

RESILIENCE SCALE: EXPLORATION OF ITEMS VALIDITY AND RELIABILITY (FIRST- ORDER CFA MODEL)

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Abstract

The resilience advantage is getting more and more attention in education especially to the student in Higher Education Institutions (HEIs) because certain basic of resilience skills provide the foundation for mastering higher-level abilities. To know their level of resilience, the student need to assess them by using the self- assessment and the instrument that is valid and reliable have to be use in the context of Malaysian Higher Education Institutions. Questionnaire was used as the main instrument to collect data and the data were analyzed using SEM-Amos 18.0. 1336 HEIs' undergraduate students were selected as respondents. The aim of this paper was to explore item validity and reliability of Resilience Scale of Malaysian HEIs by using the first order Confirmatory Factor Analysis. This scale is a new develop instrument with 54 items using 5 response type of Likert scale and consists of six sub constructs namely social skills; problem solving; autonomy; optimistic; spiritual and humor. The results provided evidence of the dimensionality, reliability, and validity of the Resilience Scale of Malaysian HEIs.

Key Words: resilience; problem solving; autonomy; optimistic, spiritual; humor; social skill.

1 Introduction

There are no scientific definitions of resilience that are universally accepted. However Bonanno (2004); Connor et al. (2003); Fribourg et al. (2003; 2005); Masten et al. (1990) and Richardson (2002) defined resilience as a characteristic of human strength that able to cope well with stress, adaptation to changes and demonstrate positive outcomes despite exposure to adversity in life. Rutter (2007) and Wagnild (2009) state that resilience is not and cannot be a personality trait and that individuals become resilient only in the presence of adversity.

Malaysian Ministry of Education (MOE) in their Higher Education Strategic Plan Beyond 2020 had emphasis on the important of resilience among the university student in line with the current challenges of globalization. According to Nunez et al. (2010) and Mustafa (2009); the aspect of resilience gained attention due to low level of graduates' capability in getting job because mismatch of skill owned by graduates with the jobs applied. Other reasons why graduates are unemployed is because lack of self-confidence to face the world of work (Ministry of Higher Education of Malaysia 2011).

A standard instrument needed, to measure and identify the level of resilience among the student in higher education but previous instruments referred to measure resilience are taken from the West which were developed based on the context of their culture and society. Therefore, this research aims to verify the dimensionality, reliability and

construct validity of resilience scale of Malaysian molded instrument which contain two domains, namely internal factor and external factor but in this article only internal factor will be discussed.

2 Research Objective

The objective of this study is to examine a first-order Confirmatory Faktor Analysis (CFA) model designed to test the multidimensionality of a theoretical construct. Specifically, this application test the hypothesis that Malaysian HEIs Resilience Scale composed of six sub construct namely social skills ; problem solving; autonomy; optimistic; spiritual and humor. Second aim is to verify validity and reliability of the instrument.

3 Methodology

This study used testing and evaluation method, which involves a quantitative approach. The theoretical construct was developed based on theories and models that was introduced by Benard (1991, 2004); Garmezy, Masten and Tellegen (1984); Henderson and Milsten (2003); Rutter (2000); Werner and Smith (1986, 2001); and Wolin and Wolin (1993). This resilience scale contains 54 items of five point Likert type scale and was administered to 1336 HEIs' undergraduate student in Malaysia by stratified random sampling. These items have gone through the Delphi technique process to gain face and content validity. Items are analyzed using SEM-Amos 18.0 dan the fitness indices being used to report the fitness of the model are (1) absolute fit [Root Mean Square of Error (RMSEA) and Goodness of Fit Index (GFI)]; (2) incremental fit [Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI)]; and (3) parsimonious fit [Chi square/Degrees of Freedom (Chisq/df)].

