A COMPARABILITY ANALYSIS OF ANXIETY SCALE FOR INTERNATIONAL STUDENTS' CLASSIFICATIONS: INVARIANCE ACROSS GENDER, STATUS, AND STUDENTS' CURRENT DEGREE

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Abstract

This study aimed to investigate the structure of the latent factor of an anxiety symptoms scale (Pudrovska et al., 2001) and the stability of invariance across groups of international students' classifications (gender, students' current degree, and students' status). In the large, non-clinical sample (619), Saudi students as international students in the USA completed the anxiety symptom scale. Confirmatory factor analysis (CFA) was used to test the factor structure of the scale, and a *multiple-group confirmatory factor analysis* (MGCFA) model was used to test stability of invariance across groups of students' classifications.

The findings of the CFA indicated support for the original one-factor model. Additional analyses of the MGCFA method support for the measurement (configural, metric and strong) invariant and practical invariant components of this model. There was an invariant across gender. The instrument appeared to measure the same constructs in both groups (male and female). However, there was partially invariant across groups of students' current degree. The instrument appeared to measure the same constructs in both groups (undergraduate students and graduate students), except for Item 3. Moreover, there was partially invariant across groups of students' status. The instrument appeared to measure the same constructs in both groups (single and married), except for Item 3 and 4. Given that this study is the first investigation for the structure of anxiety symptoms scale (Pudrovska et al., 2001), it will be important for future studies to replicate the findings.

Keywords: *Anxiety, International Students, Factor Analysis, And Factorial Invariance.*

Subject Area: Evaluation, Measurement, and Research.

Introduction:

Anxiety is a normal human emotion that everyone experiences at times. Many people feel anxious in many situations, e.g., facing a problem at work, or making an important decision. Anxiety is a result of problems and hard circumstances that are faced every day due to environment, social life, or traumatic developments in life. Anxiety's symptoms, causes, and treatment are not the same. So, it's important to understand the incidence of each case individually. People with high anxiety have unstable lives, and their lives are affected in different ways: they seem less productive, less interested in work, and depressed (Cummings, Caporino, & Kendall, 2014; Stark & Laurent, 2001).

Studying abroad is challenging in a very personal way. The transition to college or to a university is difficult, although it can also be an exciting new experience for many students. Some students get depressed, anxious, and challenged when they are studying abroad, emanating from overlapping linguistic, academic, and sociocultural sources (Marginson, 2010). In many countries, the Ministry of Higher Education's increase in funding over the last decade has pushed more students to get their degrees from different countries and civilizations.

Anxiety is an unobservable latent trait that can be described and measured indirectly as can be done for height or weight for example (Satorra & Bentler, 1994). Many psychiatric illness researchers are concerned with the precision and stability of scales that are used to infer unobservable traits (Preacher & MacCallum, 2002). This study examined the factor structure and stability uniqueness of the latent factor of an anxiety symptoms scale (Pudrovska, Schieman, Pearlin & Nguyen, 2001).

In recent years, research developed several anxiety symptom measures, or provided satisfactory levels of validity and reliability for anxiety symptom scales (e.g., Geisser, Cano, & Foran, 2006; Keogh & Reidy, 2000). However, the lengths of these measures are time consuming and may be unsuitable for administration in large studies (Wanting et al., 2015). Pudrovska et al. (2001) developed a short anxiety symptom scale that was introduced to be a specific self-report assessment, which included four items.

Given that, this study is the first examination of factor structure of the anxiety symptoms scale (Pudrovska et al., 2001), further empirical evaluation would be helpful to sustain its continued application as a self-report measure. The current investigation had two objectives. The first objective was to test the factor structure of the latent factor of an anxiety symptoms scale (Pudrovska et al., 2001) in a large, non-clinical sample of international students. Based on a content review of the scale, it is found that the scale is a unidimensional. The second objective was to examine the stability of the anxiety scale by test invariance across the international students' classifications (gender, students' current degree, and students' status).

Materials and Methods

Methodology

The methodology used in this study was a single group pretest (survey) only design. The scale instrument as described below was administered via an online survey administration. The application following Human Subject Institutional Review Board (HSIRB) and the study protocol was approved by the Western Michigan University (WMU).

