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Technostress Construct Validity Test with Confirmatory Factor Analysis (CFA) Method

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Abstract

This study aims to test the construct validity of the technostress instrument using an instrument developed by Ragu-Nathan et al. (2008) contained 20 modified items using the Indonesian language. The research data was obtained from middle adult teaching staff, namely teachers and lecturers aged 35-60 who taught online learning during Covid-19. 212 respondents participated in this study. The test used confirmatory factor analysis (CFA) with first-order per-dimensional, first-order unidimensional, and second-order models. The analysis was done in MPLUS. Based on CFA first-order unidimensional results, the model fits the data with one item discarded (Item 17). The CFA second-order model is also fit according to the goodness criteria with all items being valid except item 6. According to CFA first-order per-dimensional testing, results show that items for three dimensions (techno-overload, techno-complexity, and techno-insecurity) are valid, while the other two dimensions (techno-uncertainty and techno-invasion) are not fit because the number of items is too small. The instrument can be used to measure technostress and is considered to be unidimensional measuring technostress.

Keywords: confirmatory factor analysis, teaching staff, technostress.

Abstrak

Penelitian ini bertujuan untuk menguji validitas konstruk instrumen technostress dengan menggunakan alat ukur yang dikembangkan oleh Ragu-Nathan et al. (2008) yang memiliki 20 item modifikasi menggunakan bahasa Indonesia. Data penelitian diperoleh dari tenaga pengajar dewasa madya yaitu guru dan dosen berusia 35-60 tahun yang mengajar metode pembelajaran daring pada masa Covid-19. Responden yang diperoleh berjumlah 212 responden. Pengujian dilakukan dengan menggunakan analisis faktor konfirmatori (CFA) dengan model first-order per-dimensi, first-order unidimensi, dan second-order. Analisis dilakukan di MPLUS. Berdasarkan uji validitas konstruk menggunakan CFA unidimensi first order, model fit dengan data dan terdapat satu butir soal yang dibuang (Butir 17). Model CFA second-order kedua juga fit dengan data berdasarkan kriteria goodness of fit dan semua item valid kecuali item 6. Hasil pengujian CFA first order per dimensional diperoleh hasil bahwa item untuk tiga dimensi (techno-overload, techno-complexity, dan techno-insecurity) valid, sedangkan dua dimensi lainnya (techno-uncertainty and techno-invasion) tidak valid karena jumlah item terlalu sedikit. Dengan demikian, alat ukur technostress yang dikembangkan oleh Ragu-Nathan et al. (2008) dapat digunakan untuk mengukur Technostress seseorang di Indonesia.

Kata Kunci: analisis faktor konfirmatori, staf pengajar, technostress.

Introduction

In the rapidly growing digital 4.0 era, many activities use information technology, from education to jobs that cannot be separated from using technology (Rahmatullah et al., 2022). With the progress of science and technology, which is increasingly advanced, workers must increase their ability and performance in using technology to realise exemplary professionalism. Workers must do their work in an innovative, creative, and exciting way to increase the company's or organisation's value (De Carlo et al., 2022; Jeske & Axtell, 2014). Information and communication technology in the world of work can benefit officials in obtaining material and non-material benefits (Fahdiansyah & Anas, 2017). Technology makes it easier for every employee to gain access to information and communication through the system, and employees can also share knowledge with other employees anywhere in real-time (Tarafdar et al., 2011).

However, the rapid development of technology in this era has not only many positive impacts but also negative impacts caused by the development of technology itself (Ragu-Nathan et al., 2008; Stich et al., 2018), such as when employees are asked to learn to complete tasks using new technology but do not experience the increase in performance expected by the organisation, employees must handle tasks simultaneously or multitasking and must also respond to related information on real-time work (Nudurupati et al., 2011; Tarafdar et al., 2014; Walz, 2012). Especially after going through this pandemic, many employees are still confused by complex technological developments and application updates that affect their daily activities, including today's workforce. They must learn quickly to use online technology to teach and work virtually due to an urgent need for a teaching and learning process that cannot be done face-to-face due to COVID-19.

The current post-covid-19 pandemic also has a direct impact on the development of information and communication technology and changes the interactions of world society to adapt to using more advanced technology (Yusuf, 2021). Rapid adaptation is carried out for the smooth running and recovery of various sectors in Indonesia such as the economy, education, social, etc. All Indonesian people are flocking and forced to learn technology quickly for the sake of smoothness and recovery of daily activities which have changed drastically. They usually carry out their daily activities offline or face to face, but the Covid pandemic has caused everything to be done online, so they are vulnerable to missing out on the latest information if they do not immediately adapt to technology (Zhou et al., 2020). When someone uses technology, there are positive and negative impacts that result. Positive impacts include activities being automated and saving resources (such as saving paper, saving time and costs for interacting with people in other regions, etc.). However, there are also negative impacts felt by users of information and communication technology, including stress which can indirectly affect human psychology, physical and behavior (Ayyagari et al., 2011).

