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Psychometric Properties of the State-Trait Anxiety Inventory (Form Y) among Malaysian University Students

Chua Bee Seok [1,*], Harris Shah Abd Hamid [2], Jasmine Adela Mutang [1] and Rosnah Ismail [3]

[1] Faculty of Psychology and Education, Universiti Malaysia Sabah, Kota Kinabalu 88400, Malaysia; Jasmine@ums.edu.my
[2] Faculty of Education, Universiti Malaya, Kuala Lumpur 50603, Malaysia; harris75@um.edu.my
[3] Department of Psychology, Faculty of Allied Health Sciences, Cyberjaya University College of Medical Sciences, Cyberjaya 63000, Malaysia; rosnahismail@gmail.com
* Correspondence: chuabs@ums.edu.my

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Abstract: Health Ministry statistics showed mental health problems among Malaysian students increased from one in ten individuals in year 2011 to one in five in 2016. Anxiety and depression were cited as the main causes of mental health problems among students in Malaysia. However, an anxiety measure that has been validated for use with Malaysian students is still lacking. Thus, the main objective of the current study is to examine the psychometric proprieties of the State-Trait Anxiety Inventory (Form Y) (STAI), and to assess the suitability of the factorial model in the context of Malaysia. The STAI contains separate scales for measuring state and trait anxiety. A Confirmatory Factor Analysis (CFA) was conducted to test and to compare the two-factor model (State Anxiety and Trait Anxiety) and the four-factor model (State Anxiety Present, State Anxiety Absent, Trait Anxiety Present, and Trait Anxiety Absent) of STAI. In addition, the reliability and validity of the model were also tested. The sample consisted of 341 university students from one of the universities in Kota Kinabalu, Sabah. The results supported a better fit to the data for the four-factor model of STAI. To improve composite reliability and the average variance extracted (AVE) of the constructs, one item was removed from each of the State Anxiety Present factor, Trait Anxiety present factor, and Trait Anxiety Absent factor. Convergent validity for the four-factor model was also improved by the removal of the three items. The findings also suggested that the STAI may have some discriminant validity issues. In the framework of psychology of sustainability and sustainable development, research and intervention regarding this topic should also be enhanced from a primary prevention perspective to improve the quality of life of every human being, fostering wellbeing at all different levels, from individuals to organizations.

Keywords: composite reliability; confirmatory factor analysis; convergent validity; discriminant validity; the State-Trait Anxiety Inventory; psychology of sustainability and sustainable development

1. Introduction

Good health and wellbeing is one of the 17 sustainable development goals proposed by the United Nations [1]. Wellbeing is a key sustainable development goal, and a fundamental pillar for good health. Wellbeing is defined in terms of "a state of complete physical, mental, spiritual, and social wellbeing, and not merely the absence of disease or infirmity" [2–4]. Wellbeing is therefore an essential part of a healthy sustainable development in the framework of psychology of sustainability [5,6] for both individuals and organizations.

Sustainability expands beyond an interest for economic and ecological resources to an attention for increasing the psychological and contextual resources that can lead to wellbeing for all [5,6]. A positive healthy organization's perspective [5] underlines the shift from illness to positive health for both individuals and organizations, highlighting the relevance of improving the individuals' and organizations' strengths. This new perspective overcomes the ecological and socioeconomic aspects by centering on sustaining wellbeing and promoting the wellbeing of individuals, groups, and organizations [6]. From this perspective, we have the importance of the framework of prevention [7–9] at three different levels: Primary prevention, secondary prevention, and tertiary prevention [7]. Primary prevention centers on both avoiding the rise of a problem before it starts and fostering psychological wellbeing. Secondary prevention concerns prompt interventions as soon as the first symptoms appear. Tertiary prevention has the objective of reducing symptoms and facilitating recovery. Preventive actions are more effective when the attempts to enhance resources are joined with attempts to diminish risks [10].

Mental health problems around the globe, including Malaysia, have showed an increasing trend, especially among adults. The World Health Organization reported that the top five mental health issues, particularly in the Asia Pacific region, are anxiety, depression, Post-Traumatic Stress Disorder (PTSD), suicidal behavior, and substance abuse disorder [11]. The National Health and Morbidity Survey (NHMS) [8] in 2011 showed that the prevalence of generalized anxiety disorder (GAD) among Malaysian adults aged 16–24 years old is 2.1%. Adults aged 16–24 also showed a similar trend in the prevalence for lifetime depression (2.4%), current depression (1.8%), suicidal ideation (2.4%), suicide planning (1.3%), and suicide attempts (0.7%). The NHMS in 2015 further reported that 29.2% of Malaysian adults (aged $\geq$ 16 years) were having mental health problems [12] with an increment of 18.5% as compared to the first NHMS study in 1996. Looking at the prevalence of the age group, university students are most likely to face mental health issues.

It is common for university students to experience mental health problems to a certain degree, as they need to adapt to a new environment [13,14], academic commitments, self-management, time management [15], interpersonal relationships [16], and financial management [17]. The most common mental health problems faced by university students are stress, anxiety, and depression [13,18,19]. These problems have the potential to be detrimental to academic achievement if university students are not able to cope well.

