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Exploratory Factor Analysis for Technostress Among Primary School Teachers

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ABSTRACT

The aim of this study was to explore and develop instruments for measuring technostress among primary school teachers in Malaysia. The researchers adapted 28 items from previous study and modified the statement to suit current study. Then the items statement was translated into Malay language to suit the local setting. The instruments underwent expert verification for content validity, face validity and criterion validity. The study amended the item statement accordingly based experts' comment. For pilot study, some 106 school-teachers were selected randomly for data collection. The data were explored and validated through exploratory factor analysis (EFA) procedure. The results of the EFA procedure revealed the 28 items fall into five underlying components. The components are renamed as technical oriented, profession oriented, social oriented, personal oriented and teaching-learning process oriented. The items under these five components explained 71.1% of the total variance. The internal reliability of the technostress construct was 0.95. In addition to adding to the current body of knowledge, the findings provide a reliable source of information for researchers and professional practitioners interested in future research in technostress for educators, particularly primary school teachers.

Contribution/Originality: The primary contribution of this study is explore and develop instruments for measuring technostress through Exploratory Factor Analysis which can be used as guidance to measure technostress for primary school teacher.

1. Introduction

The government has implemented a number of policies in preparing the country for technological advancement and digitization. The National Science, Technology, and

Innovation Policy was established in 2013 to encourage the adoption of advanced technology. The Malaysian Education Development Plan (2013-2025) also calls for improving learning quality in Malaysia through the use of ICT (PPPM 2013-2025). The national budget for 2021 includes a large allocation of up to RM9.4 billion to accelerate digitization, including improving broadband services in rural areas and an industry digitization transformation scheme (Ministry of Finance, 2021). Currently, the government launched the Fourth Industrial Revolution (4IR) policy to build the National Agenda for Science, Technology, and Innovation (2021-2030) (Berita Harian, 2021).

New emerging technologies have the potential to propel the country forward. Technology can also improve community well-being, but it also has the potential to create risks in social interaction and community well-being (Economic Planning Unit, n.d). The global Covid 19 pandemic has accelerated global digitization, with all countries adopting the new norms (Sia & Adamu, 2020). The pandemic has increased the urgency of dealing with global contingencies and disruptions. As a result, countries must be better prepared to deal with similar phenomena in the future, such as those caused by technology and climate change (Economic Planning Unit, n.d).

With the advent of the Fourth Industrial Revolution, the educational system is faced with the challenge of producing a creative, innovative, and competitive generation. The Malaysian Education Development Plan 2013-2025 is an effort by the Ministry of Education to produce individuals who can thrive and compete globally. To achieve this goal, the education system must undergo a comprehensive and systematic transformation. All transformations must be carried out at all levels, including schools. In a challenging and ever-changing global context, schools must continue to fulfil their mandate of preparing young people for the future (Helliwell, 2018). With the advancement of ICT and the general public's understanding, using ICT in all aspects of teaching and learning to improve student achievement in grades K-21 has become a top priority for educators (Anderson & Dexter, 2005; Vanderlinde & Van Braak, 2010).

Skills and knowledge in using technology tools are becoming increasingly important not only to school leaders, but also to teachers. Educators must be versatile and competent to adapt and promote the use of ICT in the increasingly sophisticated Education trend (Tondeur et al., 2014; Daling, 2017) in order to provide the knowledge and skills needed by 21st century students. As an educator in the school, the teacher himself needs to prepare the learning process using the ICT facilities available in the school. The use of ICT in teaching and learning can make a subject a fun activity for all students (Wong & Daud, 2018).

With the rapid development of technology and the need to gradually integrate technology into teaching, teachers are expected to always keep up with new technology in order to be able to apply the use of technology (Ge et al., 2018). This creates work pressure such as additional workload, challenges and pressure for teachers. Teachers are perpetually pressed for time to keep up with technological advances and related pedagogical innovations (Tarus et al., 2015). Finally, teachers experience stress related to technology or what is called technostress (Jameel Abo Mokh et al., 2021).