Technostress, coined by Clinical Psychology expert Craig Brod in 1984, emerged alongside the rise of computer technology in daily life. It represents a modern affliction resulting from an inability to adapt healthily to new computer technologies (Chiappetta, 2017). Weil and Rosen (1997, as cited in Chiappetta (2017)) described Technostress as technology's direct or indirect negative impact on human behaviour, thoughts, attitudes, and psychology. Building on this, Ragu-Nathan et al. (2008) identified stress stemming from information and communication technology (ICT) use. They further delineated two constructs: the creators of Technostress, factors causing stress among ICT users, and technostress inhibitors, organisational mechanisms alleviating stress from ICT use. While previous research tested these constructs among government, manufacturing, and finance office workers, it remains unexplored among teaching staff. Hence, this study aims to validate the Technostress model developed by Ragu-Nathan et al. (2008), specifically within the context of Indonesian teaching professionals. This validation involves adapting the measuring instrument, comprising five dimensions and 20 items in English, for use with Indonesian respondents. Utilising Confirmatory Factor Analysis (CFA) through the Mplus application, this study scrutinises the validity of technostress and technology self-efficacy.

Technostress

According to Wang (Hendartono, 2022), Technostress is defined as a reflection of a person's disappointment, fear, tension, and anxiety when a person learns and uses computer technology directly or indirectly, which ends in psychological disorders and emotional rejection, resulting in a person's reluctance to learn more or using computer technology.

Tarafdar et al. (2011) defined Technostress as the impact of stress experienced by users due to multitasking applications, continuous connectivity, getting excessive information, frequent system changes, and the consequences of uncertainty, re-learning, and the impact of insecurity with work in progress. Ongoing and technical issues associated with the use of technology in organisations.

Technostress Dimension

According to Ragu-Nathan et al. (2008) divide the Technostress dimension into 5, namely;

1. Techno-overload
   It describes the technology that forces users to work faster and longer so that users feel they have more work to do.
2. Techno-complexity
   It depicts a situation where the associated association with technology causes their users to have insufficient computer-related skills. Hence, users feel forced to spend time and effort to learn and understand the technology.
3. Techno-insecurity
   It is a situation where the user feels threatened with losing his job because of technology or someone who understands technology better.
4. Techno-invasion
   It depicts the effects of invasive technology in situations where employees can be contacted at any time, and their users are connected to work anywhere and anytime so that work and personal relationships are disrupted.
5. Techno-uncertainty
   Instead, it refers to the context of change and improvement in technology, so users feel uneasy because they have to keep learning about new technologies.

Technostress measurement

There are several types of Technostress measurements, namely;

1. Ragu-Nathan et al. (2008) developed a technostress scale with five dimensions and 25 items. The five dimensions of technostress in this measuring instrument are; Techno-overload (reliability = 0.82); Techno-invasion (reliability = 0.80); tecno-complexity (reliability = 0.77); tecno-insecurity (reliability = 0.78); tecno-uncertainty (reliability = 0.83).
2. Ayyagari et al. (2011) developed a Technostress measuring instrument which has five dimensions, namely, work-home conflict, work overload, invasion of privacy, role ambiguity, and job insecurity, with RMSEA results in the measurement model of 0.027 and the structural model of 0.037.
3. Nimrod (Nimrod, 2018) developed the Technostress scale into five dimensions and 14 items for internet users 60 years and over. The five dimensions of Technostress in this measuring instrument are Overload (Reliability= 0.626), Invasion (Reliability= 0.550), Complexity (Reliability= 0.764), Privacy (Reliability= 0.822), and Inclusion (Reliability= 0.602).
4. Collar et al. (2017) developed the Teachers' Technostress Levels Defining Scale (TTLDS) scale into five dimensions and 28 items. The five dimensions of this measuring instrument are Learning-Teaching Process Oriented, Profession Oriented, Technical Issue Oriented, Personal Oriented, and Social Oriented, with Cronbach alpha results on this measuring instrument, is 0.917 and Spearman-Brown 0.845.

This study used the Technostress measuring tool from Ragu-Nathan et al. (2008), which is the first measuring tool developed and has not been tested on teaching staff, and this measuring tool is in line with this research.

Method

Research subjects

The sample for this study was limited to middle adult teaching staff aged 35-60 years who worked during the COVID-19 pandemic as lecturers and teachers and actively used technology in carrying out their work. Respondent data collection in this study used a Google form distributed via social media. Sampling in this study was carried out for approximately three weeks. As for the respondents who had been collected at the beginning, the researchers got 213 respondents. After screening the samples obtained through the Google form, the researcher dropped one sample due to double filling. The total number of respondents whom researchers can process is 212 respondents. Sampling in this study uses a non-probability sampling technique, with the method used being snowball sampling.

Research measuring tool

The research variable in this study is Technostress, measured using the instrument developed by Ragu-Nathan et al. (2008). In their study, Ragu-Nathan et al. (2008) explain that 5 out of 25 items were dropped based on the factor analysis results. The 20 items were then translated into Indonesian language. The blueprint of the instrument can be seen as follows:

Table 1. Technostress Scale Blueprint

No	Dimension	Indicator	Items
1	Techno-overload	Users feel they are working faster and longer with technology, so users feel they are doing more and more of their work.	1, 2, 3, 4
2	Techno-invasion	Users feel constantly connected to technology so that work and personal relationships are disrupted	5, 6, 7
3	Techno-complexity	Users are forced to spend time and effort to learn and understand the technology	8, 9, 10, 11, 12
4	Techno-insecurity	Users feel threatened of losing their jobs because of technology or someone who has a better understanding of technology	13, 14, 15, 16
5	Techno-uncertainly	Users feel restless because of new technology because users have to keep learning about new technology	17, 18, 19, 20
		Number of Items	20

Data analysis method

To test the construct validity of each item in this study, researchers used Confirmatory Factor Analysis (CFA) with first-order and second-order analysis using the Mplus application. Criteria are needed to determine valid and invalid items in fulfilling construct validity. The CFA test steps or item validity and criteria (Umar & Nisa, 2020). A concept (trait) is defined operationally as an ability so that a question or statement can be prepared to measure a concept. This ability is called a factor, and the measurement of this factor is carried out by analysing the responses to the question items or statements. All items compiled, theorised, or hypothesised are valid in measuring the defined construct, in other words, measuring only one factor or a unidimensional model. The researcher has collected data that can be used to estimate the correlation matrix between items (unidimensional model). This correlation matrix is called sigma (∑) and then compared with the matrix from empirical data (S). If the theory is correct, then the result is that there is no difference between the ∑ matrix and the S matrix (or it can be expressed as $\sum - S = 0$).