4 Analyzing The Measurement Model In SEM

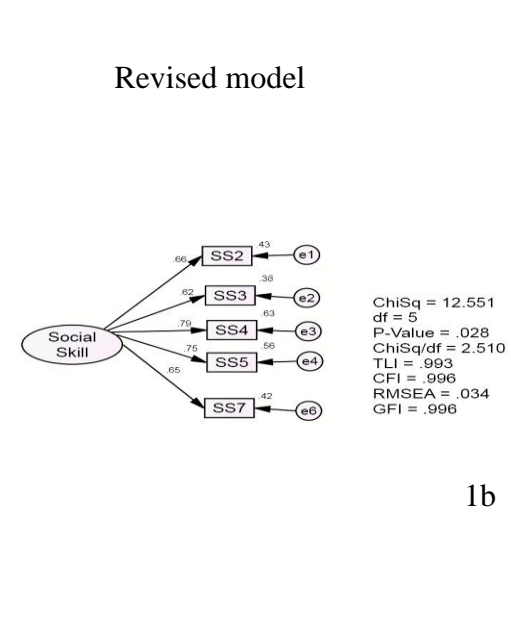
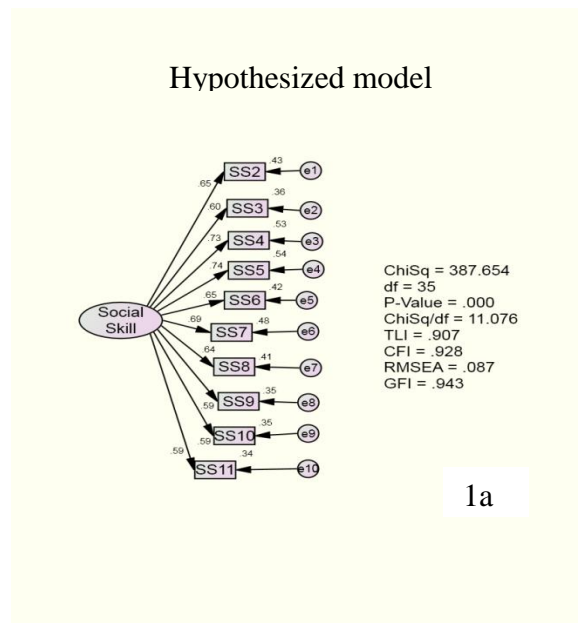
The statistical procedure for investigating relations between set of items and latent sub constructs variable (social skills ; problem solving; autonomy; optimistic; spiritual and humor) is by carry out the factor analysis. There are two basic types of factor analyses: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). To determine how and to what extent, the item and the sub constructs are linked to their underlying factors; the EFA was proceed. Table 1 shows that out of the 54 items, 48 items are retained subjected to principal components analysis (PCA) using SPSS version 18. The Kaiser-Meyer-Olkin value was 0.97, exceeding the recommended value of 0.60 and Bartlett's Test of Sphericity reached statistical significance $p < 0.05$ (Pallant, 2011). Principal component analysis using varimax rotation revealed the presence of six component with eigenvalues exceeding 1, explaining 34.2%, 5.8%, 4.7%, 4.3%, 2.8% and 2.6% of the variance respectively. The sub constructs are social skills (SS) with 10 items; problem solving (PS) with 8 items; autonomy (AU) with 11 items; optimistic (OP) with seven item; spiritual (SP) with five items and humor (HU) with seven item.

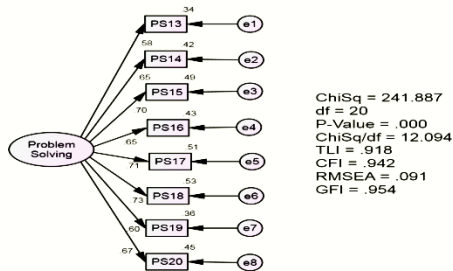
Table 1: Number of items retained for CFA

	Social Skill	Problem Solving	Autonomy	Spiritual	Optimistic	Humor
	SS2	PS13	AU21	SP49	OP31	HU42
	SS3	PS14	AU22	SP50	OP33	HU43
	SS4	PS15	AU23	SP51	OP34	HU44
	SS5	PS16	AU24	SP53	OP35	HU45
	SS6	PS17	AU25	SP54	OP36	HU46
	SS7	PS18	AU26		OP37	HU47
	SS8	PS19	AU27		OP39	HU48
	SS9	PS20	AU28			
	SS10		AU29			
	SS11		AU30			
			AU41			
Total	10	8	11	5	7	7

CFA need to be performing for every latent sub construct involved in a model to assess unidimensionality, validity and reliability. Figure 1 shows the suitability index for both hypothesized and revised model for resilience sub constructs namely social skill; problem solving and autonomy and Figure 2 shows hypothesized and revised model for others resilience sub constructs which are optimistic; humor and spiritual.