Numerous studies have used the State-Trait Anxiety Inventory (STAI) to measure anxiety among university students. However, an anxiety measure that has been validated for use with Malaysian students is still lacking. Moreover, it is important to investigate the reliability and validity of the STAI in a Malaysian context, as most instruments were developed in western countries; hence, culture or other local context factors may play a role in the psychometric properties of the instrument. Therefore, the current study aimed to evaluate the psychometric proprieties of the State-Trait Anxiety Inventory (Form Y) (STAI-Y) and to compare two alternative factor structures in the context of Malaysian university students.

1.1. Concepts of State and Trait Anxiety

The earlier concepts of state and trait anxiety was developed empirically by Cattell and Scheire in the late 1950s, and further investigated by Spielberger [20]. A person with state anxiety is an individual whose anxiety is over a certain occasion, may fluctuate over time, is temporary, and may be triggered by external stimuli. A person with trait anxiety, on the other hand, reflects individual differences in anxiety proneness as personality characteristics which may be influenced or triggered by residues of pass experiences and may perceive non-dangerous situations as threatening, thereby creating alleviating anxiety-state reactions [20].

The State-Trait Anxiety Inventory (STAI) is a 40-item self-reported questionnaire designed by Spielberger, Gorsuch, Lushene, Vagg, and Jacobs [21] to measure both state and trait anxiety. The original version of the STAI (Form X) consists of two separate factors: a state factor and a trait

factor. This two-separate-factors structure has been questioned by Spielberger et al. [21], the authors of the original STAI scale. The STAI (Form Y) version contains 20 items to measure state anxiety, and another 20 items to measure trait anxiety. Both state and trait subscales are assessed using a four point scale, from "not at all" to "very much so" for the trait anxiety factor, and from "almost never" to "almost always" for the state anxiety factor. The score ranges between 20 and 80. The higher the score is, the greater the anxiety. Spielberger et al. [21] suggested a further division of each of the two basic dimensions, based on how the items were keyed in the direction of the presence or absence of anxiety [22], resulting, thus, in the four-factor model of STAI (Trait Anxiety Present, Trait Anxiety Absent, State Anxiety Present, and State Anxiety Absent). However, evidence of the validity of this four-factor model is still lacking. Therefore, we suggested that the four-factor model of the STAI should be tested and compared to the original two-factor model for a better fit to the data.

Studies on the Validation of STAI and studies on the Validation of STAI in Malaysia are reported in Appendix A.

1.2. The Objective

The aim of the current study was to test and to compare the adequacy of the original two-factor model (State and Trait Anxiety) and the alternative four-factor model (State Anxiety Present, State Anxiety Absent, Trait Anxiety Present, and Trait Anxiety Absent) of the State-Trait Anxiety Inventory (STAI), using confirmatory factor analysis. The reliability and validity of the STAI were also tested.

2. Method

2.1. Respondents

A convenience sampling of 341 psychology course undergraduate students from one of the public universities in Kota Kinabalu, Sabah took part in this study. They were all in their second and third year of studies and their age ranged from 19 to 25 years old (with an average age of 22.01 years old, SD = 0.99). In terms of ethnic background, 26.7% were Malay, 13.4% were Chinese, 6.5% were Indian, 12% were Kadazandusun, 11.1% were Bajau, 3.2% were Malay Brunei, and 27.2% indicated "Other". The respondent gender ratio was not balanced, with 18.2% male students and 81.8% female students. Respondents of the current study were randomly recruited for the online study, using a Google Docs Form. The announcement related to the study and the Google Docs Form link were communicated to the potential respondents by the researchers and lecturers. The respondents involved in this study were those who responded to the study's online Google Docs Form.

In the current study, the sample size was determined based on the need to have sufficient statistical power and the expense of data collection. As suggested by Tabachnick, Fidell and Osterlind [23], in order to conduct a multivariate statistical technique, the minimum sample size should be 200, and to run a confirmatory factor analysis, the ratio of cases to free parameters should be 10:1 [24]. In the present study, there were 20 constructs for the State anxiety scale and 20 constructs for the Trait anxiety scale out of 341 cases involved, which indicated that the ratio of cases to free parameters was 11:1. As recommended by Tabachnick, Fidell, and Osterlind [23], and Kline [24], the size of the sample for the current study was sufficient and should not be an issue.

2.2. Measures

State-Trait Anxiety Inventory (STAI Form Y) is an inventory designed by Spielberger et al. [21]. The STAI has been used widely and extensively in research and clinical settings. The inventory is also used in screening for anxiety problems in college and high school students, and for evaluating the immediate and long-term outcomes of counseling, psychotherapy, drug-treatment programs, and behavior modification.