Statements that are used as null hypotheses will then be tested with chi-square. If the chi-square results are insignificant or $p > 0.05$, the null hypothesis is "not rejected," meaning that the unidimensional theory can accept that the item statement only measures one factor. If the model is declared fit, the next step is to test whether the item is significant in measuring what should be measured using the t-test. If the t-test results are insignificant, then the item cannot measure what should be measured, and items that are not significant will be dropped or deleted. The factor scores analysed are factor scores that are positively charged and significant. T-score formula, namely:

$$Tscore=50+(10 * factor\ score)$$

Perform per-dimensional variable analysis, first-order confirmatory factor analysis, and second-order confirmatory factor analysis of the Technostress variable, following the steps: (a) Identify the model, (b) Establish a model for the dimensions of the Technostress variable (Techno-overload, Techno-invasion, Techno-complexity, Techno-insecurity, and Techno-uncertainly), (c) Testing unidimensionality (validity and reliability), (d) Performing fit testing between the model and data with the Goodness of Fit criteria and modifying the model if it is not appropriate, (e) Interpretation of the model that has been obtained, and (f) Make conclusions from the resulting model. From the explanation above, it can be concluded that the criteria of Goodness of fit in interpreting a CFA model are:

Table 2. Goodness of Fit and item validity Criteria

The Goodness of Fit index	Criteria
P-value	>0.05
RMSEA	<0.05
Item validity index	**Criteria**
t-value of the Coefficient / Estimate	>1.96
Coefficient / Estimate	Positive Value (+)

Results and Discussions

In this section, we present the construct validity test of the Technostress variable with its five dimensions: Techno-overload, Techno-invasion, Techno-complexity, Techno-insecurity, and Techno-uncertainly.

First Order CFA for Each Dimension

Techno-Overload

From the results of the validity test of the Techno-Overload dimension, the researcher tested four unidimensional items, meaning that they only measured Techno-Overload. The fit model results were obtained from the CFA results, namely, chi-square = 0.591, df = 1, P-value = 0.4420, and RMSEA = 0.000. RMSEA results < 0.05 mean that all items analysed only measure one factor: Techno-Overload.

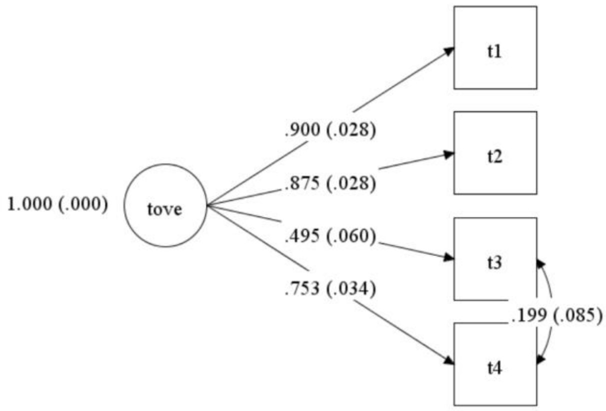
Next, the researcher looks at the item's significance to evaluate whether the item measures the factor and determines whether the item needs to be dropped. Therefore, it is necessary to test the hypothesis about the factor loading coefficient of the items. The significance of factor loading coefficients can be seen from the value of $t > 1.96$, which means that the item is significant and vice versa. The test is carried out by looking at the t-value of each factor loading coefficient listed in Table 3 below.

Table 3. Item Factor Loading Techno-Overload

Item	Coefficient	Standard Error	t-value	Significant
T1	0.90	0.06	15.76	v
T2	0.88	0.06	15.16	v
T3	0.50	0.07	7.27	v
T4	0.75	0.06	12.33	v

Table 3 shows that all items are signed with a *t* value > 1.96, and all coefficients are positively charged.

Thus, there are no items that need to be dropped. Figure 1 is the path diagram of the Techno-Overload validity test results.

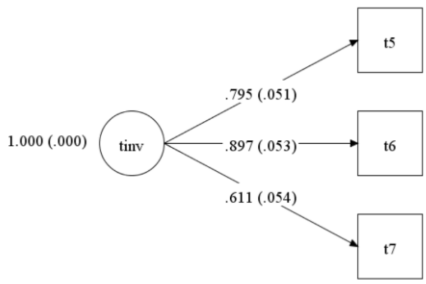


Sources: Personal data

Figure 1. CFA Path Diagram for Techno-Overload

Techno-Invasion

From the Tecno-Invasion dimension validity test results, the researcher tested three unidimensional items, meaning they only measured Techno-Invasion. The results of model fit information are chi-square = 0.00, df = 0, P-value = 1.00000, and RMSEA = 0.000. The results illustrate that the model is saturated; thus, the fit is perfect. When the model is saturated, the Goodness of fit of the model cannot be evaluated, and the construct validity cannot be confirmed.