2. Literature Review

2.1. Technostress

Stress is a state in which a person has bodily or mental instability as a result of his or her way of life. It is a non-specific reaction by a person due to a burden that falls on him (Selye, 1976). Technology is one of the factors that contribute to stress and has termed as technostress (Tarafdar et al., 2007). Brod (1982) introduced the idea of technostress, describing it as a condition caused by a person's or an organization's inability to adapt to new technology in a healthy way. Technostress is influenced by age, prior technological experience, workload, perceived control, and working environment, and as a result, it impairs people's performance and restricts their use of technology (Estrada-Munoz et al., 2020). Technostress in the workplace is caused by people's attempts and struggles to deal with constantly changing technology and the changing physical, social, and cognitive demands that come with it. Technostress causes a variety of negative outcomes, including dissatisfaction, fatigue, anxiety, and overwork, all of which reduce individual productivity (Tarafdar et al., 2007).

The technostress studied is the technological pressure that happens to teachers. Either way, technostress is an important issue for the teaching profession. Teachers especially experience technostress during the process of integrating new technology, which is often the case with digital technology (Lei & Zhao, 2007). Research shows that teachers do experience stress related to the technology they use, even in traditional classroom environments (Al-Fudail & Mellar, 2008). In addition, the constant institutional and societal pressure to integrate technology produces technostress among teachers due to a lack of understanding and support (Longman, 2014).

Advances in technology in recent times have also contributed to the pressure caused by the use of technology and have become a major issue in organizations especially among employees who are technology blind (Hassan et al., 2019). The situation worsened with the existence of the Covid 19 Pandemic which had a significant impact and affected the well-being of teachers (Lizana et al., 2021). The pandemic situation that has occurred has accelerated the evolution of digital migration but poses a significant threat and danger to mental health and well-being due to increased levels of anxiety and stress (Allen et al., 2020; Alves & Lopes, 2021). Excessive bureaucracy, unclear instructions, a lack of support in telecommunications work, and a lack of technical means are among the major issues raised by teachers (Espino-Díaz et al., 2020). Due to technology stress, employees may experience anxiety that includes symptoms such as irritability, headaches, nightmares, insomnia, rejection of technology, and resistance in using technology (Ragu-Nathan et al., 2008).

2.2. Person-environment fit theory

Work stress is a phenomenon that occurs when there is a mismatch between a person and the environment. This shows that stress is not inherently about stress, nor the symptoms of stress, but is relational and occurs when there is a lack of fit between either the demands of the environment and the individual's abilities or the needs of the individual and the supply in the environment to meet these needs (Edwards et al., 1998; French et al., 1974).

The theory of Person-environment fit assumes a balance between people and their environment (Edwards et al., 1998). Tension will arise if this relationship is out of balance (Ayyagari, 2012). Stress is typically caused by a lack of adjustment between the individual and the environment. As a result, technostress is defined as a mismatch between a person and their surroundings. It is constrained not only by the technology itself, but also by the organisation that has established the requirements for its use, as well as by the members of the organisation who, on several occasions, have influence over the use of individual technologies (Avanzi et al., 2018). There are two possible causes of imbalance or misfit (Edwards et al., 1998). First, there could be a mismatch between the demands of the environment and the individual's ability to meet those demands. For example, the task demands imposed by the work environment may be greater than an individual's ability to handle. This creates a stressful situation. The individual's values may be misaligned with the work environment in the second case (Ayyagari et al., 2012).

3. Methodology

The study adapted a total of 28 items related for measuring the technostress construct from previous literature. The item statement was modified to suit the study at hand. Then, the statement was translated into Malay language to suit the target population. The modified and translated item statement were sent to the experts for their verification and validation in term of content validity, face validity and criterion validity. Upon getting the feedback from the above experts, the researchers amended the statement accordingly based on their comment and suggestion.

The pilot study was conducted to gather data using the newly developed questionnaire. Some 100 respondents were selected randomly from the sampling frame which consists of primary school teachers in the Kota Kinabalu district. The questionnaires were sent to the randomly selected respondents to gather pilot study data. From the data collected, the researchers employed the exploratory factor analysis (EFA) procedure in SPSS 25.0 to explore and assess the usefulness of every measuring item and to determine their dimensionality.