The original STAI consists of two separate scales to measure state and trait anxiety. The S-Anxiety scale (STAI Form Y-1) consists of 20 items (item 1 to item 20) that measure the respondent's feeling in that moment. The T-Anxiety scale (STAI Form Y-2) also consists of 20 items (item 21 to item 40), and this scale measures how the respondent "generally" feels. All items in both Form Y-1 and Form Y-2 are rated on a 4-point scale [25], where state anxiety items assess intensity of current feeling (1 = not at all, 2 = somewhat, 3 = moderately so, and 4 = very much so) and trait anxiety items assess frequency of feeling in general (1 = almost never, 2 = sometimes, 3 = often, and 4 = almost always). A high score indicates the presence of high levels of anxiety.

The four-factor model of STAI (state anxiety present, state anxiety absent and trait anxiety present, trait anxiety absent) consists of 10 anxiety-absent items (reversed items) in S-Anxiety scale and 9 anxiety-absent items in T-Anxiety scale. The scoring weights for the anxiety-absent items were reversed on the State Anxiety and Trait Anxiety scale. The reversed score items included: Items 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 (State Anxiety Scale) and items 21, 23, 26, 27, 30, 33, 34, 36 and 39 (Trait Anxiety Scale). Scores for both the State Anxiety Scale and Trait Anxiety Scale ranged from a minimum of 20 to a maximum of 80.

2.3. Data Analysis

Data of the study was analyzed using the IBM SPSS AMOS 23 Program. The Confirmatory Factor Analysis (CFA) was conducted to test and to compare the two-factor model and the four-factor model of the State-Trait Anxiety Inventory (STAI). We estimated the two-factor model and the four-factor model of STAI using the maximum likelihood method. In addition, composite reliability, convergent validity, and discriminant validity of the inventory were also tested. The model fit of the two-factor model and the four-factor model of STAI were tested by comparing the results to the recommended four model fit indices suggested by Hu and Bentler [26] (as shown in Table 1), which were used to determine the adequacy of the model. The chi square value (χ^2) and its associated degree of freedom (df) were also reported. In addition, the Aikaike Information Criterion (AIC) and Expected Cross-Validation Index (ECVI) were used for model to model comparison. It was expected that smaller values of AIC and ECVI would indicate a better model fit.

Table 1. Comparative Fit Index suggested by Hu and Bentler [26].

Comparative Fit Index (CFI)	>0.90
Tucker-Lewis Index (TLI)	>0.90
Root Mean Square Error of Approximation (RMSEA)	0.05–0.08
Chi-Square Statistic value (CMIN/DF)	<5.0

3. Results

3.1. The Two-Factor Model and Four-Factor Model of State-Trait Anxiety Inventory (STAI)

The model fit statistics of the confirmatory factor analyses for the two-factor model and four-factor model of STAI are presented in Table 2. The results indicated that the four-factor model of STAI provided a better fit to the data than the two-factor model. For the four-factor model, the CMIN/DF ratio (2.270) and the RMSEA (0.061) achieved the recommended model fit indices, whereas the CFI (0.883) and TLI (0.869) were very close to the criteria value of 0.90. In addition, the results also reported smaller values of AIC (1918.272) and ECVI (5.642) for the four-factor model. By contrast, all the model fit indices for the two-factor model of STAI (χ^2 (df) = 4281.871 (740); CMIN/DF = 5.786; CFI = 0.554; TLI = 0.506; RMSEA = 0.119) did not achieve the recommended criteria value. The AIC (4521.871) and ECVI (13.300) for this model also showed a bigger value compared to the four-factor model. These results further support that the four-factor model of STAI provided a better fit to the data.

Item loading on their hypothesized latent variables is reported in Appendix B. The analysis reported in Table A1 for the item loading of the two-factor model (State Anxiety and Trait Anxiety)

of STAI indicated that items loaded insufficiently (ranging from −0.014 to 0.879) on the trait anxiety factor, and for the state anxiety factor (ranging from −0.057 to 0.871). The result suggested that the data required some adjustment. Figure 1 shows the two-factor model of STAI.

Table 2. Model Fit Statistics of Confirmatory Factor Analysis for the State-Trait Anxiety Inventory (STAI).

Fit Indices	Recommended Fit	The Two-Factor Model	The Four-Factor Model
χ^2 (df)		4281.871 (740)	1406.789 (623)
CMIN/DF	CMIN/DF < 5.0	5.786	2.270
CFI	>0.90	0.554	0.883
TLI	>0.90	0.506	0.869
RMSEA	0.05–0.08	0.119	0.061
AIC	Smaller value	4521.871	1918.272
ECVI	Indicate better fit	13.300	5.642