Sources: Personal data

Figure 2. CFA Path Diagram for Techno-Invasion

Techno-Complexity

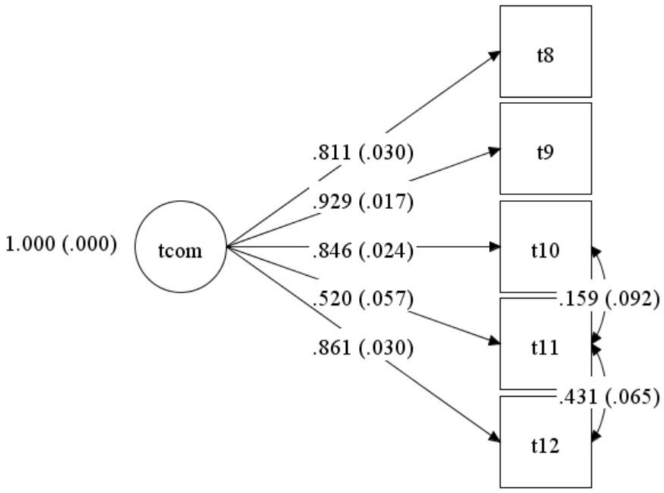
From the results of the validity test of the Techno-Complexity dimension, the researcher tested five unidimensional items, meaning that they only measured Techno-Complexity. The CFA results show that the fit model was obtained: chi-square = 2.07, df = 3, P-value = 0.5567, and RMSEA = 0.000. The p-value > 0.05 and RMSEA < 0.05 mean that all items analysed only measure one factor: Techno-Complexity.

Next, the researcher looks at the item's significance, measures the factor and determines whether the item needs to be dropped. Therefore, it is necessary to test the hypothesis about the factor loading coefficient of the items. The hypothesis testing can be done by evaluating the t value, where t > 1.96 means that the item is significant and vice versa. The test is carried out by looking at the t-value of each factor loading coefficient listed in Table 5 below.

Table 4. Item Factor Loading Techno-Complexity

Item	Coefficient	Standard Error	t-value	Significant
T8	0.81	0.06	13.96	v
T9	0.93	0.05	17.50	v
T10	0.84	0.06	14.88	v
T11	0.52	0.07	7.78	v
T12	0.85	0.06	15.42	v

Based on Table 4, we can see that all items have a t-value > 1.96, and all coefficients are positively charged. Thus, there are no items that need to be dropped. The following is the model of validity test results.



Sources: Personal data

Figure 3. CFA Path Diagram for Techno-Complexity

Techno-Insecurity

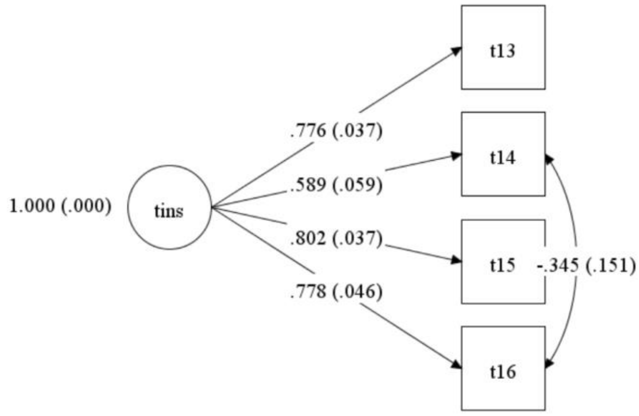
From the results of the validity test of the Techno-Insecurity dimension, the researcher tested four unidimensional items, meaning that they only measured Techno-Insecurity. The fit model was obtained using the following values: chi-square = 0.994, df = 1, P-value = 0.3187, and RMSEA = 0.000. The p-value is greater than 0.05, and RMSEA results < 0.05, which means that all items analysed only measure one factor, namely Techno-Insecurity.

Next, the researcher looks at the item's significance, measures the factor and determines whether the item needs to be dropped. Therefore, it is necessary to test the hypothesis about the factor loading coefficient of the items. The significance of the factor loading coefficient can be seen from the value of t > 1.96, which means that the item is significant and vice versa. The test is carried out by looking at the t-value of each factor loading coefficient listed in Table 6 below.

Table 5. Item Factor Loading Techno-Insecurity

Item	Coefficient	Standard Error	t-value	Significant
T13	0.78	0.04	20.96	v
T14	0.59	0.06	10.04	v
T15	0.80	0.04	21.82	v
T16	0.78	0.05	16.88	v

Based on Table 5, it can be seen that all items are signed with a t value > 1.96, and all coefficients are positively charged. Thus, no items need to be dropped. Following are the results of the model validity test.