Objectives of The Study

The primary goal of this study was to examine the factor structure and stability uniqueness of the latent factor of the anxiety symptoms scale (Pudrovska et al., 2001).

Research Procedure and Sources of Data

Participants were contacted from followers of the WMU Saudi Students Club Facebook group and directed to a survey-hosting site (Survey Monkey). The survey-hosting site (Survey Monkey) was open for 8 weeks. Given that there are approximately 850 Facebook followers this would set the upper limit for the obtained sample. Six hundred sixty five participants responded, but 46 cases were deemed to be multivariate outliers and were removed from analysis leaving 619 cases

Sample Design

The sample was selected using the convenience sampling technique. There was an estimated student body of 850 Saudi students enrolled over all degree programs and the English Language program (CELCIS) during the Fall 2014 semester. A Facebook group list (primary sample frame) of Saudi students with a F1- or F2-Visa and who were 18 years old or older was obtained from the Saudi Students Club. This report focuses on 619 completed instruments.

Measures

Demographic questionnaire. A brief demographic questionnaire was used to obtain background characteristics of the

participants. Items in this questionnaire requested information on sex, marital status, and current study degree.

Anxiety. A short (4-item) anxiety measure developed by Pudrovska et al. (2001) was used in this study. The response scale was modified by increasing the time frame for from the past week to the past month and the response options were as follows: (1) At no days, (2) from 1 to 10 days a month, (3) from 11 to 20 days a month, and (4) almost every day in the last month. Pudrovska et al. (2001) reported internal consistency reliability estimates of $\alpha = 0.710$ indicating this measure is applicable in research settings.

Data analysis

Factor structure

The factor structure of the anxiety symptoms scale (Pudrovska et al., 2001) was tested using confirmatory factor analysis (CFA) in SAS (version 9.4). Chi-square value and overall model fit indices were used to answer the first research question. Table 1 illustrates the procedure for the testing model structure and suggestions threshold values.

Table 1 : Procedure for Testing Model Structure

Test Name	Symbols	Statistics Guidelines	Resources
Chi-square value	χ^2		
Goodness-of-fit index	GFI	GFI $\geq$ 0.9 good fit	(Schumacker & Lomax, 1996)
Adjusted goodness-of-fit index	AGFI	AGFI $\geq$ 0.9 good fit	(Schumacker & Lomax, 1996)
Tucker-Lewis index	TLI	TLI $\geq$ 0.96 good fit	(Brown, 2006; Hu & Bentler, 1999)
Comparative fit index	CFI	CFI > 0.95 good fit	(Hu & Bentler, 1999)
Root mean square error of approximation	RMSEA	RMSEA: 0.00 - 0.05 very good fit RMSEA: 0.05 - 0.08 fair fit RMSEA: 0.08 - 0.10 mediocre fit	(Steiger, 1989)
Root mean square residual	RMR	RMR $\leq$ 0.05 good fit RMR > 0.05 unacceptable fit	(Byrne, 1998; Diamantopoulos & Siguaw, 2000)

Invariance

The present study used a *multiple-group confirmatory factor analysis* (MGCFA) model to test invariance of the anxiety symptoms scale (Pudrovska et al., 2001) across international students' classifications (gender, status and students' current degree). Table 2 illustrates the order for testing measurement invariance starting with configural invariance (model 0). Model testing was evaluated by the chi-square difference test ($\Delta\chi^2$) between two groups (Brown, 2006; Byrne, 1998), and RSMA, CFI, and TLI were used to evaluate all of the model fits. As previously referenced, the following criteria values suggested by Hu and Bentler (1999) and

Schumacker and Lomax (1996) were used in this study: RMSEA: 0.00 - 0.05 very good fit, CFI > 0.95 good fit, and TLI ≥ 0.96 good fit. Three levels of MIV were tested.