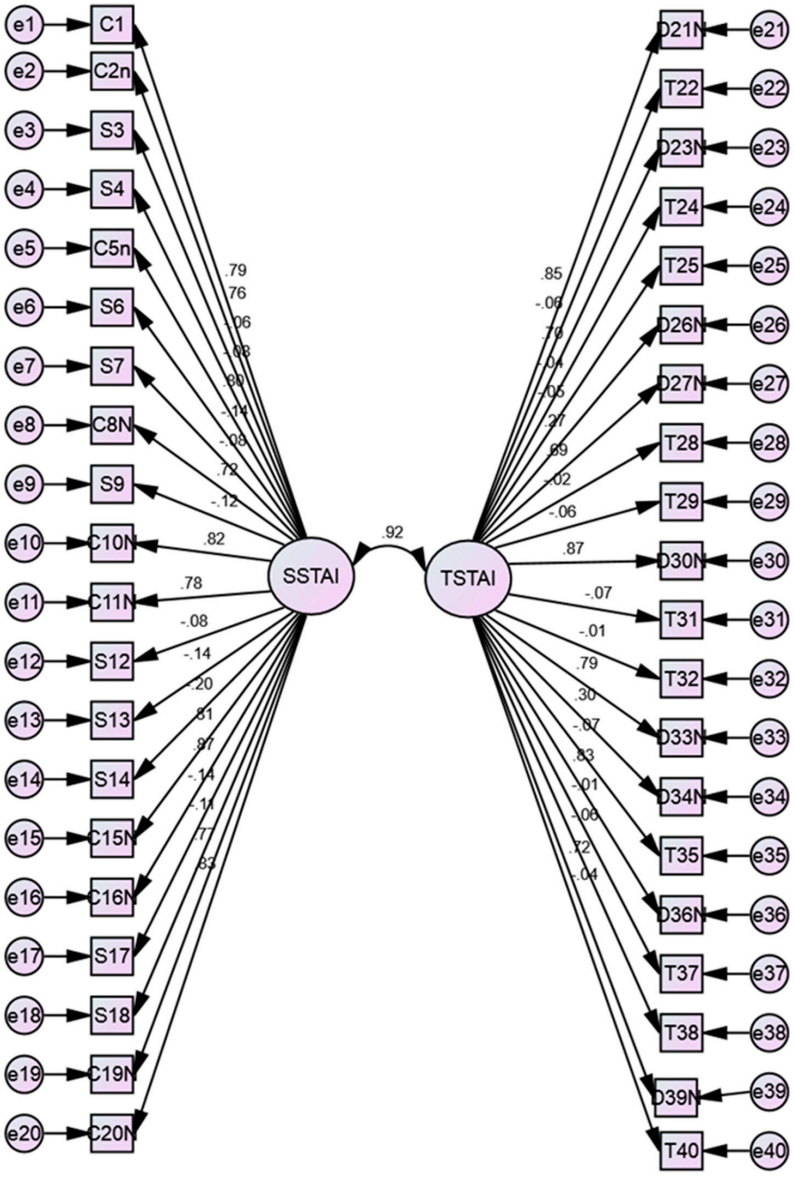

Figure 1. Four-factor model of the State-Trait Anxiety Inventory with standardized parameter estimates. SSTAI = State Anxiety item; TSTAI = Trait Anxiety Items.

The result shown in Table A2 (Appendix B) revealed that all items loaded significantly on their hypothesized latent variable for the four-factor model (State Anxiety Present, State Anxiety Absent, Trait Anxiety Present, and Trait Anxiety Absent). Standardized regression weights for the State Anxiety Present factor ranged from 0.590 to 0.790; State Anxiety Absent (0.716–0.841); Trait Anxiety Present (0.299–0.658) (item D24 indicated insufficient loading of 0.299); and Trait Anxiety Absent (0.269–0.873) (item D26 indicated insufficient loading of 0.269). The two items that showed insufficient loading were item D4 ("I wish I could be as happy as others seem to be") and item D26 ("I feel rested"). Figure 2 shows the four-factor model of STAI. Overall, these findings provide support for the use of the four-factor model of STAI.