Sources: Personal data

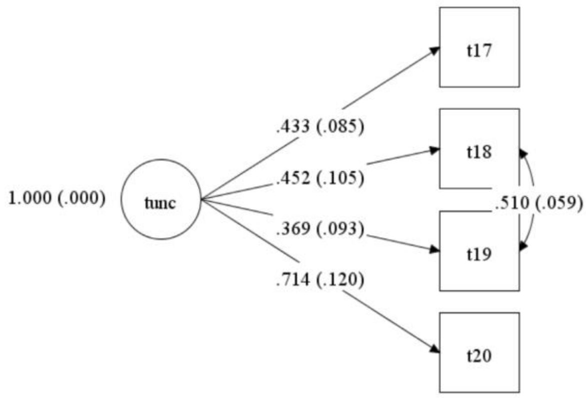
Figure 4. CFA Path Diagram for Techno-Insecurity

Techno-Uncertainty

From the results of the validity test of the Techno-Uncertainly dimension, the researcher tested four unidimensional items, meaning that they only measured Techno-Uncertainly. The Goodness of model fit test results are chi-square = 2.566, df = 1, P-value = 0.109, and RMSEA = 0.086. The p-value is greater than 0.05; thus, the model fits with the data, although the RMSEA value is greater than 0.05. The model cannot be modified anymore since the DF=1, and freeing one more parameter will result in a saturated model. Table 6 shows the loading factor of every item measuring techno-uncertainty and its significance. Figure 5 is the CFA path diagram for techno-uncertainty.

Table 6. Item Factor Loading Techno-Uncertainty

Item	Coefficient	Standard Error	t-value	Significant
T17	0.43	0.04	5.09	v
T18	0.45	0.06	4.30	v
T19	0.37	0.04	3.98	v
T20	0.71	0.05	5.94	v



Sources: Personal data

Figure 5. CFA Path Diagram for Techno-Uncertainty

First Order CFA Unidimensional

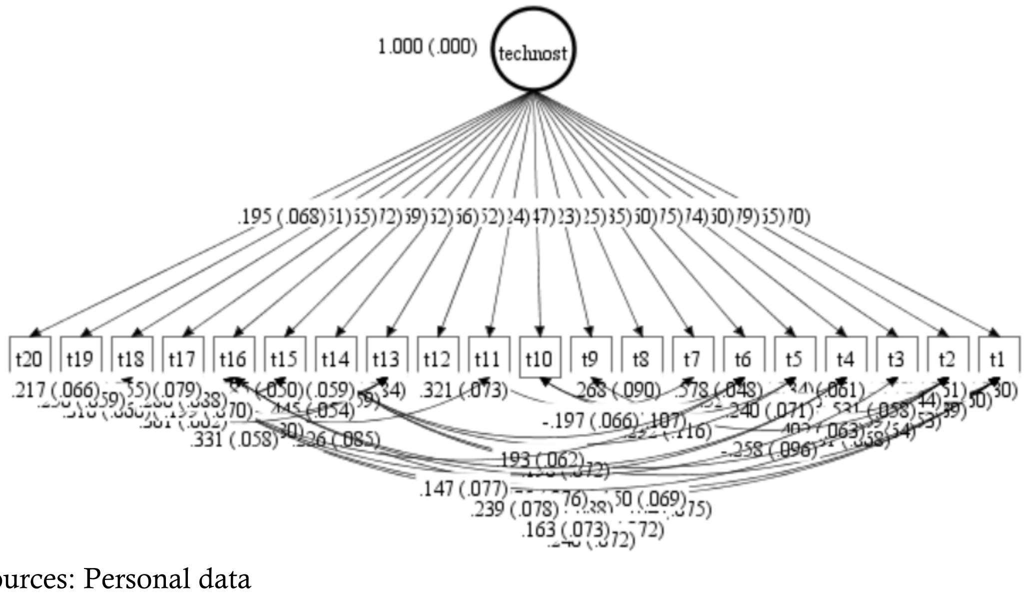
In this section, the researcher wants to see the validity test with the first-order CFA unidimensional model, where this model theorises that all items only measure one factor, namely the Technostress variable. From the results of the Technostress dimension validity test, researchers tested 20 items. From the CFA results, the model fit has reached based on chi-square = 138.186, df = 116, P-value = 0.0784, and RMSEA = 0.030. The p-value is >0.05, and RMSEA results <0.05, which means that all the items analysed only measure one factor, namely Technostress.

Next, the researcher looks at the significance of the item. Therefore, it is necessary to test the hypothesis about the significance of the factor loading coefficient of the items. The test is carried out by looking at the t-value of each factor loading coefficient listed in Table 7 below.

Table 7. Item Factor Loading First-Order Technostress Model

Item	Coefficient	Standard Error	t-value	Significant
T1	0.244	0.070	3.485	v
T2	0.287	0.065	4.424	v
T3	0.191	0.079	2.437	v
T4	0.435	0.060	7.277	v
T5	0.057	0.074	0.769	X
T6	0.091	0.075	1.214	X
T7	0.480	0.060	7.940	V
T8	0.765	0.035	21.581	V
T9	0.882	0.025	35.768	V
T10	0.870	0.023	37.156	V
T11	0.580	0.047	12.229	V
T12	0.884	0.024	36.960	V
T13	0.671	0.052	12.952	V
T14	0.346	0.066	5.259	V
T15	0.502	0.062	8.039	V
T16	0.494	0.069	7.185	V
T17	0.029	0.072	0.405	X
T18	0.348	0.065	5.342	V
T19	0.566	0.051	11.129	V
T20	0.195	0.068	2.846	v

Based on Table 7, we can see that all items are positively signed. However, three items, numbers 5, 6, and 17, have a t value of less than 1.96. Therefore, three items need to be dropped. The following is the path diagram of unidimensional model validity test results.



