respectively, indicate that the proportion of older employees is lower. In terms of gender, the proportion of female employees in the sample (58.82 %) is higher than that of male employees (41.18 %). Marital status was evenly divided among the participants. 49.32 % were unmarried and 50.68 % were married. In terms of job position, most of the respondents (66.97 %) were general employees while 33.03 % held managerial roles. Table 1 presents the descriptive characteristics of the sample.

The results of the frequency analysis of the demographic variables of the sample are shown in Table 1, with 248 males (46.3 per cent) and 288 females (53.7 per cent). The average age of the respondents was 38.5, with the youngest being 25 years old and the oldest 65 years old. Among the education levels, 63.2% were master's degree holders and 20.1% were doctoral degree holders. Of the respondents, 46.1 per cent had intermediate titles, 33.2 per cent had associate titles and 14 per cent had senior titles.

Table 1 Frequency analysis of demographic variables

variant	options (as in computer software settings)	frequency	percent age
age groups	<= 25	8	1.5 %
	26 - 35	205	38.2 %
	36 - 45	236	44.0 %
	46 - 60	86	16.0 %
	61+	1	0.2 %
academic qualifications	university college	2	0.4 %
	university undergraduate course	87	16.2 %
	Master's degree student	339	63.2 %
	PhD student	108	20.1%
title	ungraded	36	6.7 %
	middle level (e.g. doctoral degree)	247	46.1%
	deputy high official title	178	33.2 %
	high official title	75	14.0 %
distinguishing between the sexes	male	248	46.3 %
	women	288	53.7 %

Measurement Model Analysis

Measurement model analyses assessed Cronbach ' s alpha (α) and combined reliability (CR) to confirm internal consistency, while mean variance extraction (AVE) was examined to verify convergent validity. Reliability of the indicators was ensured by analyzing the loading values of individual question items.

The results in Table 2 show that all the constructs meet the established criteria for a robust measurement model. The loading of all items exceeds 0.7, indicating strong indicator reliability . The CA and CR values for all constructs were well above the acceptable cut-off value of 0.7, confirming internal consistency . AVE values for all constructs surpassed the 0.50 standard, affirming convergent validity, which suggests that the majority of the variance in items is explained by their respective constructs.

Table 2 Construct Reliability, Validity, and Factor Loadings

	CA	CR	AVE	Items	Loading
TPK	0.906	0.930	0.726	TPK1	0.875
				TPK2	0.873
				TPK3	0.796
				TPK4	0.866
				TPK5	0.848
WP	0.940	0.947	0.581	WP1	0.722
				WP2	0.766
				WP3	0.806
				WP4	0.767
				WP5	0.829
				WP6	0.837
				WP7	0.793
				WP8	0.704
				WP9	0.761
				WP11	0.737
				WP12	0.700
				WP13	0.703
				TT	0.929
TT2	0.914				
TT3	0.909				
TT4	0.897				
EX	0.884	0.928	0.810	EX1	0.896
				EX2	0.942
				EX3	0.860

Distinguishing validity was critically assessed by three methods: cross-loadings, the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. Cross-loading analyses indicated that the question items had the highest loadings on their respective constructs, and according to Table 3, the Fornell-Larcker criterion indicated that the square root of the AVEs was greater than the correlation between the constructs, and that the HTMT ratio was less than 0.85. Together, these findings suggest that the measurement model has strong discriminant validity, consistent with model (Hair et al., 2021) criteria for discriminating between constructs in the model.

Table 3 Correlation among Variables

	EX	TPK	TT	WP
EX	0.900			
TPK	-0.185 (0.205)	0.852		
TT	0.185 (0.201)	-0.349 (0.375)	0.908	
WP	-0.200 (0.214)	0.592 (0.633)	-0.535 (0.569)	0.762

Note. the square root of AVE is presented in diagonal; square root of AVE is presented in diagonal; value within bracket is the value of HTMT ratio.

Common Method Bias (CMB) Assessment and Multicollinearity

To address the potential problem of common method bias (CMB) and to assess multicollinearity in the study, Harman's one-factor test was used. In this study, four factors with eigenvalues greater than 1 were obtained based on data from 536 formal measurement samples and the variance contribution of the first factor was 43.32%, which is less than the critical value of 50%, indicating that common method bias is not serious. In addition, the application of marker variable technique as an assessment of CMB additional measure. The method involves the inclusion of a variable in the model that is theoretically unrelated to the variable of interest. The correlations between all latent and marker variables were less than 0.3; further supporting the conclusion that there is no common methodological bias in this study (Tehseen et al., 2017).