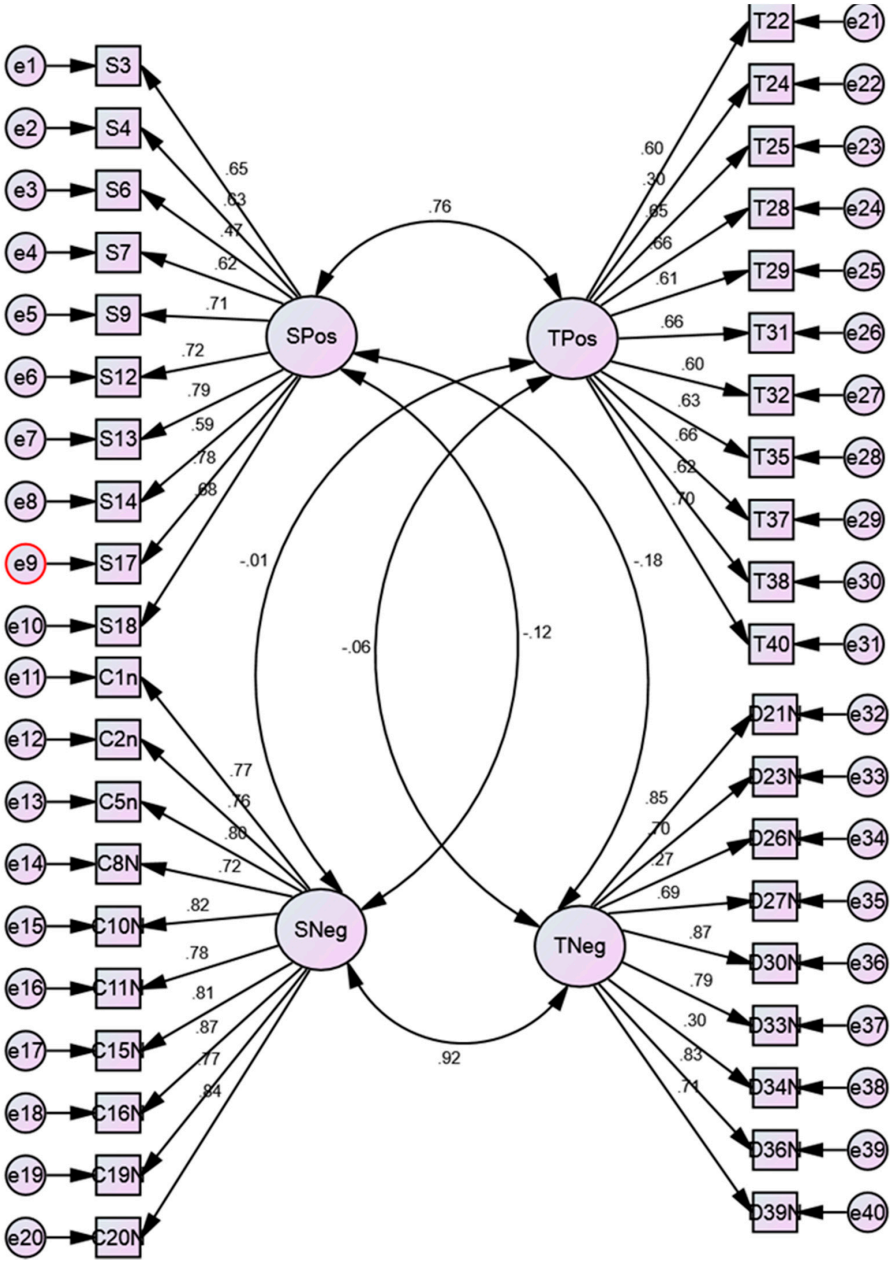

Figure 2. Four-factor model of the State-Trait Anxiety Inventory with standardized parameter estimates. SPos = State Anxiety, Positive Items; SNeg = State Anxiety, Negative Items; TPos = Trait Anxiety, Positive Items; TNeg = Trait Anxiety, Negative Items.

3.2. Composite Reliability

The reliability of the two-factor model and the four-factor model of the State-Trait Anxiety Inventory (STAI) were determined by referring to the composite reliability index (CRI) and average variance extracted (AVE). The recommended value of composite reliability (CR) for each construct should exceed the threshold value of 0.7021 [27]. A composite reliability value below 0.60 indicates a lack of internal consistency reliability [28]. The minimum recommended level of AVE, however, is 0.5022. Table 3 shows the CR and AVE of each factor/construct for the current study. The results indicated the composite reliability indices for all factors of the STAI were greater than the recommended level of 0.70. The composite reliability values for the two-factor model were 0.732 (State Anxiety) and 0.858 (Trait Anxiety). The composite reliability values for the four-factor model were 0.888 (State Anxiety Present); 0.945 (State Anxiety Absent); 0.868 (Trait Anxiety Present); and 0.888 (Trait Anxiety Absent).

Table 3. Composite Reliability and Average Variance Extracted of the Two-Factor Model and Four-Factor Model of STAI.

Factors	Composite Reliability (CR)	Average Variance Extracted (AVE)
State Anxiety	0.732	0.223
Trait Anxiety	0.858	0.323
State Anxiety Present	0.888	0.447
State Anxiety Absent	0.945	0.633
Trait Anxiety Present	0.868	0.381
Trait Anxiety Absent	0.888	0.492

However, the results of Average Variance Extracted (AVE) values showed that only the construct of State Anxiety Absent (AVE = 0.633) exceeded the minimum recommended level of 0.50. The results suggested a reasonable adjustment of data was required especially for items of the four-factor model of STAI. In order to improve composite reliability and the AVE of the items, we removed one item with the lowest loading value (C6 = 0.466) in the State Anxiety Present factor, one item (D24 = 0.299) in the Trait Anxiety present factor, and one item (D26 = 0.269) in the Trait Anxiety Absent factor, which loaded insufficiently on the corresponding latent factors. The AVE value of State Anxiety Present scale increased from 0.447 to 0.500. The AVE value of the Trait Anxiety Present scale also increased from 0.381 to 0.410. The AVE value of Trait Anxiety Absent increased from 0.492 to 0.544 after item D26 was removed. Overall, the result revealed a good composite reliability for the four-factor model of STAI, but not for the two-factor model.

3.3. The Convergent Validity of the STAI

The evidence of convergent validity of the STAI in the current study was examined by comparing the analysis results to the recommended threshold values for convergent validity, where composite reliability should be greater than 0.70 (CR > 0.70); the value of composite reliability should be greater than the average variance extracted value (CR > AVE); and the AVE values should be 0.50 or higher (AVE > 0.50) [28]. As showed in Table A2 in Appendix B, the factors of the two-factor model of STAI were greater than the recommended level of CR > 0.70 and CR > AVE, but the AVE value did not reach the recommended AVE of more than 0.50. Hair et al. [28] claimed that the AVE value that is less than 0.50 suggested that more variance remains in the error of the items than in the variance explained by the construct.