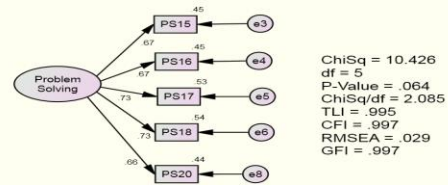
The initial six sub constructs of resilience CFA models, numbering 1a to 6a in Figure 1 and Figure 2 presents that the model did not fit well with Chi Square/Degrees of Freedom (Chisq/df) > 5.0; Root Mean Square of Error Approximation (RMSEA) > 0.08. The required level of Comparative Fit index (CFI); Tucker-Lewis index (TLI) and Goodness of Fit Index (GFI) are achieved with index value > 0.90 for social skill; autonomy; problem solving; optimistic and spiritual but for humor the required level is not achieved as the index value < 0.90. The areas of poor fit can be identified by localized areas of strain and examination of modification indices (Harrington, 2009). For the first step, any measuring item having a factor loading less than 0.6 and the squared multiple correlation (R²) less than 0.4 should be deleted from the measurement model. The lowest loading item should be removed first and delete one item at a time. Refer to figure 1 and figure 2, items SS9, SS10, SS11, PS13, AU30, AU41 and HU42 were removed. Researcher also look at the modification indices to modify the model and the revised model shown at figure 1 and figure 2, e.g model 1b, 2b, 3b, 4b, 5b and 6b.





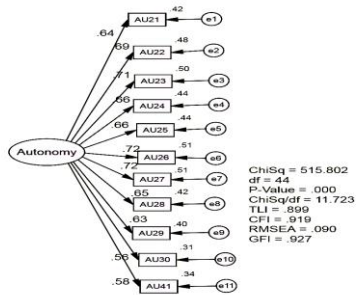
ChiSq = 241.887
df = 20
P-Value = .000
ChiSq/df = 12.094
TLI = .918
CFI = .942
RMSEA = .091
GFI = .954

2a



ChiSq = 10.426
df = 5
P-Value = .064
ChiSq/df = 2.085
TLI = .995
CFI = .997
RMSEA = .029
GFI = .997

2b



ChiSq = 515.802
df = 44
P-Value = .000
ChiSq/df = 11.723
TLI = .899
CFI = .919
RMSEA = .090
GFI = .927

3a

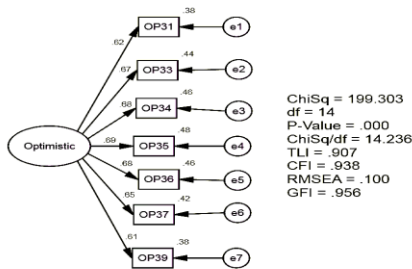


ChiSq = 4.508
df = 2
P-Value = .105
ChiSq/df = 2.254
TLI = .996
CFI = .999
RMSEA = .031
GFI = .998

3b

Figure 1: Hypothesized model and revised model of resilience sub constructs (social skill; problem solving and autonomy) using CFA

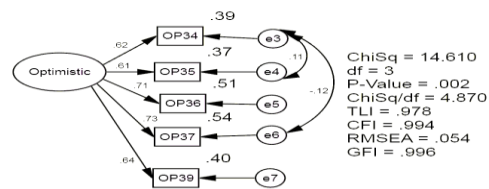
Hypothesized model



ChiSq = 199.303
df = 14
P-Value = .000
ChiSq/df = 14.236
TLI = .907
CFI = .938
RMSEA = .100
GFI = .956