Structural Model Analysis

Structural model analysis was conducted by utilizing the PLS algorithm with bootstrapping of 5000 samples and blindfolding. As shown in Fig. 3, the analysis shows the effect of TPK on Work Performance ($\beta=0.452, p<0.001$) and Technostress ($\beta=-0.319, p<0.001$) significant path coefficients, indicating that TPK positively affects Work Performance and negatively affects Technostress. Meanwhile, Technostress has a significant negative effect on Work Performance ($\beta=-0.367, p<0.001$) and Extraversion positively moderates TPK to technostress ($\beta=0.284, p<0.001$). In contrast, Extraversion's path of regulation of technostress to work Performance ($\beta =0.034, p =0.324$) was not significant, suggesting that the effect of Extraversion regulating technostress on work Performance was not significant.

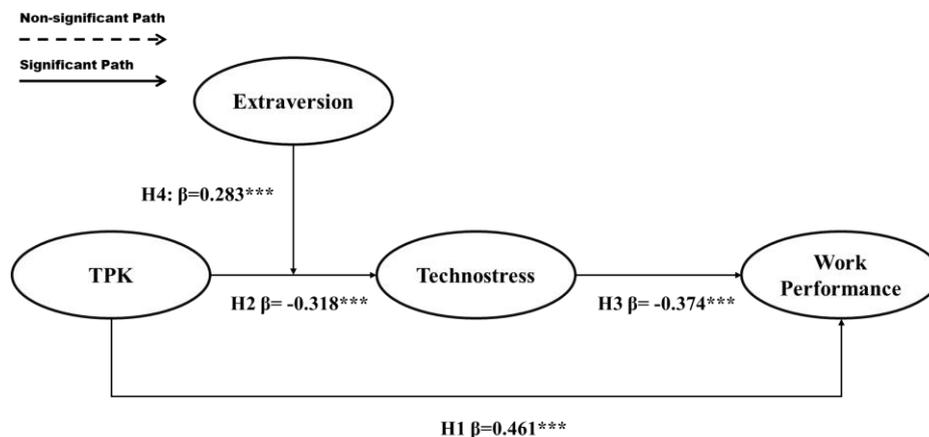


Figure 3 The Results of The Structural Model

Note. *** $p < 0.001$.

The predictive power of the model is usually assessed using R^2 according to the Hair²A according to the rule of thumb mentioned by Hair Jr et al. (2022), the model has a slightly weaker explanatory power for Technostress ($R^2 = 0.21$) and a moderate explanatory power for Work Performance ($R^2 = 0.48$). $f^2 = 0.207$, there was a medium effect. The predictive correlations for technostress (Q^2) with a value of 0.172 and Work Performance (Q^2) with a value of 0.269 are greater than 0, indicating the accuracy of the model's prediction of these outcomes, suggesting that the model has sufficient predictive power.

Mediating Effects

In order to examine the conceptual model more fully, this study also analyzed the mediating effect of technostress between TPK and work performance. The mediating effect was tested by performing a bootstrap (5000 times). According to Table 6, technostress has a complementary partial mediating effect in the model.

Table 4 Mediating Effects on the Structural Model Paths

Path	Effects	Estimate	Bootstrap 5000 times			Percentile 95 per cent		Conclusion
			SD	t	p-value	Low	Upper	
TPK -> TT -> WP	direct	0.461	0.031	12.137	<0.001	0.405	0.513	Complementary Partial Mediation
	Indirect	0.119	0.018	6.545	<0.001	0.087	0.157	
	Total	0.580	0.031	12.137	<0.001	0.528	0.627	

Moderating Effect

The significance of the coefficients of the moderating effects was assessed using the Bootstrap method in the Smart-PLS 4.0.8.7 software, and the results of the test of the moderating effects are shown in Table 4. It is known that extraversion positively moderates the relationship between TPK and technostress.

