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A PSYCHOMETRIC EVALUATION: EXPLORATORY AND CONFIRMATORY FACTOR ANALYSIS OF THE MALAY VERSION OF THE STUDENT STRESS INVENTORY (SSI) FOR UNIVERSITY STUDENTS

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ABSTRACT

Stress as a common experience amongst university students, can significantly affect academic performance despite often being seen as an integral part of personal growth. To gain a deeper understanding of this issue, this study seeks to devise and validate a tool based on the General Adaptation Syndrome (GAS) and Environment Stress Theory (EST), named the Student Stress Inventory (SSI). This tool is designed to assess the frequency or level of stress among university students. A preliminary cross-sectional study was conducted where 169 responses were collected and subjected to an Exploratory Factor Analysis (EFA) using the Statistical Package for the Social Sciences (SPSS). The EFA results recommended the exclusion of four (4) items from the construct. Subsequently, for the primary data collection, the researcher collected 366 responses. These were then subjected to Confirmatory Factor Analysis (CFA) using Analysis of Moment Structures (AMOS). The CFA results showed that the SSI meets the requisite criteria, validating its efficacy in gauging student stress in university settings. The SSI serves as a crucial instrument to identify stress and pressure that could potentially impact students' academic performance. It provides a platform for relevant

stakeholders to identify significant stress levels, thereby enabling them to take necessary measures to mitigate these stressors and cultivate a more supportive learning environment within the university.

Keywords: *Confirmatory factor analysis, Student Stress, Exploratory factor analysis, Transactional Model of Stress and Coping.*

1.0 INTRODUCTION

Stress, depression, anxiety, and other mental health issues continue to be prominent focal points within the fields of psychology and counselling. The misinterpretation and poor management of stress can result in severe consequences, including depression, elevated morbidity, and increased mortality rates. Significantly, depression is identified as a psychological disorder, highlighting the profound influence these pervasive problems exert on mental health. As indicated in a report by the Malaysian Health Ministry, approximately 12% of Malaysians aged between 18 and 60 are contending with various forms of mental illness. This figure comprises 1% suffering from psychosis, 1.8% struggling with chronic worry, and 2% experiencing depression. The remaining individuals are believed to be managing chronic diseases and milder mental health disorders, such as anxiety. Alarmingly, certain affected individuals, including university students, have turned to suicide as a result of overwhelming stress (Arria et al., 2009; Zozaniza et al., 2013). This situation underscores the pressing need to effectively address these mental health concerns. Rafidah et al. (2009) pointed out that student stress stems from multiple interconnected factors, including the pressures associated with academic obligations, financial constraints, a lack of effective time management skills, and a profound fear of failure related to their academic achievements, such as grades and research tasks. Despite the mounting evidence illustrating the negative impact of stress on university students' lives, it is surprising that only a limited number of studies are dedicated to addressing this issue in Malaysia. Recognizing the noticeable gap in comprehensive tools for measuring stress levels among university students in the country, the researcher has embarked on a project to validate the psychometrics of the Student Stress Inventory (SSI). This initiative not only aims to enhance the existing body of knowledge but also strives to improve the quality, validity and reliability of the stress measurement scale (SSI).

2.0 LITERATURE REVIEW

Since decades, ago there are many measurement scales have been created to assess stress and burnout of university students such as: Perceived Stress Scale (PSS), Maslach Burnout Inventory (MBI), academic stress scale (ASS), Stress Sensation Inventory (SSI), General Health Questionnaire (GHQ) and Student-Life Stress Inventory (SLSI). Both of the scales were designed for use across broad populations and do not capture the specific experience of population. However, numerous studies have highlighted certain limitations with measurement scales, particularly issues relating to internal consistency, validity, and generalizability issues (Farah et al., 2020). Gadzella (1991) conducted a comprehensive study on student stress, engaging a sample of 95 university students, comprising 38 males and 57 females. The research utilized the Student-Life Stress Inventory (SLSI), an instrument crafted to gauge students' stress levels, employing a 5-point Likert scale. The study found a nine-factor structure, indicating that the SLSI demonstrated nine distinct constructs through which student stress could be interpreted. However, the construct validity of the SLSI, as established by exploratory factor analysis (EFA), has exhibited inconsistencies across various learning contexts. In other words, the ways the SLSI constructs interact and correlate can differ significantly in disparate academic environments. This factor structure variability suggests that the instrument's efficacy in accurately capturing and assessing student stress may be fluctuated by specific contextual factors, potentially impacting its overall validity and reliability. This inconsistency highlights the importance of careful consideration of the context in which such instruments are deployed. It also emphasizes the need for further research to expand the SLSI's validity across a wider series of learning environments. Drawing parallels, the Student Stress Inventory (SSI) may encounter similar potential issues as the SLSI, given that its psychometric properties have not been definitively established. Therefore, there is a pressing

need to execute both EFA and confirmatory factor analysis. These procedures can serve as evidence of the SSI's validity and reliability, thereby reinforcing the credibility of this scale.