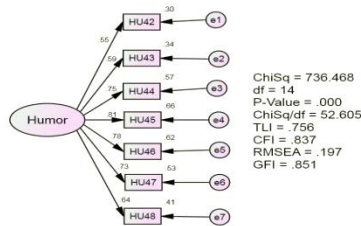
4a

Revised model

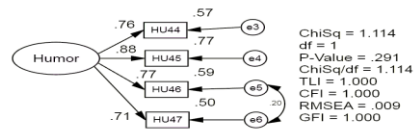


ChiSq = 14.610
df = 3
P-Value = .002
ChiSq/df = 4.870
TLI = .978
CFI = .994
RMSEA = .054
GFI = .996

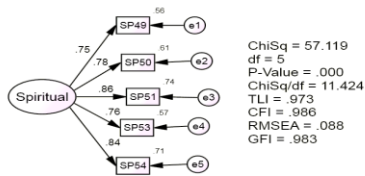
4b



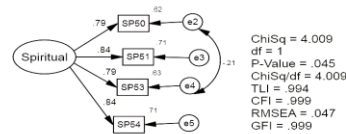
5a



5b



6a



6b

Figure 2: Hypothesized model and revised model of resilience sub-constructs (optimistic; humor and spiritual) using CFA

Since all factor loadings for the revised model exceed the required 0.6, the researchers could assume that the unidimensionality for each measurement model of resilience sub constructs (Zainudin, 2013).

Assessing fitness of a Measurement Model

Fitness indices for the revised model need to examine as these indices indicate how well the proposed model captured the covariance among items in the measurement model. The fitness index for measurement revised model are extracted and presented in Table 2.

Table 2 : The Assessment of Fitness for the Measurement Model

Default Model	CMIN	DF	P	CMIN/DF	TLI	CFI	GFI	RMSEA
Problem Solving	10.426	5	0.64	2.085	0.995	0.997	0.997	0.029
Autonomy	4.502	2	0.105	2.254	0.996	0.999	0.998	0.031
Social Skill	12.557	5	0.028	2.510	0.993	0.996	0.996	0.034

Optimistic	14.610	3	0.002	4.870	0.978	0.994	0.996	0.054
Humor	1.114	1	0.291	1.114	1.000	1.000	1.000	0.009
Spiritual	4.009	1	0.045	4.009	0.994	0.999	0.999	0.047

Goodness-of-fit indices as suggested by Hair et al. (2006) for samples more than 250 respondents would include significant χ^2 value, CFI, TLI and GFI above 0.90; and RMSEA less than 0.07. Base on this suggestion, all fitness indices in table 2 show the measurement model with a good fit.

Next, we need to run the CFA procedure linking all measured variables in a single test as shown in figure 3. In figure 3, the model is representing the underlying structure of the resilience scale. CFA results suggest the Resilience Scale of HEIs measurement model provides a reasonably good fit with χ^2 (n= 1336, df=309) = 831.568, $\chi^2/df = 2.691$, TLI = 0.964, CFI = 0.968, GFI = 0.956, NFI = 0.950 and RMSEA = 0.036. This model with Goodness-of-fit indicates how well the specified model reproduces the covariance matrix among the indicator items; meaning that observed and estimated covariance matrices are similar.

Assessing Reliability and Validity

The reliability of resilience scale of HEIs was assessed through the investigation of the Cronbach's Alpha and Composite Reliability (CR). Internal reliability is achieved when Cronbach's Alpha value is 0.7 or higher. A value of CR ≥ 0.7 is required in order to achieve good construct reliability and value between 0.6 to 0.7 may be acceptable provided that other indicator of a model's construct validity are good (Hair, 2006). Table 3 shows that the Cronbach's Alpha and CR are above 0.70, meaning that the measures all consistently represent the same latent construct.

Convergent validity refers to the items that are indicators of a single underlying construct (Salisbury et al., 2002) and several ways are available to estimate the relative amount of convergent validity among item measures such as using : (1) factor loading; (2) Normed Fix Index (NFI) (Mak and Sockel, 2001); and (3) Average Variance Extracted (AVE).