Equal intercept

Table 2 : Procedure for Testing Invariance Among Models

Baseline Model	Parameter Constrained to be Equal	Test Name	Null Hypothesis	Symbol	$\Delta\chi^2$ Test
Model 0	Equal factor pattern	Configural invariance	$H_0: \lambda^1_{group} = \lambda^2_{group} = \cdots = \lambda^g_{group}$	λ: The number of factor patterns across g^{th} groups	
Model 1	Equal factor loading	Weak measurement invariance	$H_0: \lambda_j^{group1} = \lambda_j^{group2} = \cdots = \lambda_j^{groupg}$	λ_j^{group1}: The factor loading of j^{th} indicator variable in the group	$\Delta\chi^2_{M1-M0}$
Model 2	Equal intercept	Strong measurement invariance	$H_0: \tau_j^{group1} = \tau_j^{group}$	τ: The indicator variables intercept (means) of j^{th} indicator variable in the group	$\Delta\chi^2_{M2-M1}$

Results:

Model testing

The CFA mode related the construct, anxiety symptoms was tested and the model as described in Table 3 and graphically depicted in Figure 1. The model outlined in Figure 1 was examined for each level of gender, students' status, and students' current degree separately at a baseline model (one factor model) and pooled data at each of the measurement invariance levels and structural mean invariance.

Table 3 : Standardized factor loadings of the anxiety symptoms scale pooled over all data

Items	Single-factor model	Single-factor loading model
In the past month, on how many days did you have any of these feelings:		
Item1	Feel tense or keyed up?	0.8236
Item 2	Feel afraid or fearful? Worry?	0.8006
Item 3	Feel nervous or shaky inside?	0.7817
Item 4	Have trouble getting to sleep or staying asleep?	0.6123

The one factor model of the anxiety scale was investigated in the pooled data. It shows a very good fit in the present sample: χ^2= 3.14, p-value= 0.2082, RMSEA= 0.03, CFI=0.99, and GFI=0.99. These findings indicate that the one factor model fits the present set of data and, hence, provided further support for the unidimensionality of the anxiety scale. Cronbach's alpha coefficient for this model was > 0.84.

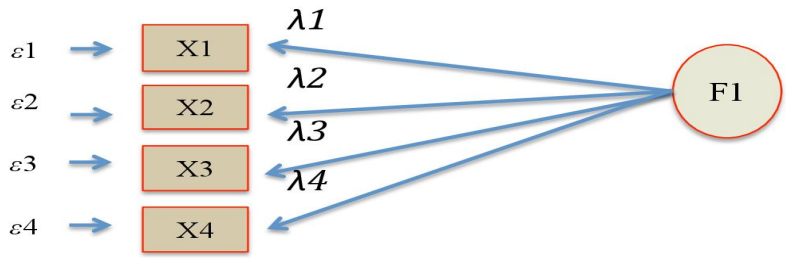

Figure 1. The factor structure of first-order CFA model for Anxiety symptoms scale

Table 4 : Testing for factorial (measurement and structural) invariance across gender groups

Model	Models	χ^2	df	*p*-value	RMSEA	CFI	TLI	GFI	Model Comparison	$\Delta\chi^2$	Δdf	*p*-value
Gender												
Group1=Male		1.689	2	0.4297	0.00	1.00	1.00	0.99				
Group2=Female		4.145	2	0.1258	0.05	0.99	0.99	0.99				
Configural invariance	M0	5.834	4	0.2118	0.04	0.99	0.99	0.99	M0			
Metric invariance	M1	7.234	7	0.4049	0.01	0.99	0.99	0.99	M1-M0	1.4	3	0.7055
Strong invariance	M2	13.165	10	0.2146	0.03	0.99	0.99	0.99	M2-M1	5.931	3	0.1150

Note: χ^2 = conventional chi-square fit statistic; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = Goodness-of-fit index; M0 = baseline model (configural invariance: no invariance imposed); M1 = invariant factor loadings; M2 = invariant factor loadings and invariant intercepts

Table 5 : Testing for factorial (measurement and structural) invariance across current-degree groups

Model	Models	χ^2	df	*p*-value	RMSA	CFI	TLI	GFI	Model Comparison	$\Delta\chi^2$	Δdf	*p*-value
Current degree												
Group1=Bachelors		6.951	2	0.0309	0.11	0.98	0.94	0.97				
Group2 =Graduate		1.753	2	0.4162	0.00	1.00	1.00	0.99				
Configural invariance	M0	8.704	4	0.0689	0.07	0.99	0.98	0.98	M0			
Metric invariance	M1	11.225	7	0.1291	0.05	0.99	0.99	0.98	M1-M0	2.521	3	0.4715
Strong invariance	M2	24.100	10	0.007	0.08	0.98	0.97	0.98	M2-M1	12.875	3	0.0049*
Item 3	M2B	14.866	9	0.0947	0.05	0.99	0.99	0.99	M2P-M1	3.641	2	0.1619

Note: χ^2 = conventional chi-square fit statistic; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = Goodness-of-fit index; M0 = baseline model (configural invariance: no invariance imposed); M1 = invariant factor loadings; M2 = invariant factor loadings and invariant intercepts; M2B = invariant factor loadings and partially invariant intercepts (free intercept of Item 3).