In a related study, Ieva et al. (2015) sought to examine the psychometric properties of the Lithuanian adaptation of the Inventory of College Students' Recent Life Experiences (ICSRLE). However, their findings revealed a discrepancy in the factor structure when compared with the original version. Their exploration and confirmatory factor analyses unveiled a distinct 6-factor structure, utilizing 36 items from the scale. The dimensions encompassed by this structure included relationship problems, lack of time, social alienation, future decision-making, academic dissatisfaction, and financial problems. Interestingly, 13 items from the original scale failed to align with this newly discovered 6-factor structure. In effect, it was concluded that the 6-factor structure provided a more fitting representation for Lithuanian students compared to the original 7-factor structure. Therefore, the researchers highlighted the pressing necessity to validate the psychometric properties of the ICSRLE. This call to action underscores the potential issues that can arise when implementing a scale in a cultural context differing from its origin. This study emphasizes the importance of thorough validation and adjustment of psychometric scales to maintain their effectiveness and reliability across diverse cultural and socio-economic contexts. The cultural and language sensitivity of such instruments play a critical role in delivering accurate and valid results. This underlines the necessity for researchers to consider the cultural context of their studies and adjust their methodologies accordingly.

At the same time, Mohamed et al. (2015) assessed the validity and reliability of a scale using 50 respondents. However, this research has a few critical shortcomings. Primarily, while the study provided the Cronbach alpha of items, it failed to conduct an Exploratory Factor Analysis (EFA). As such, it doesn't shed light on the underlying relationships between the measured variables, nor does it address the factorability of items. Additionally, the researcher did not utilize CFA to examine the factor loading of the items, the composite reliability (CR), and the average variance extracted (AVE). According to Awang (2018) and Awang et al. (2018), CFA can demonstrate how effectively the measured variables correspond to the number of constructs. It can also confirm or reject the validity of the measurement scale. Parallelly, Hair et al. (2010) argued that the minimum respondent count should be 100, even if the latent construct is less than five. In other words, the 50 respondents in the aforementioned study may not be sufficient to reveal the characteristics of the measurement model conclusively. To put it simply, the researcher failed to establish the psychometric properties of the scale. As a result, the scale's validity, reliability, and generalizability could be questioned. Therefore, a more comprehensive approach involving EFA and CFA would have been more beneficial in establishing the scale's scientific credibility.

Additionally, Farah et al. (2020) conducted a study to assess the validation of the Student Stress Inventory (SSI) among Malaysian Secondary School students. Initially, the SSI was designed to investigate stress levels or burnout among university students, but it had not been prevalently tested in this context. Despite this, the researchers proceeded to evaluate its validity, reliability, and feasibility. However, the results showed that the measurement was invalid, with only 15 out of the 40 original items being retained. In other words, only 35% of the items remained in the scale. Under these circumstances, the scale's validity can indeed be questioned. As emphasized by Awang (2015; 2018) and Afthanorhan et al. (2018) deletions should not surpass 20% of a construct. If they exceed this threshold, it could indicate issues with the scale's internal consistency and reliability. This discrepancy might be attributed to the different contexts and language nuances between university and secondary school environments. Therefore, it becomes clear that before applying a scale in a new context, especially considering environmental factors, age, and language, the psychometric properties of the scale should be identified and validated. Clearly, there is an urgent need to ensure a tool's validity, reliability, and generalizability before its deployment.

Concurrently, a study conducted by Matthew et al. (2021) sought to assess the psychometric properties of a student stress measure among medical students. Surprisingly, the results indicated that

only 22 out of the original 35 items were retained. The researchers used EFA to identify the scale's underlying factors and discovered that 13 items had to be omitted due to low factor loadings, which were less than 0.5. While they used CFA to demonstrate the scale's fitness and calculated Cronbach's alpha, they did not conduct a comprehensive CFA procedure to demonstrate the scale's AVE and CR. These metrics are crucial as AVE represents the average percentage of variation explained by the items in a construct, and CR reflects the internal consistency of the measured variables representing a latent construct (Awang, 2015; 2018). Furthermore, Awang (2015), Afthanorhan et al. (2019), and Asnawi et al. (2019) have stipulated that item deletion in a measurement model should not exceed 20% of total items. If the deleted items exceed 20%, the measurement model is deemed invalid as it fails to meet the "confirmatory" requirement. Therefore, this scale loses its validity since the deleted items exceed 20%, even reaching 30%. Given these considerations, the applicability of the scale in different cultural or linguistic contexts may indeed be questionable.

Despite the importance of stress measurement scales, it appears that to date, there's a lack of valid, reliable, and context-specific scales to assess stress levels at the university level. Most scales fail to establish their psychometric properties, rendering them unfit for diverse contexts, especially those involving different environments, ages, cultures, and languages. In light of these circumstances, this study aims to establish the validation, reliability, and generalizability of a stress measurement scale, particularly the Malay version of the SSI. Given that Malay is the national language and the primary mode of communication for Malaysians, including university students, it is crucial to validate a scale that's relevant and usable for this demographic (Othman et al., 2022). Developing this scale will not only ensure more accurate measurements but also make it possible to apply these measurements to other contexts and cultures, thus improving their overall relevance and utility.