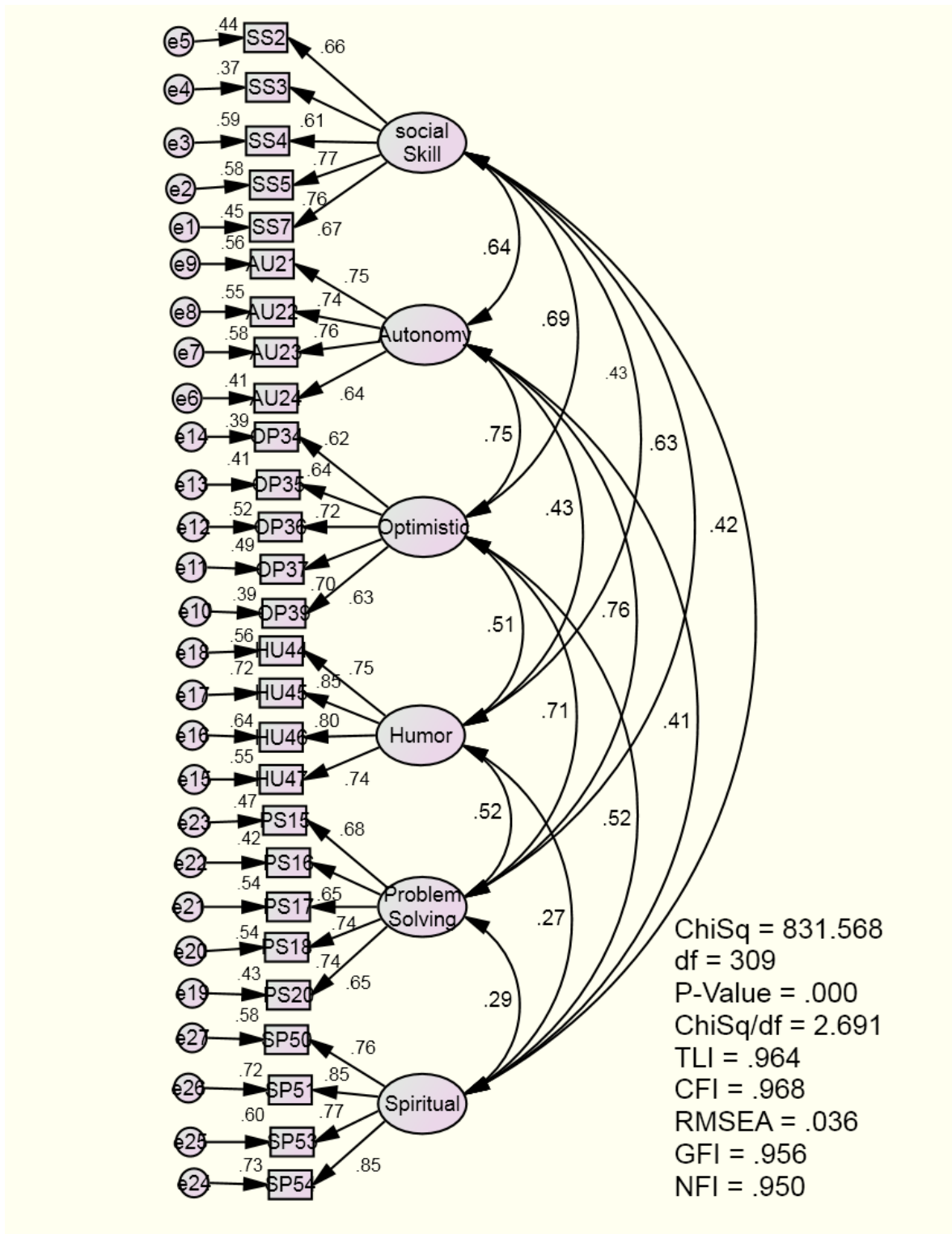


Figure 3-: Resilience model to examine discriminant validity between sub constructs