Analysis on the four-factor model of STAI showed that, after elimination of insufficient loading items, all four constructs of the STAI met the recommended level of CR > 0.70, CR > AVE, and AVE > 0.50. The result revealed that the four-factor model of STAI had demonstrated an adequate convergent validity, but the two-factor model of STAI hadn't.

3.4. The Discriminant Validity of the STAI

In the current study, the evidence of discriminant validity was analyzed by comparing the maximum shared variance (MSV) with AVE values of each construct. MSV is the square of inter-correlation between two constructs and. If MSV is less than AVE, we can confirm the discriminant validity of the construct. The evidence of discriminant validity was also indicated by the value of the square root of the AVE (bolded value on the diagonal). This value has to be the highest value among all the others construct.

The results showed that, in all comparisons, the AVE value of all the factors was lower than all of the maximum shared variance (MSV) (refer to Table 4), which indicated there was a discriminant validity issues in the data. According to Hair et al. [26], these results may be due to some variables of the STAI which strongly correlate with variables outside their parent factor rather than with the variables within their parent factor. The results can be seen in the high correlation between state anxiety present and trait anxiety present (r = 0.770), and high correlation between state anxiety absent and trait anxiety absent (r = 0.923).

Table 4. Composite Reliability and Average Variance Extracted and Maximum Shared Variance of the Four-Factor Model of STAI after Items Deletion.

	CR	AVE	MSV	Max R(H)	State Anxiety Present	State Anxiety Absent	Trait Anxiety Present	Trait Anxiety Absent
State Anxiety Present	0.888	0.472	0.593	0.897	**0.687**			
State Anxiety Absent	0.945	0.633	0.852	0.964	−0.115	**0.796**		
Trait Anxiety Present	0.874	0.410	0.593	0.971	0.770	−0.008	**0.640**	
Trait Anxiety Absent	0.900	0.544	0.852	0.979	−0.180	0.923	−0.057	**0.738**

4. Discussion and Conclusions

To meet the need for a psychometrically sound measure of anxiety among Malaysian university students, this study examined the STAI (Form Y) using the CFA approach. The main objective of the study was achieved: Statistically, the four-factor model is better than the two-factor model. The CFA clearly shows that the alternative four-factor model provides a better fit to the data compared to the two-factor model. Additionally, composite reliability is also better with the four-factor model than with the two-factor model. This finding expands on previous Malaysian studies, which did not confirm the factor structure [29] and limited the analysis to item communalities of the two factors in the STAI separately [30].

However, the findings do not provide a conclusive endorsement for the use of the STAI (Form Y) among Malaysian university students. While the alternative factor structure makes theoretical sense, with items grouped into presence and absence of anxiety, sufficient discrimination between state and trait scores is not demonstrated. Even though the STAI scores changed significantly for clinical samples undergoing surgical procedures compared to a control group [29], the State and Trait scores themselves do not seem to differ much within each group. For example, the difference between the two State and Anxiety scores for the surgical group (−2.92) is comparable to the control group (−2.28). With a non-clinical sample, where an anxiety-inducing event is expected to be randomly distributed, the discrimination between state and trait score is expected to be even lower. Therefore, the interpretation of state and trait anxiety scores for university student samples may not be very clear.

In terms of further research direction, the lack of discrimination for the state and trait constructs necessitates an external validation of the STAI. The findings from the CFA need to be supported by evidence from correlating the factors of the STAI with other relevant and related measures. For example, a single-item visual analogue scale (VAS) in a study using a simulation to decrease anxiety was shown to mimic the changes of State Anxiety scores, but not Trait Anxiety scores [31]. External validation would help to provide further clarification on the dimensionality and polarity of the items. Additionally, the discrimination of state and trait could benefit from using a different measurement paradigm. For example, using the Rasch model, the unidimensionality of the state and

traits scale was demonstrated after the removal of problematic items [32]. Using the same analysis, the unidimensionality of the four structures can be examined to ascertain their discriminant validity.

With less than 20% male respondents, the overall findings of this study are perhaps more biased to the females. Given that females tend to have higher trait scores [33], the extent to which the results are less reflective of males is a limitation of the study. This limitation would be compounded if gender invariance existed for the STAI. No direct evidence of gender invariance for the STAI was found. A related measure of anxiety (Hospital Anxiety and Depression Scale) was shown to be gender invariant [34]. Whether the same could be concluded for the STAI in Malaysian samples deserves further research attention.

Validation of the STAI in various countries with clinical and non-clinical samples is presented in Appendix A. The evidence suggests a near-universal applicability of the measure's construct in terms of internal reliability and factor structure. Further evidence for construct validity emphasizing the functionalist perspective is also important. The universality of the inventory's utility (e.g., does the use of the STAI in mental health interventions lead to better outcomes?) should also be examined.