3.0 METHODOLOGY

This research followed a cross-sectional study design, as outlined by Sekaran and Bougie (2016), where data was collected at a specific point in time. The empirical data was obtained from three public universities in the Kuala Lumpur and Selangor area. Numerous studies have highlighted that students living in big cities may experience higher levels of stress compared to those residing in less populated areas (Chung & Lee, 2012; Jarvis, 2020: Sulaiman et al., 2009). A simple random sampling technique was employed to select respondents from among the university's third and fourth-year students. This methodology guarantees that each individual within the targeted demographic has an equal chance of selection, thereby bolstering the representativeness of the research and minimizing sampling bias. The item selection for physical, interpersonal relationship, academic, and environmental factors was based on established literature, specifically the work of Farah et al. (2020). A meticulous translation process was undertaken by an expert panel, comprised of researchers, linguists, and physicians. This process was carefully planned to preserve the integrity of the original meanings, setting the stage for subsequent content and face validity assessments. Content validity refers to the degree to which an instrument's content sufficiently represents the construct it is intended to measure, taking into consideration the number and range of individual questions it contains. On the other hand, face validity involves a robust review of the instrument to ensure that, at face value, its items appear to encompass the intended topics comprehensively and without ambiguity (Zikmund & Babin, 2010). Following the revision of the instrument, based on feedback from the expert panel and pre-test results, a pilot study was carried out. It gathered 126 valid responses, thereby achieving the minimum sample size requirement of 100, (Awang, 2015; Bahkia et al., 2019). The data gathered during the pilot study were then analyzed using exploratory factor analysis (EFA), setting the groundwork for the primary survey. The finalized version of the SSI instrument included 40 items, excluding the question pertaining to the respondents' demographic profiles. The instrument utilized a 10-point interval scale, with 1 indicating 'strongly disagree' and 10 signifying 'strongly agree.' This measurement approach was recommended by Awang (2015) and Coelho & Esteves (2007) to ensure a higher level of data independence from the SSI. The actual survey gathered 368 responses. Out of

these, 326 were deemed valid and chosen as the most appropriate data set. It is vital for the researcher to ensure that the number of respondents is substantial enough to guarantee robust SEM (Kline, 2015). Data analysis was performed using the Statistical Package for Social Science (SPSS) and Analysis of Moment Structures (AMOS). SPSS was employed for data screening and the EFA. In contrast, AMOS was utilized to validate the measurement model for construct unidimensionality, validity, and reliability through CFA (Afthanorhan et al., 2019; Awang, 2015; Awang et al., 2018).

4.0 RESULTS

4.1 EXPLORATORY FACTOR ANALYSIS (EFA)

The primary aim of the EFA is to condense and summarize data by grouping correlated variables (Zikmund & Babin, 2010). In this study, EFA was applied to the data collected from the pilot study to uncover four latent dimensions: physical, interpersonal relationship, academic, and environmental factors. There were several prerequisites for conducting the EFA. Firstly, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) should exceed 0.50. Secondly, Bartlett's test of sphericity should yield significant results with $p < 0.001$, as suggested by Hair et al. (2014), Awang (2015), and Bahkia et al. (2019).

Table 1 presents the findings of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for physical, interpersonal relationship, academic, and environmental factors. For all constructs, the KMO values surpassed the threshold of 0.5. The Bartlett's test of sphericity for all constructs yielded significant results ($p < 0.001$), aligning with the guidelines suggested by Hair et al. (2014), Bahkia et al. (2019), Rahlin et al. (2019), and Shkeer and Awang (2019).

Table 1: Results of KMO and Bartlett's Test of Sphericity

Construct	KMO (>0.50)	Bartlett's Test of Sphericity (p<0.001)
Physical	0.816	0.00
Interpersonal Relationship	0.793	0.00
Environmental	0.829	0.00
Academic	0.869	0.00

In the EFA, the technique of principal component analysis was utilized to scrutinize the factor extraction process. This served to identify which factors should be retained and which should be discarded. The Varimax rotation was the chosen method, primarily due to its widespread usage in orthogonal factor rotation and its capacity to facilitate factor analysis (Hair et al., 2014; Shkeer & Awang, 2019). The factor loadings that fell below an absolute value of 0.5 were eliminated, while those equal to or above 0.5 were retained for measurement (Hair et al., 2014). Table 2 displayed the PCA with varimax rotation result for 40 items under SSI construct. The result revealed that the PCA procedure has extracted four distinct components with eigenvalue exceeding the value of 1.0, with the total variance explained for all four components to be 75.720%, over the 60% value as the minimum percentage of acceptable variance explained in factor analysis for a construct to be valid (Hair, et al., 2010; Shkeer & Awang, 2019a).

Table 2: Results of Total Variance Explained (TVE)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.215	46.433	46.433	10.215	46.433	46.433	5.980	27.183	27.183
2	3.253	14.788	61.221	3.253	14.788	61.221	4.199	19.084	46.267

3	1.823	8.288	69.509	1.823	8.288	69.509	3.418	15.537	61.804
4	1.366	6.210	75.720	1.366	6.210	75.720	3.062	13.916	***75.720***
5	1.259	5.724	81.443						

Extraction Method: Principal Component Analysis.

Table 3 illustrates the need to eliminate few items. Specifically, "sakit belakang" from the physical dimension, and "Saya tidak selesa menunggu di barisan yang panjang" from the environmental dimension, failed to meet the stipulated requirements and thus necessitated removal. Additionally, two items related to interpersonal relationships, "Ibu bapa saya menganggap saya sebagai orang yang tidak berguna" and "Keluarga saya tidak memberikan sokongan kepada saya," were found to be inadequate and were consequently deleted. These items were omitted due to their failure to attain the specified minimum factor loading of 0.6 (Hair et al., 2010). Given these findings, the initial pool of 40 items in the SSI was reduced to 36 as depicted in Table 4. These remaining items were carried forward to the next stage of research analysis CFA.