Table 3: -Assessment of internal consistency and convergent validity

Construct	Item	Factor Loading ($p < 0.05$)	Cronbach's Alpha (≥ 0.7)	CR (≥ 0.7)	AVE (≥ 0.5)	NFI
Social Skill	SS2	0.66	0.82	0.82	0.49	0.994
	SS3	0.61				
	SS4	0.77				
	SS5	0.76				
	SS7	0.67				
Autonomy	AU21	0.75	0.81	0.81	0.52	0.997
	AU22	0.74				
	AU23	0.76				
	AU24	0.64				
Optimistic	OP34	0.62	0.80	0.80	0.44	0.992
	OP35	0.64				
	OP36	0.72				
	OP37	0.70				
	OP39	0.63				
Humor	HU44	0.75	0.87	0.87	0.62	1.000
	HU45	0.85				
	HU46	0.80				
	HU47	0.74				
Problem solving	PS15	0.68	0.82	0.82	0.48	0.995
	PS16	0.65				
	PS17	0.74				
	PS18	0.74				
	PS20	0.65				
Spiritual	SP50	0.76	0.88	0.88	0.65	0.999
	SP51	0.85				
	SP53	0.77				
	SP54	0.85				

Convergent validity was assessed through presence of significant high factor loadings on a factor that would indicate they converge on some common point. Hair et al. (2006) suggested standard-loading estimates should be 0.5 or higher, and ideally 0.7 or higher. Secondly, using Normed Fit Index (NFI) ≥ 0.90 as suggested by Mak & Sockel (2001); or using Average Variance Extracted (AVE) ≥ 0.05 as suggested by Hair et al. (2006) to explained convergence.

The result in Table 3 shows that AVE for social skill, problem solving and optimistic are less than 0.5, but the standardized loading estimate for all items are positive, significant and the loading above the 0.5, furthermore all factors constituting the resilience scale had NFI ≥ 0.90 . These results showed that each factor in the scale had convergent validity.

Discriminant validity is achieved when the measurement model is free from redundant items and truly distinct from other construct. AMOS will identify the pair of redundant items in the model and reported in the MI (Modification Indices). In this procedure, the researchers had delete the redundant item and re-specify the model as shown in figure 1 and figure 2. This provides evidence of discriminant validity. Other test suggested by Kline (2001) was examined factor correlations between the six sub constructs of the resilience scale as shown in Table 4. All factor correlations were below 0.80, confirming the discriminant validity of the scale (Bhattacharjee, 2002).

Table 4 Correlations between sub constructs

	Social Skill	Autonomy	Optimistic	Humor	Problem solving	Spiritual
Social Skill	1					
Autonomy	0.64	1				
Optimistic	0.69	0.75	1			
Humor	0.43	0.43	0.51	1		
Problem solving	0.63	0.76	0.71	0.52	1	
Spiritual	0.42	0.41	0.52	0.27	0.29	1

5. Conclusion

The aim of this study was to explore items validity and reliability of resilience scale for higher education institution in Malaysia. The results from exploratory factor analysis of 54 resilience's items found that 48 items retained as items of resilience with six components and after gone through the CFA, 27 items with 6 sub constructs (namely social skills ; problem solving; autonomy; optimistic; spiritual and humor) measurement model present the Goodness-of-fit which proved the measurement model validity. The advantages of CFA/SEM program is its ability to test a model developed based on theories. Preliminary psychometric evidence suggested that this measurement model of resilience scale is reliable and valid and therefore it can be used effectively in assessing further analysis such as the second order CFA and SEM structural model.

Biography of the authors

Norasmah binti Othman is an Associate Professor at the Department of Leadership and Educational Policy in the Faculty of Education, Universiti Kebangsaan Malaysia, Malaysia. She had published 30 journals, 29 proceeding and edited 2 books namely Entrepreneurship- Catalyst of an Excellent Nation and Life's Sustainability; and Entrepreneurship and People with Disabilities. Her research interests include entrepreneurship education; evaluation and management of human resources; and evaluation of training programs.

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