This study analyzed the STAI in more depth than other psychometric studies on the STAI done with Malaysian samples. The findings showed the Malaysian version of the STAI appears to be reliable and adoptable within the Malaysian context and is acceptable for use with undergraduate students. Further studies on the reliability and invariance across gender would help to refine the measurement of anxiety, especially for clinical applications. Regarding the potential impact, the instrument could be also useful in domains different from the academic context, as for example with adults in different organizational contexts or clinical settings. It is thus important to continue to study the Malaysian version of the STAI in different domains and situations. However, the present study is a fundamental step for the validation of the instrument, because it validates the internal structure of the Malaysian version. Further validations could consider concurrent measures.

The findings of this study also contribute to a cross-cultural perspective study by putting theory in practice. Investigating the psychometric properties of the STAI in a Malaysian context is an important step in developing a cross-cultural psychology [35]. The possibility to have cross-cultural instruments able to act in a preventive framework [7–10] appears of fundamental importance to constructing a psychology of sustainability and sustainable development [5,6], which focuses on improving wellbeing and quality of life for both individuals and organizations in a preventive perspective.

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Appendix

Appendix A.1 Supplement Studies on Validation of the STAI

The STAI is widely used and suitable to administer in clinical practice and research, because of its relatively brief self-report scale to assess both state and trait anxiety. Numerous translations of the STAI have been done, including Greek [36], Dutch [37], Japanese [38], Chinese [39], and Malaysian [30]. These studies consistently found acceptable reliability of the translated versions of the STAI.

The psychometric properties of the Greek translation of the STAI showed high reliability for both the state (Cronbach's alpha = 0.93) and trait (Cronbach's alpha = 0.92) subscales [36]. The translation and back translation method was applied to translate the original English version to Greek. The study

involved 121 healthy individuals and 22 depressed patients. The convergent validity between state and trait subscales of the Greek translation was strong (r = 0.79). However, they reported a lower means score (State M = 24.95, SD = 11.36; Trait M = 27.88; SD = 11.43) than the standardized normal sample reported in the English STAI manual (State M = 36.54, SD = 10.22; Trait M = 5.55; SD = 9.76).

The reliability of the Dutch translation version (short version of six items) of the STAI-state was $\alpha = 0.83$ and reported to be correlated well with the full version (r = 0.95). The Cronbach alpha for the full form also yielded a high reliability of $\alpha = 0.94$. Meanwhile, the Japanese STAI study [38] on 2049 working adults reported high reliability of state anxiety and trait anxiety for both male (state $\alpha = 0.92$ and trait $\alpha = 0.92$) and female (state $\alpha = 0.92$ and trait $\alpha = 0.90$) workers. The means score for Japanese employees was higher than that for the normative American adults reported in the STAI manual.

The evaluation of the psychometric properties of the China Mandarin State-Trait Anxiety Inventory Y form (CMSTAI-Y) [39] was conducted involving 306 outpatients with anxiety disorders. The internal consistency reliability tests for the state and trait anxiety scale were $\alpha = 0.91$ and $\alpha = 0.92$, respectively. A confirmatory factor analysis was conducted to assess the construct validity of the CMSTAI-Y, and came out with a four-factor structure similar to the original STAI-Y by Spielberger et al. [21]. In addition, the CMSTAI-Y showed high correlations with the Chinese Hamilton Anxiety Rating Scale for both state (r = 0.69) and trait (r = 0.74) anxiety subscales, which indicated good convergent validity.

Appendix A.2 Validation of the STAI in Malaysia

Researchers in Malaysia have been using the STAI in various settings. However, research on the validity and reliability of the STAI on Malaysian students is still lacking. One of the earlier studies done in Malaysia using the STAI was among urological patients [23]. For the purpose of the validity and reliability analysis, the study involved three groups (N = 237) with a group of patients with lower urinary tract symptoms (LUTS) (n = 108) as the experimental group, a control group (n = 50), and patients diagnosed with transurethral resection of the prostate (TURP) (n = 79). All patients were admitted at one of the public university medical centers in Kuala Lumpur at the point of the study. The study reported high internal reliability (Cronbach's alpha = 0.86).

Another study using the STAI involved 253 engineering students in West Malaysia [24]. The study revealed good reliability with the Cronbach's alpha value of 0.850. Factor analysis showed the STAI is appropriate in terms of validity to measure anxiety among engineering students with KMO value of 0.824, Bartletts test of sphericity = 0.000 ($p = 0.000$). Specifically, the construct validity of the A-State shows KMO = 0.818, $p = 0.000$ (Cronbach alpha = 0.797), whereas the A-Trait proved KMO = 0.783, $p = 0.000$ (Cronbach alpha = 0.781). In addition, the strong correlations (r = 0.621) between state and trait scales support the convergent validity in the samples. The study implied that the STAI is suitable to be conducted among engineering students in Malaysia. However, adequate information on the factor structure of the measurement was not provided by Vitasari et al. [30].