Table 3: Final EFA Result of Students Stress Inventory (SSI)

Rotated Component Matrix						
			Component			
No	Dimension	Items	1	2	3	4
1		Fizikal Sakit Kepala.	.712			
2		Sakit belakang.	.416*			
3		Masalah untuk tidur.	.813			
4		Sukar untuk bernafas.	.595			
5		Bimbang yang berlebihan.	.861			
6	Fizikal	Sakit perut/mual	.669			
7		Keletihan yang berterusan/lesu	.798			
8		Berpeluh/ Tangan berpeluh	.868			
9		Kerap sejuk/selsema/demam	.628			
10		Pengurangan berat badan secara mendadak	.688			
1		Saya mendapati sukar untuk memenuhi harapan tinggi yang diletakkan oleh ibu bapa saya.		.669		
2		Ibu bapa saya menganggap saya sebagai orang yang tidak berguna.		.406*		
3		Saya rasa bersalah jika saya gagal untuk penuhi harapan ibu bapa saya.		.728		
4		Ibu bapa saya hanya mengharapkan kejayaan saya.		.889		
5		Saya mendapati sukar untuk bergaul dengan ahli kumpulan dalam menyiapkan tugasan akademik.		.883		
6	Hubungan	Rakan-rakan tidak mempedulikan saya.		.557		
7	Sesama Manusia	Saya berasa terganggu apabila ada masalah dengan rakan-rakan saya.		.667		
8		Keluarga saya tidak memberikan sokongan kepada saya.		.411*		
9		Guru-guru saya tidak memberikan sokongan kepada saya.		.527		
10		Saya berasa kecewa dengan kekurangan pengurusan sekolah.		.652		
1		Saya menghadapi masalah pengangkutan untuk ke sekolah.			.722	
2		Saya berasa stres dengan keadaan tempat tinggal yang tidak selesa.			.618	

3		Persekitaran yang bising menyebabkan saya berasa terganggu.	.602	
4		Pencemaran menyebabkan saya berasa tidak selesa.	.799	
5		Cuaca panas menyebabkan saya tidak ingin keluar.	.838	
6	Persekitaran	Keadaan tempat tinggal yang bersepah menyebabkan saya berasa terganggu.	.666	
7		Saya berasa kecewa dengan kemudahan di sekolah yang serba kekurangan.	.767	
8		Berada di khalayak ramai menyebabkan saya berasa tidak selesa.	.491*	
9		Saya tidak selesa menunggu di barisan yang panjang.	.726	
10		Saya berasa takut berada di tempat yang tidak selamat.	.827	
1		Saya mempunyai masalah kewangan disebabkan oleh perbelanjaan sekolah.		.863
2		Saya berasa sukar untuk membahagikan masa di antara belajar dan aktiviti sosial.		.816
3		Saya berasa gementar jika diajukan soalan di dalam kelas.		.828
4		Saya berasa stres jika tarikh untuk menghantar kerja sekolah semakin hampir.		.899
5		Saya berasa stres untuk menduduki peperiksaan.		.902
6	Akademik	Saya berasa sukar untuk membahagikan masa antara belajar dan penglibatan dalam aktiviti kokurikulum.		.728
7		Saya hilang minat untuk mempelajari beberapa mata pelajaran di sekolah.		.609
8		Saya berasa terbeban dengan kerja sekolah.		.692
9		Saya berasa stres belajar mata pelajaran yang susah.		.791
10		Saya berasa sukar untuk menyelesaikan masalah akademik.		.719

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Table 4: Item Retention Result after EFA

No	Construct	Items before EFA	Number of Items Dropped	Number of Items Retained after EFA
1	Fizikal	10	1	9
2	Hubungan Sesama Manusia	10	2	8
3	Persekitaran	10	1	9
4	Akademik	10	-	10

According to Table 4, a few items need to be removed due to factor loadings below the minimum threshold: 1 item from 'fizikal' and 'persekitaran,' and 2 items from 'Hubungan Sesama Manusia.' In total, 4 items need to be eliminated.

4.2 CONFIRMATORY FACTOR ANAlYSIS (POOLED-CFA)

The present study has validated the measurement models of latent constructs from three vital perspectives: unidimensionality, validity, and reliability (Afthanorhan et al., 2017; Aimran et al., 2017; Awang, 2015; Hair et al., 2014; Mohamad et al., 2018). This crucial procedure is termed 'confirmatory factor analysis' (CFA). The measurement model of the latent constructs underwent three types of validity tests: convergent, construct, and discriminant (Awang, 2015; Hair et al., 2014; and Yusof et al., 2017). The assessment of convergent validity required the calculation of the average variance extracted (AVE). Construct validity was appraised by scrutinizing the fit indices of the measurement model. To establish discriminant validity, a discriminant validity index summary was assembled. Composite Reliability (CR) was employed for the reliability assessment, as it is considered superior to the conventional Cronbach Alpha method in the analysis of SSI (Awang, 2015; Aziz et al., 2016; Hair et al., 2014; Yusof et al., 2017).