4. Findings

4.1. The Exploratory Factor Analysis (EFA) procedure

In the EFA procedure, the researcher employed principal component analysis (PCA) approach as the method of extraction. PCA considers the total variance and generates factors containing a small proportion of the unique variance. The PCA would reduce the dimensions of the items, increase interpretability, minimize the loss of information and drop the low correlation items in the items so they can form a single construct. The Varimax rotation method is applied because it can maximize the amount of variance loading required for the factor matrix and provide a clearer factor separation. For the purpose of this study, the researcher followed the steps of the EFA approach that have been suggested (Tabachnick et al., 2013; Hair et al., 2014) as follows:

a. The Kaiser-Meyer-Olkin (KMO) test, also known as the measure of sampling adequacy equal to or greater than 0.50 (KMO ≥0_.50) was applied to determine the adequacy of the study sample.

b. To measure the correlation that exists between variables or items, Bartlett's Test of Sphericity must also show significance at the p>0.05 level.

c. An Eigen value greater than 1.0 is significant for each factor. This value represents the amount of variance accounted for by the factor.

d. Items whose loading factor value equals or exceeds 0.55 (FL ≥ _0.55) have been accepted and maintained in their respective constructs because they are practically significant and have a good level of acceptability. Items with FL values less than 0.55 were dropped in this study. After considering the appropriateness of the type of analysis and sample size, the recommendation of Hair et al. (2010, 2014). The loading factor value in this study is according to the appropriateness of the sample size according to the guideline table by Hair et al. (2010) as in the Table 1 below:

Table 1: Significance factor loadings based on sample size

Sufficient Factor loadings	Sample size
0.30	350
0.35	250
0.40	200
0.45	150
0.50	120
0.55	100
0.60	85
0.65	70
0.70	60
0.75	50

Source: Hair et al. (2010)

The percentage of variance explained (Total Variance Explained) must be at least 60% of the total variance (Muda et al., 2018, 2020; Ehido et al., 2020). Whereas, the value of communalities (uniformity) needs to exceed 0.30 to show that an item is explained by a factor. Any item that did not belong or even loaded into any factor was dropped, while items identified as belonging to more than one factor were also dropped. In short, the researcher has fulfilled the set EFA approach followed fully to ensure that the research instruments that have been used are of high quality, robust and compatible with the culture of the Malaysian education system.

4.2. Instruments

The instrument used to measure this variable is an instrument adapted from Coklar et al. (2017) where a Likert-type scale developed and intended for defining teachers' techno-stress levels. This section consists of 28 items containing 5 constructs; 7 items for the learning and teaching process oriented, 6 items for profession oriented, 6 items for technical issue oriented, 5 items for personal oriented and 4 items for social oriented. The self-measurement scale for each item used in this section is a 5-point Likert scale, where point 1 represents "Strongly Disagree", point 2 represents "Disagree", point 3 represents "Not Sure", point 4 represents "Agree" and a score of 5 represents "Strongly Agree". The construct to measure technostress is shown in Table 2.

Table 2: Constructs and Item Numbers of Technostress Variable

Constructs	No of items	Item numbers
Teaching-learning process	7	1, 2, 3, 4, 5, 6, 7
Profession	6	8, 9, 10, 11, 12, 13
Technical issues	6	14, 15, 16, 17, 18, 19

Personal	5	20, 21, 22, 23, 24
Social	4	25, 26, 27, 28
Items Total	**28**	

4.3. EFA for technostress

A total of 25 technostress items were loaded to be analysed representing five constructs: learning and teaching process oriented, profession oriented, technical issue oriented, personal oriented, and social oriented. As shown in Table 3, Bartlett's test of sphericity was significant (p-value 0.05). The Kaiser-Meyer-Olkin (KMO) adequacy of sampling measurement has exceeded the required value of 0.6. (Hoque et al., 2018; Bahkia et al., 2019; Rahlin et al., 2021, 2022). This reflects the type of factorability that meets the assumptions. As a result, the data is sufficient for the data reduction procedure.