Sources: Personal data

Figure 6. CFA Path Diagram for Technostress Unidimensional Model

Technostress Model (Second-order CFA)

The researcher wants to see the validity test with the second-order CFA model in this sub-chapter. At the first level, a factor analysis of 20 items was carried out, which measured five dimensions of the Ragu-Nathan et al. (2008) scale. The dimensions of the Technostress variable are Techno-overload (4 items), Techno-invasion (3 items), Techno-Complexity (5 items), Techno-Insecurity (4 items), and Techno-Uncertainly (4 items). It was theorised that all five dimensions only measured one higher-level factor (unidimensional), namely Technostress. The model fit information results are chi-square = 170.344, df = 114, p-value = 0.0005, and RMSEA = 0.048. RMSEA is less than 0.05 and satisfies the model fit criteria. However, the p-value is less than 0.05, thus not satisfying the model fit. Nonetheless, the model has a CFI of 0.984 and TLI of 0.974, indicating a good fit.

Next, the researcher looks at the item's significance, measures the factor and determines whether the item needs to be dropped. Therefore, it is necessary to test the hypothesis about the factor loading coefficient of the items. The factor loading coefficient can be seen from the value of t > 1.96, which means that the item is significant and vice versa. The test is carried out by looking at the t-value of each factor loading coefficient listed in Tables 8 and 9.

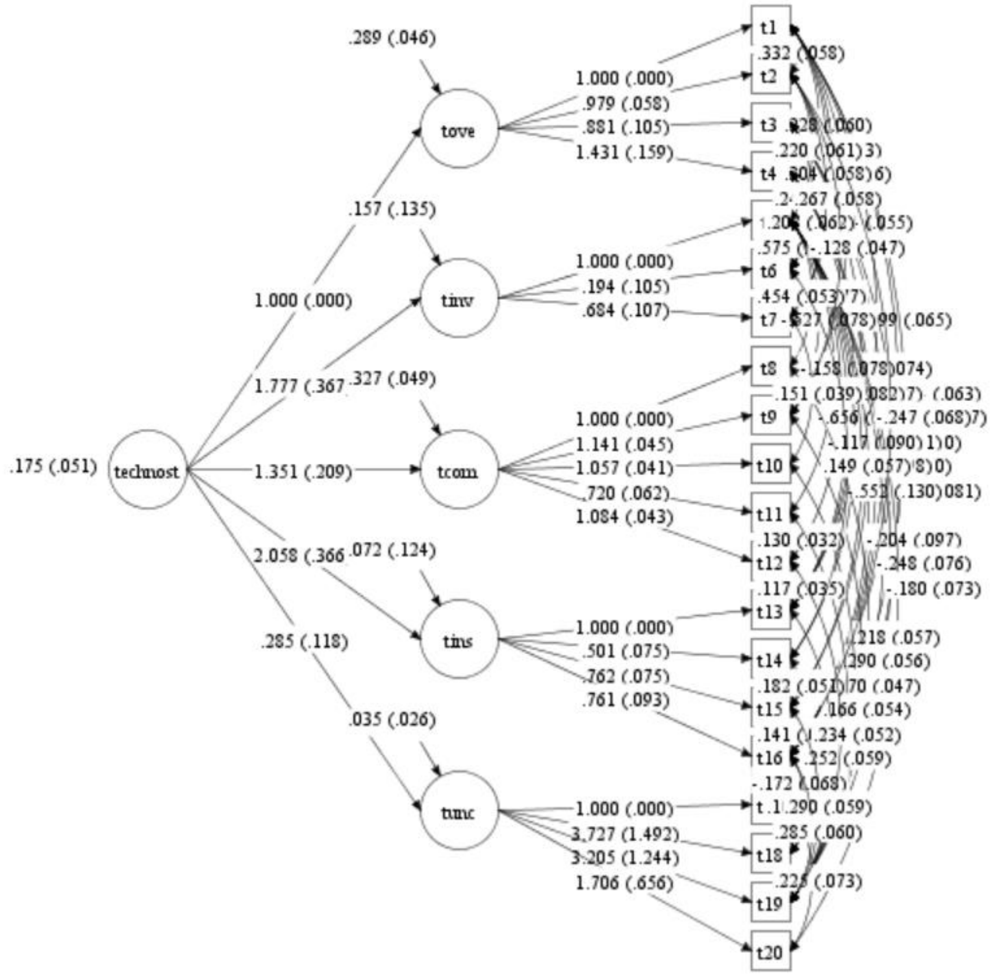
Table 8. Item Factor Loading Second-Order Technostress Model

Dimension	Number of Items	Coefficient	Standard Error	t-value	Significant
Techno-Overload	1	0.682	0.049	13.803	v
	2	0.667	0.049	13.516	v
	3	0.600	0.061	9.914	v
	4	0.975	0.051	18.943	v
Techno-Invasion	5	0.842	0.096	8.818	v
	6	0.164	0.088	1.857	X
	7	0.576	0.051	11.294	v
Techno-Complexity	8	0.804	0.030	27.094	v
	9	0.917	0.019	48.247	v
	10	0.850	0.023	36.652	v
	11	0.579	0.049	11.790	v
	12	0.872	0.025	34.542	v
Techno-Insecurity	13	0.902	0.041	22.223	v
	14	0.452	0.066	6.819	v
	15	0.688	0.052	13.242	v
	16	0.686	0.068	10.066	v
Techno-Uncertainly	17	0.223	0.084	2.637	v
	18	0.829	0.090	9.250	v
	19	0.713	0.072	9.918	v
	20	0.380	0.073	5.196	v

Table 9. Item Factor Loading Second-Order per-dimension

Dimension	Coefficient	Standard Error	t-value	Significant
Techno-Overload	0.614	0.064	9.577	v
Techno-Invasion	0.883	0.094	9.399	v
Techno-Complexity	0.703	0.053	13.334	v
Techno-Insecurity	0.955	0.079	12.131	v
Techno-Uncertainly	0.537	0.067	7.954	v

Table 8 shows that all items except one are significant with a t-value > 1.96, and all coefficients are positively charged. Further, Table 9 illustrates that all five dimensions have p-values < 0.005 and have positive estimates; thus, all dimensions are valid in measuring the Technostress factor. Finally, only one item from the Techno-Uncertainty dimension (item T6) needs to be dropped. The following is the path diagram of the second-order model of validity test results.