Figure 1: Pooled- CFA Student Stress Inventory (SSI)

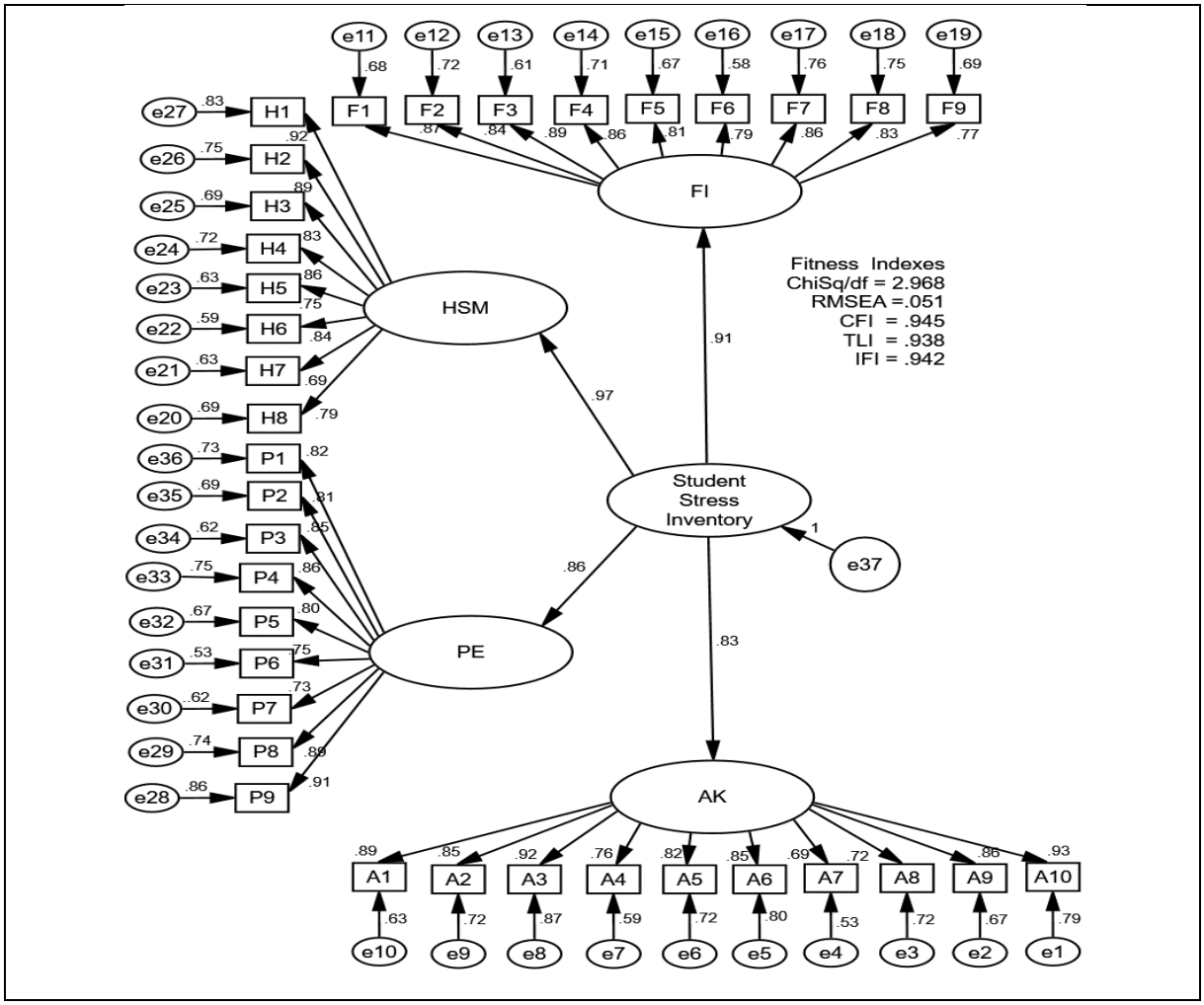

Figure 1 demonstrates that all components in the model were tested together using a method called pooled-CFA for validation. As suggested by Awang (2015) and Awang et al. (2018), the development of pooled-CFA can effectively address model identification, even when some components have fewer than four items. By combining the components, the model gains more flexibility. In this study, the use of pooled-CFA is considered more efficient than conducting separate analyses (the conventional method) for each measurement component.

4.3 UNIDIMENSIONALITY

Unidimensionality means that a set of variables can be interpreted as measuring a single construct (Hair et al., 2014). According to Awang (2012: 2015), unidimensionality is achieved when all items that measure a specific construct have satisfactory factor loadings. If any items in the CFA have unsatisfactory factor loadings, they should be removed from the measurement model until the fit indices meet the desired criteria (Afthanorhan et al., 2017; Asnawi et al., 2019; Awang, 2015; Hair et al., 2014). Awang (2015) outlines two conditions that should be met before removing an item from the analysis: 1) for newly created items, their factor loading should be 0.5 or higher and 2) for existing items that have been previously established, their factor loading should be 0.6 or higher.