Table 6 : Testing for factorial (measurement and structural) invariance across status groups

Model	Models	χ^2	df	*p*-value	RMSEA	CFI	TLI	GFI	Model Comparison	$\Delta\chi^2$	Δdf	*p*-value
Status												
Group1=single		3.151	2	0.2069	0.04	0.99	0.98	0.99				
Group2= married		0.727	2	0.6952	0.00	1.00	1.00	0.99				
Configural invariance	M0	3.878	4	0.4227	0.00	1.00	1.00	0.99	M0			
Metric invariance	M1	11.160	7	0.1318	0.04	0.99	0.99	0.98	M1-M0	7.282	3	0.0634
Strong invariance	M2	37.556	10	<. 0001*	0.10	0.96	0.96	0.99	M2-M1	26.396	3	<. 0001*
Item3	M2B	18.369	9	0.0311	0.06	0.98	0.98	0.99	M2B-M1	7.209	2	0.0270*
Items 3 & 4	M2C	12.521	8	0.1294	0.05	0.99	0.99	0.99	M2C-M1	1.361	1	0.2433

Note: χ^2 = conventional chi-square fit statistic; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = Goodness-of-fit index; M0 = baseline model (configural invariance: no invariance imposed); M1 = invariant factor loadings; M2 = invariant factor loadings and invariant intercepts; M2B = invariant factor loadings and partially invariant intercepts (free intercept of Item 3); M2C = invariant factor loadings and partially invariant intercepts (free intercept of Item 3&4); M3 = invariant factor loadings, partially invariant intercepts, and invariant residual variances.

As Tables 4, 5, and 6 indicates one factor model was investigated in the CFA analyses: initial (one factor model for each subsample; e.g., male, female, and both groups together), and it shows a very good fit across all subsamples. Based on these results, we can conclude that there is configural invariance of the CFA model over the students' groups (gender, students' current degree, and students' status).

After configural invariance was established across all subsamples, parameter invariance was supported at the metric level across all subsamples, and chi-square difference test statistics were calculated to test if the model resulted in statistical significance. As can be seen in Tables 4, 5, and 6, the chi-square difference between Model 1 and Model 0 was *not* statistically significant. In addition, the change of less than .001 in the CFI, TLI, and RMSEA suggests at the metric invariance level the factor loadings were invariant across gender, students' current degree, and students' status.

When metric invariance was established across all subsamples, the chi-square difference between Model 2 and Model 1 across gender groups was *not* statistically significant, $\Delta\chi^2(3) = 5.931$, p= 0. 1150, which indicates that there was invariant of the intercepts across gender groups.

However, the chi-square difference between Model 2 and Model 1 in students' current-degree groups *was* statistically significant, $\Delta\chi^2(3) = 12.875$, p=0.0049, which indicates that there is not complete invariance of the intercepts across the students' current-degree groups. Following the proposition to free one parameter at a time, starting with the one with the largest MI, Model 2 is modified by freeing the intercept for Item 3. The resulting modified model is labeled Model 2B (see Table 5). After freeing the intercept for Item 3, the chi-square drops to 14.866, and the chi-square difference between Model 2B and Model 1 was no longer statistically significant, $\Delta\chi^2(2) = 3.943$, $p > .05$. Thus, there are invariant factor loadings and invariant intercepts across the two groups, except for the intercept of one indicator (Item 3).