Sources: Personal data

Figure 7. Path diagram of Second Order CFA for Technostress

From the results of testing the construct validity using Mplus, the researcher tested a variable, namely Technostress, to see whether the original items used in English and statement items that were changed to Indonesian, which had been modified according to the needs of researchers, could be measured and be used for further analysis.

The test results show that the First-Order model per-dimensional fits 4 out of 5 dimensions analysed. The items measuring Techno-overload, Techno-complexity, Techno-insecurity, and Techno-uncertainty dimensions are proven to be valid since the model satisfies the Goodness of fit criteria, the t-value of the factor loading coefficients is greater than 1.96, and the sign of the factor loadings are positive. The remaining dimension—Techno-invasion—does not satisfy the Goodness of fit model criteria because the number of items is too few or the number of parameters to be freed is larger than the number of available items. Therefore, it is not recommended to use the dimensions of the technostress instrument as a separate variable.

The results of the construct validity test using the First-Order CFA unidimensional model demonstrate that the model is fit and 17 out of 20 items are valid measuring Technostress. Item T5, T6, and T17 must be discarded due to the non-significant t-test results for its factor loading coefficient. The second-order model fits all items except item T6, which has a t-value >1.96 and a positive coefficient. Therefore, the five dimensions are valid for measuring Technostress, and only one item is discarded, namely T6.

The first-order unidimensional and second-order models have T6 as the non-valid item. Item T6 reads as follows: "*Saya harus mengorbankan waktu liburan dan akhir pekan saya untuk membahas pekerjaan melalui whatsapp, zoom meeting atau aplikasi online lainnya.*" This item is intended to measure the techno-invasion construct. However, item T6 can measure a concept that overlaps with other constructs in the questionnaire, such as the techno-overload construct. Respondents may interpret the item as reflecting techno-overload rather than specifically techno-invasion. This could result in the item loading onto a factor different from the intended one. Similar case happened with item T5 which reads as "*Dengan adanya perkembangan teknologi membuat saya harus berhubungan dengan pekerjaan saya bahkan selama liburan.*". Item T5 is considered invalid based on the first-order unidimensional model. This item might be interpreted as workload rather than specifically techno-invasion or overlap with items measuring techno-overload construct. The first-order unidimensional CFA results show that item T17 is invalid for measuring techno-insecurity. Item T17 reads as follows: "*Selalu ada perkembangan teknolologi baru yang kami gunakan dalam mengajar*". The statement highlights the phenomenon of technological advancement in teaching, which can generally be seen as something positive. The use of new technology in teaching can be regarded as an effort to enhance the effectiveness and efficiency of learning. However, specific aspects that cause uncertainty or feelings of insecurity related to the technology used must be considered to measure techno-insecurity. An example is the feeling of being unable to keep up with rapid technological advancements.

There are differences between the results of this study and differences with research from Ragu-Nathan et al. (2008), which tested the validity of the technostress instrument using the theories of convergent validity and discriminant validity. In the previous study by Ragu-Nathan et al. (2008), the 20 items are valid. However, this study suggests that not all of the items are valid. Nevertheless, the first-order unidimensional and second-order model shows a good fit, indicating that this instrument is unidimensional, measuring one construct, namely Technostress and suitable for further research (Setyadi & Taruk, 2019). However, further research that will use this instrument is suggested to use the composite score of the latent variable rather than the raw score. Factor scores are the composite (latent) scores for each subject on each factor (Thompson, 2004; Wells, 1999). Using composite scores of the instruments allows the assignment of different weights to different items, leading to more reliable test results (Woodbury & Lord, 1956). Factor scores, or composite scores, are often used in research to represent an individual's placement on a factor or to create composite indices. Distefano et al. (2009) provide a comprehensive overview of the methods for creating factor scores and their potential applications in research. Ki and Chow (1995) further discuss using composite scores in quality of life assessment, proposing a method for their selection and interpretation.

Conclusion

From the results of testing the validity of the Technostress variable through the first-order per-dimension model (Techno-overload, Techno-invasion, Techno-complexity, Techno-insecurity, and Techno-uncertainly), the first-order unidimensional model, and second-order model, the models are fit except for the first-order per-dimension Techno-uncertainty and Techno-invasion models. The model fit was obtained after modification according to the output tested according to the instructions from the Mplus application because the initial results did not fit according to the criteria of Goodness of fit. The results from the first-order unidimensional indicate that one item from the Techno-uncertainty dimension—T17—is invalid and needs to be discarded, while second-order models discarded item T6.

Overall, it can be seen that the Technostress instrument modified into Indonesian can be used to measure and see a person's stress level caused by technology and can also see a person's level of confidence in using technology, which is currently developing rapidly. Many new features must be learned carefully and fast because technology development is also growing to meet human needs in interacting and carrying out work to make it easier and more practical.