Table 5. Factor Loading of All Items

No	Construct/Item	Factor Loading
	Fizikal (Physical)	
1	Sakit Kepala.	.87
2	Masalah untuk tidur.	.84
3	Sukar untuk bernafas.	.89
4	Bimbang yang berlebihan.	.86
5	Sakit perut/mual	.81
6	Keletihan yang berterusan/lesu	.79
7	Berpeluh/ Tangan berpeluh	.86
8	Kerap sejuk/selsema/demam	.83
9	Pengurangan berat badan secara mendadak	.77
	Hubungan Sesama Manusia	
1	Saya mendapati sukar untuk memenuhi harapan tinggi yang diletakkan oleh ibu bapa saya.	.92
2	Saya rasa bersalah jika saya gagal untuk penuhi harapan ibu bapa saya.	.89
3	Ibu bapa saya hanya mengharapkan kejayaan saya.	.83
4	Saya mendapati sukar untuk bergaul dengan ahli kumpulan dalam menyiapkan tugasan akademik.	.86
5	Rakan-rakan tidak mempedulikan saya.	.75
6	Saya berasa terganggu apabila ada masalah dengan rakan-rakan saya.	.84
7	Guru-guru saya tidak memberikan sokongan kepada saya.	.69
8	Saya berasa kecewa dengan kekurangan pengurusan sekolah.	.79
	Persekitaran	
1	Saya menghadapi masalah pengangkutan untuk ke sekolah.	.82
2	Saya berasa stres dengan keadaan tempat tinggal yang tidak selesa.	.81
3	Persekitaran yang bising menyebabkan saya berasa terganggu.	.85
4	Pencemaran menyebabkan saya berasa tidak selesa.	.86
5	Cuaca panas menyebabkan saya tidak ingin keluar.	.80
6	Keadaan tempat tinggal yang bersepah menyebabkan saya berasa terganggu.	.75
7	Saya berasa kecewa dengan kemudahan di sekolah yang serba kekurangan.	.73
8	Saya tidak selesa menunggu di barisan yang panjang.	.88
9	Saya berasa takut berada di tempat yang tidak selamat.	.91
	Akademik	
1	Saya mempunyai masalah kewangan disebabkan oleh perbelanjaan sekolah.	.89
2	Saya berasa sukar untuk membahagikan masa di antara belajar dan aktiviti sosial.	.85
3	Saya berasa gementar jika diajukan soalan di dalam kelas.	.92
4	Saya berasa stres jika tarikh untuk menghantar kerja sekolah semakin hampir.	.76
5	Saya berasa stres untuk menduduki peperiksaan.	.82
6	Saya berasa sukar untuk membahagikan masa antara belajar dan penglibatan dalam aktiviti kokurikulum.	.85
7	Saya hilang minat untuk mempelajari beberapa mata pelajaran di sekolah.	.69

8	Saya berasa terbeban dengan kerja sekolah.	.72
9	Saya berasa stres belajar mata pelajaran yang susah.	.86
10	Saya berasa sukar untuk menyelesaikan masalah akademik.	.93

According to Table 5, all items measuring various constructs have achieved factor loading values higher than the minimum threshold of 0.50, as recommended by Awang (2015) and Awang et al. (2018). Therefore, no items need to be removed from this construct.

4.4 CONVERGENT VALIDITY

Convergent validity refers to a collection of indicators that are presumed to measure a single construct (Hair et al., 2014; Awang, 2015; Awang et al., 2018). The primary purpose of assessing convergent validity is to determine the strength of correlation among items that are expected to represent a latent construct (Brown, 2006). Convergent validity is typically confirmed by calculating the Average Variance Extracted (AVE), where a value of 0.5 or higher is considered desirable for achieving convergent validity (Fornell and Larker, 1981). Values above 0.7 are considered to be particularly strong (Awang, 2015).

Table 6: Average Variance Extracted for All Constructs

Codes	Construct	AVE (Above 0.5)
FI	Fizikal (physical)	0.700
HSM	Hubungan Sesama Manusia (interpersonal relationship)	0.679
PE	Persekitaran (environmental factors)	0.681
AK	Akademik (academic)	0.693

Based on the data presented in Table 6, all constructs in the study exceeded the minimum AVE threshold of 0.5, indicating satisfactory convergent validity. Among the constructs, Fizikal (physical) had the highest AVE value of 0.700, indicating strong convergent validity. However, hubungan sesama manusia (interpersonal relationship) had a lower factor loading of 0.679, suggesting a relatively weaker relationship. Overall, the model demonstrated convergent validity based on these findings.

4.5 CONSTRUCT VALIDITY

Construct validity is achieved when the fitness indices for a construct meet the required levels. These indices assess how accurately the items measure the underlying latent constructs (Awang, 2015; Awang et al., 2018; Afthanorhan et al., 2018, 2019). Previous studies (Awang et al., 2015, 2018; Kashif et al., 2015, 2016; Yusof et al., 2018; Asnawi et al., 2019) suggested that construct validity can be established through three types of model fit indices: absolute, incremental, and parsimonious. Among these indices, the Root Mean Square of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Normed Chi-Square ($\chi 2/df$) are considered particularly important and should be reported by researchers (Awang, 2015; Awang et al., 2018). The results have been displayed in Table 7 as follows:

Table 7: Fitness Indices

Name of category	Name of index	Level of acceptance	Result	Status
Absolute Fit Index	RMSEA	RMSEA < 0.08 (Hu & Bentler, 1999)	0.516	Achieved

Incremental Fit Index	CFI TLI IFI	CFI > 0.90 TLI > 0.90 IFI > 0.90 (Afthanorhan et al., 2019)	0.945 0.938 0.942	Achieved
Parsimonious Fit Index	Chi-Square/df	Chi-Square/df < 3.0 (Hu & Bentler, 1990)	2.968	Achieved

Table 7 shows that the SSI (construct) met all three categories of fitness indices: (1) The RMSEA value was below 0.08 (specifically, 0.516), confirming the absolute fit index. (2) The SSI achieved an incremental fit index by obtaining a CFI value of 0.948, surpassing the recommended threshold of 0.90. (3) The parsimonious fit index, measured by the Chisq/df value of 2.968, was below the recommended threshold of 3.0 as suggested by Bentler (1990). Based on these results, this study successfully established the construct validity of the SSI.