Table 4 Results of moderation effect analysis

Path	β	SD	T	P	2.50 per cent	97.50 per cent
EX x TPK -> TT	0.283	0.042	6.720	<0.001	0.201	0.366

Discussion

The results of this study's hypothesis testing support the effect of TPK based on technostress to improve teachers' work performance. Firstly, the results of the study support the hypothesis that TPK has existed on teachers' work performance. Previously also proposed that there is a positive effect of TPACK on teachers' work performance. However, they all studied TPACK and did not address TPK separately. Secondly, the results of the study supported the one hypothesis that TPK negatively affects technostress. 's also suggested that TPACK contributes to the reduction of teachers' technostress conclusion. However, also both

discussed TPACK as a whole framework as a variable and did not discuss TPK as a separate dimension. Third, the study confirms that there is a negative effect of technostress on WORK Performance, which is consistent with the findings of previous studies. Moreover, the study confirmed the partial mediating effect of technostress in TPK and teachers' work performance. Fourth, the findings support that extraversion positively moderates the relationship between TPK and technostress, i.e., the more extroverted a teacher is, the stronger the alleviation of technostress is by increased TPK. found that people with extraversion personality trait are more inclined to use introduced technology and less prone to technostress because of their motivation to maintain a good social image (Brod, 1984).

Theoretical Contributions

Previous studies have examined the effect of TPACK on work performance, but not from the perspective of Conservation of Resource Theory. Individual factors such as knowledge possessed by the individual and cognitive ability are important factors affecting work Based on the Conservation of Resource Theory, the effects on work performance were discussed in terms of Emotional exhaustion, family-to-work conflict, and empowering leadership, respectively. But there is no discussion about personal knowledge for directly for work performance. By exploring the effects of TPK on work performance and how TPK affects teachers' work performance by influencing technostress, this study enriches the theoretical support of COR in work performance and provides a theoretical basis for teachers' knowledge to enhance teaching performance (Cai, & Lin, 2003).

COR does not emphasise the different responses of individual cognition to stressful events. Based on the Conservation of Resource Theory and the Cognitive Appraisal Theory of Stress, this study introduces extraversion as a moderating variable, and finds that different degrees of Extraversion, do affect technostress to different degrees. Combining the COR and the CAT to understand and cope with stress provides a more comprehensive perspective on the study of stress experiences and coping mechanisms.

Practical Contributions

Firstly, because TPK has a positive effect on improving work performance and can link teachers' technostress, teachers themselves need to develop an awareness of improving TPK.

Secondly, technostress will play a partial mediating role in TPK and work performance. Therefore, this study suggests that technostress can be alleviated to help improve teachers' work performance.

Finally, Extraversion was found to have a moderating effect on technostress in this study. Having more Extraversion would make the TPK more effective in alleviating technostress. There are many ways that college administrators can use to understand the role of personality traits in influencing work outcomes (positive or negative). Teachers with different personality traits can be supported with appropriate work demands and work resources that take into account their individual characteristics to reduce teaching anxiety and improve work performance (Cheng, & Zhu, 2023).

Conclusion

This study examined the relationship between teachers' TPK, technostress and work. The results showed that there was a positive effect of TPK on work performance and a negative effect of technostress. There was a negative effect of technostress on work performance and extraversion negatively moderated the relationship between TPK and teachers. In addition, technostress had a significant mediating role in TPK and work performance. This paper strengthens the theoretical framework of the effect of TPK on work Performance and confirms the effect of technostress on work performance. The paper provides valuable insights and suggestions for future research directions and management practices.

Suggestion

1. General suggestion

Despite its contributions, the study also has some limitations. Firstly, the data collected in this study came from undergraduate institutions in mainland China, and the limited size of the data may lead to generalizability issues, which is related to the cautious generalization of the findings. Secondly, the study adopts a cross-sectional research method, which has the disadvantage of not being able to test the causal relationship between variables. However, it is important to find out the effect of time lag because examined causality allows the researcher to provide useful and valuable suggestions for solving practical problems. Thirdly, in selecting the Big Five personality traits for this paper, only extraversion was considered and it may not represent a holistic view of how teacher personality moderates' technology and technostress.

2. Suggestion for future research

The following recommendations are made for future research in this area. Firstly, future research could validate these findings in more higher education institutions from different backgrounds and cultures to gain a deeper understanding of the relationship between educational technology and teachers' work performance. Secondly, the main factors considered in the study were personal factors affecting teachers' work performance, such as external factors such as the school, support from colleagues and the environment, which were not included in the model and could be taken into account in subsequent studies. Third, future studies may consider longitudinal designs to further investigate possible causal relationships between these constructs. Fourth, future research could benefit from testing or moderating personality traits other than extraversion, or other extraversion traits that are representative of teachers or more specific as potential moderators.

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