From the conclusions and discussions that the researcher has presented, the researcher wants to advise future researchers who want to test the validity of the Technostress measuring tool developed by Ragu-Nathan et al. (2008), specifically:

1. Future researchers who wish to test the validity of the Technostress measuring instrument hope to use composite or factor scores for more reliable test results.
2. It is suggested that the research subject be expanded not only to teachers or lecturers but also to students, office workers, and government workers.
3. It is hoped that the number of respondents will be increased to increase the trust and validity of an item on the measuring instrument that will be tested using the CFA method or other methods.
4. The ages of the respondents should be more varied.

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Conflict of Interest

The researchers declare that this paper has no conflict of interest

Authors Contribution

IS, HM, and HN created a big picture of the research. MKN sought theories, developed instruments, and collected data. PARD wrote the manuscript and helped process the research data. WAS processed research data. All authors discussed the results of the research and refined the final manuscript.

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Appendix

Instrument (Indonesian Version)

Technostress Scale Indonesian Version

No	Pertanyaan	Sangat Tidak Setuju	Tidak Setuju	Setuju	Sangat Setuju
1	Perkembangan teknologi memaksa saya untuk melakukan lebih banyak pekerjaan daripada yang bisa saya tangani.	1	2	3	4
2	Perkembangan teknologi memaksa saya untuk bekerja dengan jadwal yang sangat ketat.	1	2	3	4
3	Saya terpaksa mengubah kebiasaan mengajar saya untuk beradaptasi dengan teknologi baru.	1	2	3	4
4	Saya memiliki beban kerja yang lebih tinggi karena meningkatnya kompleksitas teknologi	1	2	3	4
5	Dengan adanya perkembangan teknologi membuat saya harus berhubungan dengan pekerjaan saya bahkan selama liburan.	1	2	3	4
6	Saya harus mengorbankan waktu liburan dan akhir pekan saya untuk membahas pekerjaan melalui whatsapp, *zoom meeting* atau aplikasi online lainnya.	1	2	3	4
7	Saya merasa kehidupan pribadi saya terganggu karena selalu terhubungan dengan aplikasi online seperti whatsapp, *zoom meeting*.	1	2	3	4
8	Saya tidak cukup menguasai teknologi yang saya gunakan untuk bekerja dengan memuaskan.	1	2	3	4
9	Saya perlu waktu lama untuk memahami dan teknologi baru dalam mengajar secara online	1	2	3	4
10	Saya tidak cukup waktu untuk belajar dan meningkatkan keterampilan saya untuk menggunakan teknologi.	1	2	3	4
11	Saya menemukan rekan kerja saya lebih banyak mengetahui tentang teknologi daripada saya sendiri.	1	2	3	4
12	Saya sering merasa terlalu rumit untuk memahami penggunaan teknologi baru.	1	2	3	4
13	Saya merasa pekerjaan saya terancam karena perkembangan teknologi	1	2	3	4
14	Saya harus terus memperbarui keterampilan saya untuk menghindari diganti	1	2	3	4
15	Saya merasa terancam oleh rekan kerja saya yang memiliki keterampilan teknologi yang lebih canggih	1	2	3	4
16	Saya merasa kurang berbagi ilmu dengan rekan kerja saya karena takut tergantikan.	1	2	3	4
17	Selalu ada perkembangan teknolologi baru yang kami gunakan dalam mengajar	1	2	3	4
18	Aplikasi online dan software di tempat kerja saya untuk mengajar sering berubah-ubah	1	2	3	4
19	Perangkat keras atau laptop yang saya gunakan untuk bekerja dan mengajar sering berubah-ubah	1	2	3	4

20	Sering ada peningkatan dalam jaringan laptop di tempat kerja saya	1	2	3	4

Instrument (Original Version)

The Original Technostress Scale

Technostress creators		**Mean**	**Standard Deviation**
Techno-overload (Reliability = 0.82)			
		3.00	**0.91**
Item 1	I am forced by this technology to do more work than I can handle		
Item 2	I am forced by this technology to work with very tight time schedules		
Item 3	I am forced to change my work habits to adapt to new technologies		
Item 4	I have a higher workload because of increased technology complexity		
Techno-invasion (Reliability = 0.80)			
		2.21	**0.83**
Item 5	I have to be in touch with my work even during my vacation due to this technology		
Item 6	I have to sacrifice my vacation and weekend time to keep current on new technologies		
Item 7	I feel my personal life is being invaded by this technology		
Techno-complexity (Reliability = 0.77)			
Item 8	I do not know enough about this technology to handle my job satisfactorily	**2.71**	**0.75**
Item 9	I need a long time to understand and use new technologies		
Item 10	I do not enough time to study and upgrade my technology skills		
Item 11	I find new recruits to this organization know more about computer technology than I do		
Item 12	I often find it too complex for me to understand use new technologies		
Techno-insecurity (Reliability = 0.78)			
Item 13	I feel constant threat to my job security due to technologies	**2.71**	**0.75**
Item 14	I have to constantly update my skills to avoid being replaced		
Item 15	I am threatened by coworkers with newer technologies skills		
Item 16	I feel there is less sharing of knowledge among cowokers for fear of being replaced		
Techno-uncertainty (Reliability = 0.83)			

Item 17	There are always new developments in technologies we use in our organization	**3.33**	**0.76**
Item 18	There are constant changes on computer software in our organization		
Item 19	There are constant change in computer hardware in our organization		
Item 20	There are frequent up grades in computer networks in our organization		