4.6 DISCRIMINANT VALIDITY

Discriminant validity is a crucial aspect of construct evaluation, ensuring that the measurement model effectively captures distinct constructs without redundancy. Redundancy refers to the presence of highly correlated constructs within the model, where items become duplicative and fail to provide unique information (Hair et al., 2014). To assess discriminant validity, the focus lies on the correlation between exogenous constructs. A widely accepted threshold is that the correlation between two exogenous constructs should not exceed 0.85. If the correlation surpasses this threshold, it implies that the constructs are redundant and suffer from multicollinearity, which can lead to interpretation challenges and unreliable estimation results. High correlation indicates a significant overlap in what the constructs measure, potentially rendering them conceptually similar or even interchangeable. By ensuring discriminant validity, researchers ensure that each construct measures a distinct aspect, promoting accurate and meaningful measurement. This enhances the robustness of the analysis and supports the interpretation of construct-specific effects in subsequent modelling. Therefore, careful examination of the correlation matrix is essential to identify and address potential issues of redundancy and multicollinearity when establishing discriminant validity. The results of this study are displayed in Table 8 as follows:

Table 8: Discriminant Validity Index Summary

Construct/ Codes	FI	HSM	PE	AK
Fizikal (FI)	***0.700***			
Hubungan Sesama Manusia (HSM)	0.203	***0.679***		
Persekitaran (PE)	0.388	0.375	***0.681***	
Akademik (AK)	0.204	0.477	0.177	***0.693***

Discriminant validity was established for each construct in the model, as supported by Table 6 (Awang et al., 2018; Awang, 2015; Hair et al., 2014). This is evidenced by the fact that the square root of the average variance extracted (AVE) exceeded the correlation values with other constructs (highlighted in italic and bold). Additionally, the diagonal values, displayed in bold, were higher than any other values in their respective rows and columns, providing further confirmation of discriminant validity. Therefore, based on the values presented in Table 8, all constructs in the SSI have successfully met the threshold for discriminant validity.

4.7 COMPOSITE RELIABILITY

Composite reliability is a measure of the reliability and internal consistency of a latent construct (Hair et al., 2014; Awang, 2015; Awang et al., 2018). A threshold value of at least 0.6 is typically considered acceptable for composite reliability. In the analysis conducted, it was found that the composite reliability of all constructs in the SSI exceeded the minimum threshold of 0.6 (Table 9). Among the constructs, the highest composite reliability was observed for Akademik (Academic), with a value of 0.957, while Hubungan Sesama Manusia (Interpersonal relationship) had the lowest composite reliability of 0.944. Therefore, the composite reliability of the SSI was successfully achieved.

Table 9: Composite Reliability

Codes	Construct	CR (Above 0.6)
FI	Fizikal (Physical)	.954
HSM	Hubungan Sesama Manusia (Interpersonal relationship)	.944
PE	Persekitaran (environmental factors)	.950
AK	Akademik (Academic)	.957

Based on Table 9, all constructs have successfully achieved the minimum threshold, which is higher than 0.6. Therefore, this proves that all constructs have achieved the composite reliability.

4.8 NORMALITY ASSESSMENT

In order to evaluate the normality distribution of the items measuring the constructs in the SSI, it is important to assess the skewness values. Skewness is a statistical measure that indicates the asymmetry of a distribution. For the items to adhere to normality, acceptable skewness values are typically recommended. This assessment is guided by various sources including Hair et al. (2014), Awang (2015), Asnawi et al. (2019), and Afthanorhan et al. (2019). A widely accepted range for acceptable skewness values is -2 to 2. Skewness values within this range indicate a reasonably symmetric distribution and are considered to align well with the assumptions of normality. Skewness values less than -2 or greater than 2 may suggest a significant departure from normality and may raise concerns about the reliability and validity of the measurement. Therefore, during the analysis of the SSI, it is important to examine the skewness values of the items to ensure that they fall within the acceptable range. By doing so, researchers can evaluate whether the data distribution of the items approximates a normal distribution, which is crucial for appropriate statistical analysis and interpretation of the results.