A recent study [26] on the reliability and validity of the Malay translated version of the STAI (Form Y) in predicting anxiety disorders of parents with children visiting hospital for medical treatment at one of the public university medical centers in West Malaysia reported high internal consistency for both state anxiety (Cronbach's alpha = 0.94) and trait anxiety (Cronbach's alpha = 0.84). The test–retest reliability (4 weeks retest) showed significant intra-correlation coefficients ranging from 0.60 to 0.94 (95% CI, $p < 0.05$) in 25 of the items. Generally, the factor analysis supports the alternative four-factor structure of the original STAI (Form Y) by Spielberger et al. [21]. However, Hashim et al. [40] emphasize that the interpretation must be made cautiously, as some items did not fit into their theoretical factor.

Limited investigations have been done on the factor structure of the STAI in a Malaysian context, although anxiety is claimed as universal across culture, but the experience context, interpretations, and responses may be influenced by belief and practices in a particular culture, as argued by Hishinuma et al. [41]. Thus, this study expands on previous studies by examining and comparing the

adequacy of the original two-factor model (State and Trait Anxiety) and the alternative four-factor model (State Anxiety Present, State Anxiety Absent, Trait Anxiety Present, and Trait Anxiety Absent) of the STAI-Y, using confirmatory factor analysis. In addition, this study is a step towards providing empirical evidence to facilitate mental health-related programs and policy for a Malaysian context, in a campus setting in particular. The findings from this study will also provide a further understanding of the specific concepts of state-anxiety and trait-anxiety. In addition, the findings of this study will assist in developing suitable interventions on campus, taking the local context of anxiety faced by the students into consideration.

Appendix Standardized Regression Weights

Table A1. Standardized Regression Weights: Two-Factor Model of STAI.

			Item Loading				Item Loading
D21	<—	TSTAI	0.847 *	C20	<—	SSTAI	0.828 *
D22	<—	TSTAI	−0.062	C19	<—	SSTAI	0.773 *
D23	<—	TSTAI	0.702 *	C18	<—	SSTAI	−0.109
D24	<—	TSTAI	−0.040	C17	<—	SSTAI	−0.140
D25	<—	TSTAI	−0.046	C16	<—	SSTAI	0.871 *
D26	<—	TSTAI	0.269 *	C15	<—	SSTAI	0.809 *
D27	<—	TSTAI	0.690 *	C14	<—	SSTAI	−0.197
D28	<—	TSTAI	−0.022	C13	<—	SSTAI	−0.138
D29	<—	TSTAI	−0.063	C12	<—	SSTAI	−0.083
D30	<—	TSTAI	0.873 *	C11	<—	SSTAI	0.783 *
D31	<—	TSTAI	−0.070	C10	<—	SSTAI	0.817 *
D32	<—	TSTAI	−0.006	C9	<—	SSTAI	−0.121
D33	<—	TSTAI	0.788 *	C8	<—	SSTAI	0.716 *
D34	<—	TSTAI	0.300 *	C7	<—	SSTAI	−0.080
D35	<—	TSTAI	−0.074	C6	<—	SSTAI	−0.143
D36	<—	TSTAI	0.829 *	C5	<—	SSTAI	0.799 *
D37	<—	TSTAI	−0.014	C4	<—	SSTAI	−0.081
D38	<—	TSTAI	−0.063	C3	<—	SSTAI	−0.057
D39	<—	TSTAI	0.715 *	C2	<—	SSTAI	0.756 *
D40	<—	TSTAI	−0.038	C1	<—	SSTAI	0.789 *

Note: * P < 0.05; SSTAI = State Anxiety item; TSTAI = Trait Anxiety Items.

Table A2. Standardized Regression Weights: Four-Factor Model of STAI.

			Item Loading				Item Loading
C18	<—	SPos	0.677	D22	<—	TPos	0.595
C17	<—	SPos	0.777	D24	<—	TPos	0.299
C14	<—	SPos	0.590	D25	<—	TPos	0.652
C13	<—	SPos	0.790	D28	<—	TPos	0.658
C12	<—	SPos	0.718	D29	<—	TPos	0.611
C9	<—	SPos	0.706	D31	<—	TPos	0.663
C7	<—	SPos	0.619	D32	<—	TPos	0.596
C6	<—	SPos	0.466	D35	<—	TPos	0.631
C4	<—	SPos	0.632	D37	<—	TPos	0.663
C3	<—	SPos	0.651	D38	<—	TPos	0.624
C20	<—	SNeg	0.841	D40	<—	TPos	0.702
C19	<—	SNeg	0.773	D21	<—	TNeg	0.846
C16	<—	SNeg	0.873	D23	<—	TNeg	0.702
C15	<—	SNeg	0.810	D26	<—	TNeg	0.269
C11	<—	SNeg	0.783	D27	<—	TNeg	0.690
C10	<—	SNeg	0.818	D30	<—	TNeg	0.873
C8	<—	SNeg	0.716	D33	<—	TNeg	0.789
C5	<—	SNeg	0.799	D34	<—	TNeg	0.301
C2	<—	SNeg	0.760	D36	<—	TNeg	0.829
C1	<—	SNeg	0.770	D39	<—	TNeg	0.715

Note: SPos = State Anxiety, Positive Items; SNeg = State Anxiety, Negative Items; TPos = Trait Anxiety, Positive Items; TNeg = Trait Anxiety, Negative Items.

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