Table 3: The KMO and Bartlett's test score

Kaiser-Meyer-Olkin measure of Sampling Adequacy.		**.884**
Bartlett's Test of Sphericity	Approx. Chi-Square	2045.094
	Df	300
	Sig	<.001

4.4. Dimensions and total variance

Table 4 below shows the total variance explained for the construct. The table displays five components that are bigger than 1.0 as a result from computing eigenvalue. The variance explained for the first component is 49.069%, the second is 7.851%, the third is 6.625%, the fourth is 4.798%, and the fifth component is 4.344%. The value ranged from 1.086 to 12.267. The total variance explained is 72.688%. It is acceptable because it is exceeded the minimum requirement of 60% (Awang, 2010, 2012; Hoque et al., 2017, 2018; Yahaya et al., 2018, Bahkia et al., 2019; Shkeer & Awang, 2019).

Table 4: The total variance explained for the construct

	Extraction Sums of the squared Loadings			**Rotation Sums of Squared Loadings**		
Component	**Total**	**% of variance**	**Cumulative %**	**Total**	**% of variance**	**Cumulative %**
1	12.267	49.069	49.069	4.558	18.232	18.232
2	1.963	7.851	56.920	4.200	16.798	35.030
3	1.656	6.625	63.545	4.053	16.214	51.244
4	1.200	4.798	68.343	2.754	11.015	62.259
5	1.086	4.344	72.688	2.607	10.429	**72.688**
Extraction Method : Principal Component Analysis						

The 25 items were extracted using Principal component analysis (PCA) with Varimax rotation. The Table 5 below presents the results acquired from the EFA procedure, including the five components and their respective items. The minimum factor loading necessary to retain an item is 0.55; items with lower factor loadings would be eliminated (Hair et al., 2010; Yahaya et al., 2018; Bahkia et al., 2019). There are three items with loading value of less than 0.55: item 13 in the profession-oriented construct and items 20 and 21 in the personal-oriented construct. The analysis results show that the other 25 items are good and acceptable.

Table 5: Rotated Components Matrix

	1	2	3	4	5
TECH1	.811				
TECH 2	.793				
TECH 3	.763				
TECH 4	.709				
TECH 5	.680				
TECH 6	.648				
PRO1		.767			
PRO2		.748			
PRO3		.716			
PRO4		.630			
PRO5		.607			
PRO6		.563			
PER1			.779		
PER2			.712		
PER3			.677		
PER4			.650		
PER5			.637		
PER6			.608		
SOC1				.762	
SOC2				.759	
SOC3				.722	
LTP1					.694
LTP2					.682
LTP3					.643
LTP4					.636

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaise Normalization
a. Rotation converged in 8 iterations

4.5. The instrument internal reliability

The Cronbach's alpha value was used to determine the internal reliability of the retained items. Internal reliability measures a set of items' effectiveness in measuring the construct. The Cronbach's alpha must be greater than 0.7 for the items to be considered internally reliable (Muda et al., 2018, 2020; Rahlin et al., 2021, 2022; Fitriana et al., 2022) which all the items in this study found to be internally reliable, as their Cronbach's alpha meets the requirement. Each component's Cronbach alpha score is shown in Table 6.

Table 6: The reliability

Component	N of items	Cronbach's Alpha
Technical	6	0.906
Profession	5	0.902
Personal	6	0.919
Social	3	0.810
Learning-Teaching Process	4	0.788
All items	**24**	**0.952**

5. Conclusion

The current study adds the instruments for measuring a construct, namely technostress among teachers in a local setting. The construct was measured with 28 items which fall under five dimensions namely, technical, professional, personal, social, and learning-teaching process. The internal reliability measures for the five dimensions of technostress yielded high Cronbach's alpha values, satisfying the Bartletts test requirements (Significant). Satisfactory KMO scores (>0.6) and factor loadings greater than 0.55. The findings indicated that the items under consideration were appropriate for this study. Multiple scale improvement and validation procedures were implemented to ensure that the newly developed instrument is internally consistent and stable across the sample.

Ethics Approval and Consent to Participate

All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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