Table 10: Normality Assessment Results

No	Construct/Item	Skewness
	Fizikal (FI)	
1	Sakit Kepala.	.932
2	Masalah untuk tidur.	-.363
3	Sukar untuk bernafas.	.119
4	Bimbang yang berlebihan.	-.228
5	Sakit perut/mual	.626
6	Keletihan yang berterusan/lesu	-.118
7	Berpeluh/ Tangan berpeluh	-.219

8	Kerap sejuk/selsema/demam	.669
9	Pengurangan berat badan secara mendadak	.886
	Hubungan Sesama Manusia (HSM)	
1	Saya mendapati sukar untuk memenuhi harapan tinggi yang diletakkan oleh ibu bapa saya.	.634
2	Saya rasa bersalah jika saya gagal untuk penuhi harapan ibu bapa saya.	-.267
3	Ibu bapa saya hanya mengharapkan kejayaan saya.	.771
4	Saya mendapati sukar untuk bergaul dengan ahli kumpulan dalam menyiapkan tugasan akademik.	.539
5	Rakan-rakan tidak mempedulikan saya.	.707
6	Saya berasa terganggu apabila ada masalah dengan rakan-rakan saya.	-.294
7	Guru-guru saya tidak memberikan sokongan kepada saya.	-.335
8	Saya berasa kecewa dengan kekurangan pengurusan sekolah.	.882
	Persekitaran (PE)	
1	Saya menghadapi masalah pengangkutan untuk ke sekolah.	.116
2	Saya berasa stres dengan keadaan tempat tinggal yang tidak selesa.	.832
3	Persekitaran yang bising menyebabkan saya berasa terganggu.	.626
4	Pencemaran menyebabkan saya berasa tidak selesa.	-.123
5	Cuaca panas menyebabkan saya tidak ingin keluar.	.384
6	Keadaan tempat tinggal yang bersepah menyebabkan saya berasa terganggu.	.662
7	Saya berasa kecewa dengan kemudahan di sekolah yang serba kekurangan.	-.338
8	Saya tidak selesa menunggu di barisan yang panjang.	-.019
9	Saya berasa takut berada di tempat yang tidak selamat.	.528
	Akademik (AK)	
1	Saya mempunyai masalah kewangan disebabkan oleh perbelanjaan sekolah.	.998
2	Saya berasa sukar untuk membahagikan masa di antara belajar dan aktiviti sosial.	.832
3	Saya berasa gementar jika diajukan soalan di dalam kelas.	.881
4	Saya berasa stres jika tarikh untuk menghantar kerja sekolah semakin hampir.	-.318
5	Saya berasa stres untuk menduduki peperiksaan.	.336
6	Saya berasa sukar untuk membahagikan masa antara belajar dan penglibatan dalam aktiviti kokurikulum.	.661
7	Saya hilang minat untuk mempelajari beberapa mata pelajaran di sekolah.	-.396
8	Saya berasa terbeban dengan kerja sekolah.	.678
9	Saya berasa stres belajar mata pelajaran yang susah.	.356
10	Saya berasa sukar untuk menyelesaikan masalah akademik.	.772

The analysis of the model's components revealed that the skewness values for all variables were within the acceptable range of -2 to 2, as recommended by Awang (2012; 2015) and Hair et al. (2022). This indicates that the distribution of the data did not exhibit substantial deviations from normality. Therefore, it can be concluded that the data distribution in the SSI study met the requirement of a normal distribution, providing a sound basis for further statistical analysis and interpretation of the results.

5.0 CONCLUSIONS

The aim of this study was to validate a Malay version survey instrument for assessing stress levels of students in the university learning process. The results obtained from the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) demonstrate that the instrument successfully validates the factors influencing stress levels among university students, as measured by the Student Stress Inventory (SSI) scale. The EFA findings indicated that the majority of the items in the instrument were suitable and did not require significant modifications. Subsequent CFA analysis confirmed that the SSI

instrument met the criteria for convergent validity, construct validity, and discriminant validity. The assessment of unidimensionality and normality further supported the validity of the SSI instrument's items. Therefore, based on the results obtained from both the EFA and CFA, it can be concluded that the SSI instrument is reliable for effectively assessing stress levels among students in Malaysian local universities. These findings provide strong evidence supporting the adequacy and applicability of the SSI in Malaysian local universities, including those located in the east (Sabah or Sarawak) and private universities. By successfully validating the SSI instrument for Malaysian local universities, it implies that the scale, constructs, and items of the SSI can be applied across different local universities in Malaysia. Thus, the Malay version of the SSI can be considered a reliable and relevant scale for understanding stress levels and associated factors among university students in Malaysia.

This study recommends the application of the Student Stress Inventory (SSI) in various research settings, including different levels of education institutes in Malaysia. The SSI, developed in Malaysia, is particularly relevant in the Malaysian context due to its collectivist culture, where students' thinking and behave are always influenced by authority figures such as parents, teachers, relationship of classmate and learning environment (Hung & Jeng, 2012; Pi-Yueh et al., 2012). Consequently, future research can focus into other contributing factors to student stress in universities or schools from these viewpoints, or explore yet undiscovered factors by researchers. Some potential factors to consider include the syllabus of courses, teaching and learning styles, the relationship between teachers/lecturers and students, time management, and other relevant aspects. Furthermore, incorporating information on moderating variables such as age, gender, and ethnicity can strengthen the SSI instrument and provide a more comprehensive understanding of student stress experiences. By expanding the research scope to include these factors and exploring the influence of various moderating variables, scholars can further enhance the robustness and applicability of the SSI instrument in capturing the complexities of stress among students in educational settings.

AUTHOR CONTRIBUTIONS

Yee C.Y: Conceptualization, Methodology; Nurul Ain: Writing-Original Draft Preparation; Nurhasma, Wan and Ng: Validation, Writing-Reviewing and Editing.

CONFLICT OF INTEREST

The manuscript has not been published elsewhere and is not under consideration by other journals. All authors have approved the review, agree with its submission and declare no conflict of interest on the manuscript.

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