Moreover, the chi-square difference between Model 2 and Model 1 in

students' status groups was statistically significant, $\Delta\chi^2(3) = 26.396$, $p < .0001$, which indicates that there is not complete invariance of the intercepts across the students' status groups. Following the recommendation to free one parameter at a time, starting with the one with the largest MI, Model 2 is modified by freeing the intercept for Item 3. The resulting modified model is labeled Model 2B (see Table 4). After freeing the intercept for Item 3, the chi-square drops to 18.369, and the chi-square difference between Model 2B and Model 1 was still statistically significant, $\Delta\chi^2(2) = 7.209$, $p = 0.0270$. Thus, there is still not complete invariance of the intercepts across the students' status groups after freeing the intercept for Item 3. After continuing by freeing the next largest MI, Model 2B is modified by freeing the intercept for Item 3 and 4. The resulting modified model is labeled Model 2C (see Table 6). After freeing the intercept for Item 3 and 4, the chi-square drop to 12.521, and the chi-square difference between Model 2C and Model 1 was no longer statistically significant, $\Delta\chi^2(1) = 1.361$, $p = 0.2433$. Thus, there are invariant factor loadings and invariant intercepts across the two groups, except for the intercept of two indicators (Item 3&4).

Discussion

The current study was the first to test the factor structure of anxiety symptoms. Second, the study investigated whether the factor structure of the anxiety symptoms scale was invariant across international students' classifications for Saudi students studying abroad as international student in the USA.

Based on the current findings, the one-factor model fit the data best. These results are consistent with previous studies by Pudrovska et al. (2001). The one factor model of the anxiety symptoms scale was supported for gender, students' current degree, and students' status. Thus, a total 4-items score can be computed and meaningfully interpreted as a unitary construct. The standardized factor loadings for all items were positive, high, and statistically significant, ranging from 0. 612 to 0. 823. The reported Cronbach's alpha coefficient for this model was > 0.84 and was generally higher than those reported by Pudrovska et al. (2001) (α = .710).

This study provided the first evidence for an anxiety symptom scale (Pudrovska et al., 2001) using the MGCFA method. The model of scale emerged as invariant across groups of gender, students' current degree, and students' status. The results indicated that in both (males and females groups; under graduate students and graduate students groups; or married and single groups) the anxiety symptom scale may be measuring the same constructs and that the groups likely share a common frame of reference for anxiety symptoms.

Achievement of metric invariance suggested that the factor loadings of each item were equivalent across groups of gender, students' current degree, and students' status. This finding indicated that regardless of classification groups participants responded in a similar way. Furthermore, the intercepts of each item on the latent factors seem to be equivalent across male and female groups regarding the results of the analyses of scalar invariance. However, the equivalent of item intercepts have been achieved across groups of undergraduate students and graduate students with respect to Item 3. Moreover, there is some evidence of slight variability across married and single groups with respect to Items 3 and 4. This finding exhibited that respondents may share the same starting point concerning levels of anxiety.

Conclusion

In conclusion, the anxiety symptoms scale for the present sample of

Saudi students as international students in the USA was invariant across gender. The instrument appeared to measure the same constructs in both groups (male and female). However, there was partially invariant across groups of students' current degree. The instrument appeared to measure the same constructs in both groups (undergraduate students and graduate students), except for the Item 3 related to "nervous or shaky inside". Moreover, there was partially invariant across groups of students' status. The instrument appeared to measure the same constructs in both groups (single and married), except for the Item 3 related to "nervous or shaky inside" and Item 4 related to "trouble getting to sleep or staying asleep". It will be important for future studies to replicate the findings and also assess strong levels of factorial invariance of the anxiety symptom scale (Pudrovska et al., 2001) across other subpopulations including language, age, socioeconomic status, and race/ethnicity.

There are two key features (stability, and precision) that are of paramount importance for design of scale. However, no study has been found in the existing literature that investigates the structure of the anxiety symptoms scale (Pudrovska et al., 2001). Given that this study is the first examination of the anxiety symptoms scale (Pudrovska et al., 2001) factor structure, more studies will need to replicate the findings of this research.

Limitations of the Study

The first limition of this study is that the data only included Saudi students from Western Michigan University (WMU). This data may not apply to the greater population of Saudi Arabian students as international students in the USA. Since the data was only collected at WMU, other international students from different universities or nationality in the USA may have different experiences. The anxiety symptom scale is a self-report measure of emotional states. It is possible that self-report bias influenced the participants' responses of their emotional states. Nonetheless, the findings may have limited generalizability to other international populations in the U.S. and internationally.

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